MARA CONSULTING

Visual Impact Assessment

Finley Solar Farm

Providence Asset Group

17 April 2020

PROVIDENCE ASSET GROUP

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Project Number	2017
Client	Providence Asset Group
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1. Introduction

1.1. Background

This report is meant to aid in the approval process for the proposed solar farm near Finley, NSW. The site is located at 231 Broockmanns Road, Finley NSW. The proposed development will consist of solar panels with supporting inverters and switchboards with an access road from Broockmanns Road. The development will be fully contained within Lot 61 DP1053533.

This visual impact assessment has been prepared to identify and evaluate the visual impacts on the landscape and to recommend measures to minimise the visual impact of the proposed development.

This report describes the existing visual environment and provides a methodology to assess the visual sensitivity of the site and to assess the visual impact of the planned development. Viewing zones and significant viewing locations within each zone are identified and assessed.

1.2. The site and context

The site is situated approximately 1.5km west of the edge of the Finley township. The Newell Highway runs about 1.7km to the east of the site.

The site sits on flat agricultural land that is divided by fences and canals. There are scattered trees along boundary lines and clusters of trees around residences and farm buildings. Surrounding the proposed solar farm site are fields of crops with occasional grazing paddocks.

The Finley golf course is located 800m east of the site with the Finley Airport south of the golf course.

Image: View of the solar farm site with the golf course in the background.

Figure 1.1. Site location (shown in red)
Aerial from SIXmaps (2020).

2. Methodology

2.1. Background

This section provides a methodology for the visual impact assessment. The methodology used in this assessment has been adapted from the Roads and Maritime Services *Environmental Impact Assessment Guidance Note (2013): Guidelines for landscape character and visual impact assessment.* This methodology has been used as a guide to align with the features and requirements of this Proposal.

The methodology for assessing the visual impact includes the following key processes:

- Section 2.2 identifies the existing visual environment, the significant landscape features of the site and the visibility of the site from the significant vantage points
- Section 2.3 provides an assessment criteria that describes site visibility and visual absorption capacity
- Section 2.4 identifies viewing zones from which the site could be visible from various distances within the immediate vicinity, local area and regional context
- Section 3 provides an overview of the proposed development
- Section 4 assesses the potential visual impact from a variety of viewing locations
- Section 5 provides photomontages
- Section 6 provides a reflection and glare analysis
- Section 7 recommended mitigation measures.

2.2. Existing visual environment

This section describes the character and visibility of the site from the surrounding area.

2.2.1. Landscape character

The landscape around Finley is flat agricultural land. It is divided by roads, fences and irrigation canals with clumps of scattered vegetation.

The vegetation around the solar farm site is divided into grazing paddock and crop fields. As such, the vegetation is mainly grass and low crops. These fields are occasionally marked by trees along the boundaries.

Clumps of trees occur throughout the landscape, marking residential buildings, drives and boundaries. East of the site is the edge of the residential communities, where tree planting is much more dense.

2.2.2. Site visibility

The procedure for assessing site visibility involved:

- Determination of various viewing zones (regional, local and immediate vicinity)
- Detailed field investigations to plot those portions of the site that are visible from the various viewing zones.

2.3. Assessment criteria

The potential visual impact of planned development would result from the combination of two factors:

- Visibility of development
- Visual absorption capacity of the landscape in which the development occurs.

The visibility and the visual absorption capacity of the site for each representative view location have been assessed to determine the overall visual impact. Visibility and visual absorption capacity are defined below.

2.3.1. Visibility

"Visibility" is a measure of the extent to which particular activities/ components of a proposal may be visible from surrounding areas, the relative number of viewers, the period of view, viewing distance and context of view. The rationale for the assessment is that if a proposal is not visible the impact is nil and if the number of people who would potentially see the proposal is low, then the visual impact would be lower than if a potential large number of people had the same view.

For the purpose of this study, the general categories of visibility have been defined broadly as:

- **High (H)** – where a large number of people would see new development at short distance over a short, moderate or long period of time
- **Moderate (M)** – where a small number of people would see new development at a short or medium distance over a moderate or long period of time, or a moderate number of people would see the new development at a medium distance over a short, moderate or long period of time, or a large number of people would see it at a medium or long distance over a short period of time
- **Low (L)** – where a small number of people would see new development at long distance over a short (< 1 minute), moderate (< 1-10 minutes) or long (> 10 minutes) period of time.

The procedure for assessing site visibility involved:

- Determination of viewing locations from which parts of the planned development could potentially be visible (eg. by a motorist, visitor, resident)
- A field inspection to determine the extent of site visibility from the various viewing locations.

2.3.2. Visual absorption criteria

"Visual Absorption Capacity" is an estimation of the capacity of the landscape to absorb development without creating significant visual change. The capacity to absorb development is primarily dependent on land form, vegetation cover and the presence of other development.

The extent to which portions of the site can potentially absorb development without reducing the scenic quality of the area has been assessed under this criteria. Given the visual landscape character of the site this capacity is primarily dependent on repetition of built form and vegetation cover. The surrounding building and tree canopies provide capacity to visually absorb development without significantly changing its scenic quality provided vegetation is retained in public and private land.

The potential for development to significantly change the visual character or to reduce the scenic quality of the area will result from removal of portions of the tree cover and creation of visual contrast between development (buildings, roads and new landscape) and the existing landscape of surrounding areas.

The level of contrast is also strongly influenced by the nature of the backdrop against which development is viewed. In particular, structures that are viewed above the skyline will potentially create a higher degree of contrast that the same elements viewed against a backdrop of similar structures or a landscape of similar colour/textures as the building or structure.

The degree of contrast between proposed development and the existing landscape (buildings and vegetation) can be reduced by careful attention to the colour, scale, texture, and reflectivity of building materials and by avoiding development that breaks the height of the existing tree canopy. Where possible these considerations are to be incorporated into the design and siting of buildings, roads and other structures.

Table 2.1: Visual absorption criteria.

Criteria	Definition
High	Existing landscape and built environment able to absorb development. Low degree of visual contrast
Medium	Existing landscape able to absorb some development. Some visual contrast will result.
Low	Existing landscape unable to absorb development (unless the denser future character of an area is to deliberately make a development prominent such as a public building or special focus). High degree of visual contrast will result.

2.3.3. Visual Impact Rating

Table 2.2 provides a matrix that compares the visibility rating with the visual absorption capacity rating to determine the visual impact rating.

Table 2.2: Visual impact rating matrix

		Visibility		
		Low	Moderate	High
Visual Absorption Capacity	High	Low	Low	Moderate
	Medium	Low	Moderate	High
	Low	Moderate	High	High

2.4. Viewing zones

Viewing zones are areas outside the site that have potential views into the site. These are categorised by distance since visibility diminishes with distance. The categories are the immediate vicinity, local area and regional context.

The site of the proposed solar farm is located along Broockmanns Road. The solar arrays will be located 600m south of the road. A residence is located on the property adjacent to Broockmanns Road, which is the closest residence to the site.

The land is flat but visually there are fences along boundaries that have tall grasses growing along them. Trees also border the fields and surrounding structures, which break up any views. The most significant landscape elements are the water canals. Most of the canals are raised, or have raised embankments along them that block views. So while the land is flat, with some long views, it is difficult to see things that are 1.5m tall or lower at any distance.

The viewing zones and viewshed is illustrated in Figures 2.2 and 2.3.

In order to assess the potential visual impacts of the proposed building, viewing zones based on the distance from the proposed development were defined as follows:

- Immediate vicinity (< 1.5km)
- Local area (1.5km – 3km)
- Regional area (3km – 6km).

Representative view locations were selected from each zone and the visual impact of the planned development has been assessed from each location.

Immediate vicinity (< 1.5km).

- View 1: 138 Broockmanns Road, Finley
- View 2: Cnr Dales Road and Edwards Road, Finley
- View 3: 311 Broockmanns Road, Finley
- View 4: 231 Broockmanns Road, Finley

Local area (1.5km – 3km).

- View 5: 299 Broughans Road, Finley
- View 6: 1808 Newell Highway, Finley
- View 7: 16731 Riverina Highway, Finley
- View 8: 2-10 Hamilton Street, Finley.

Regional area (3km – 6km).

- There are no viewpoints in this zone.

Each view is addressed separately in Section 4 of this report.

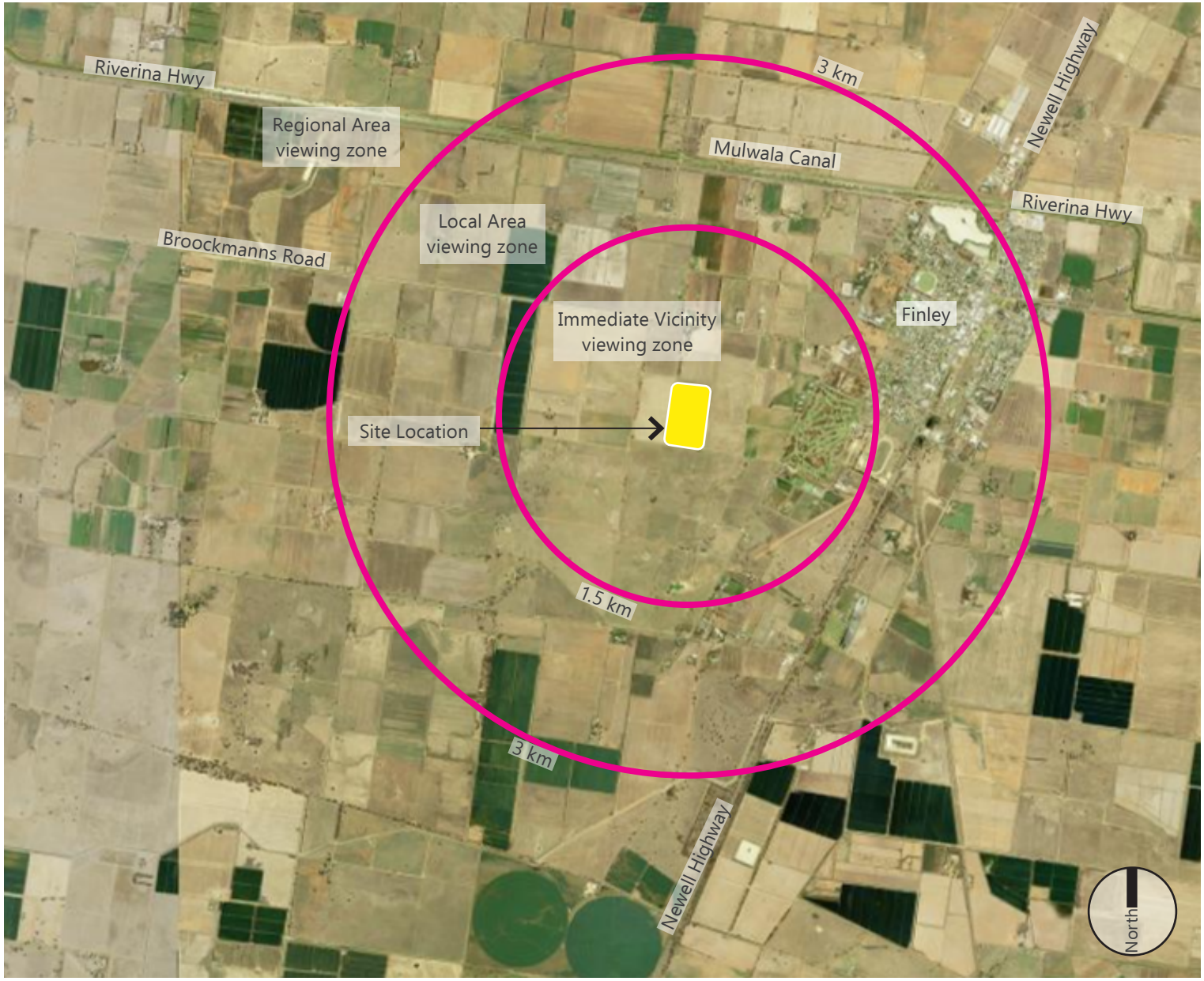
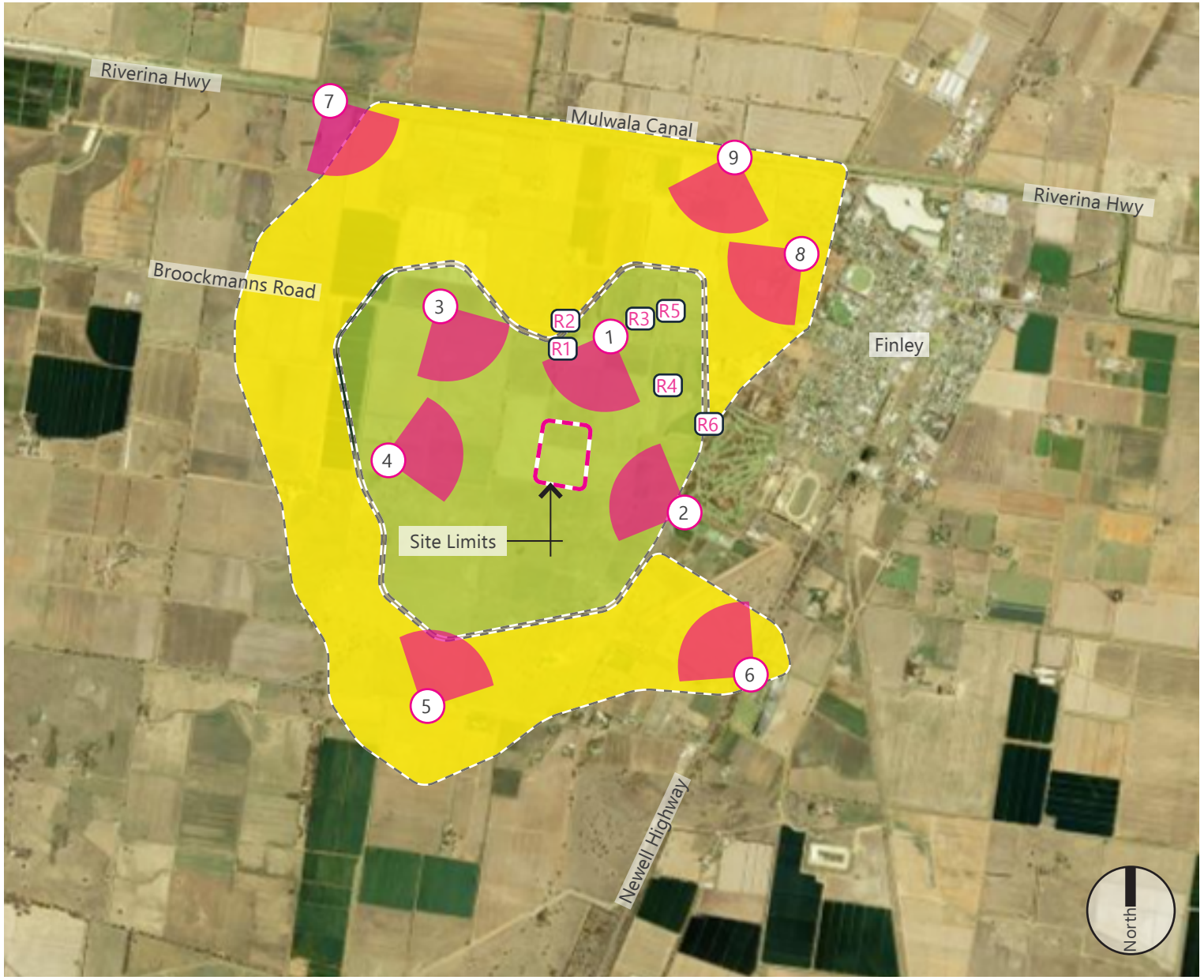


Figure 2.2: Viewing Zones
The viewing zones indicated as distance from the subject site. Figure 2.3 shows specific locations of each viewpoint that will be discussed in Section 4.



Extent of the viewing area from which the site is visible

Extent of the viewing area from which a portion of the site is visible, screened by topography or vegetation

1 View point and direction of view

R1 Residence in close proximity to the solar farm site.

Figure 2.3: Viewing Locations
The view locations are shown with arrows. The number on the arrows are associated with the visual assessment in Section 4 of this report

3. Proposal

3.1. Project Description

The proposed Solar Farm is located in Finley, south of Broockmanns Road, within the Berrigan Shire Council local government area.

The site covers an area of approximately 15 hectares. An indicative layout for the proposal has been provided (refer to Figure 3.1). This layout may be refined following the findings of various studies, of which this VIA is one.

3.1.1. Indicative project layout

The solar electricity generating facility will consist of the following elements:

- Solar array area up to 15Ha
- Solar array mounted on trackers (182 sets)
  - Rectangular photovoltaic module
  - Trackers area horizontal single-axis type
  - Solar array up to 2.7m high with +/-60° rotation angle
  - Trackers oriented north-south
- Associated infrastructure
  - Power Conversion Unit (PCU)
  - Site access from Broockmanns Road via a 4m wide road
  - Security fencing
  - Car park area
  - Off-load area

During construction, temporary facilities located within the site may include:

- Construction office

3.1.2. Solar panel dimensions and arrangement

The proposed solar array module dimensions are approximately 1m wide x 2m high. They are mounted on a tracking system that will maximise the electricity production. The tracking system rotates about a north-south axis to follow the sun with the aim of orienting each panel perpendicular to the incoming sun.

The tracking systems will be arranged in rows running in a north-south direction as indicated in Figure 3.1. The enclosure for the solar panel arrays and other equipment will cover about 15Ha.

The diagram in Figure 3.2 illustrates the dimensions and rotation of the panels. The panels only rotate from east to west and are not tilted toward the north.

Image: Solar panels similar to the proposed development.

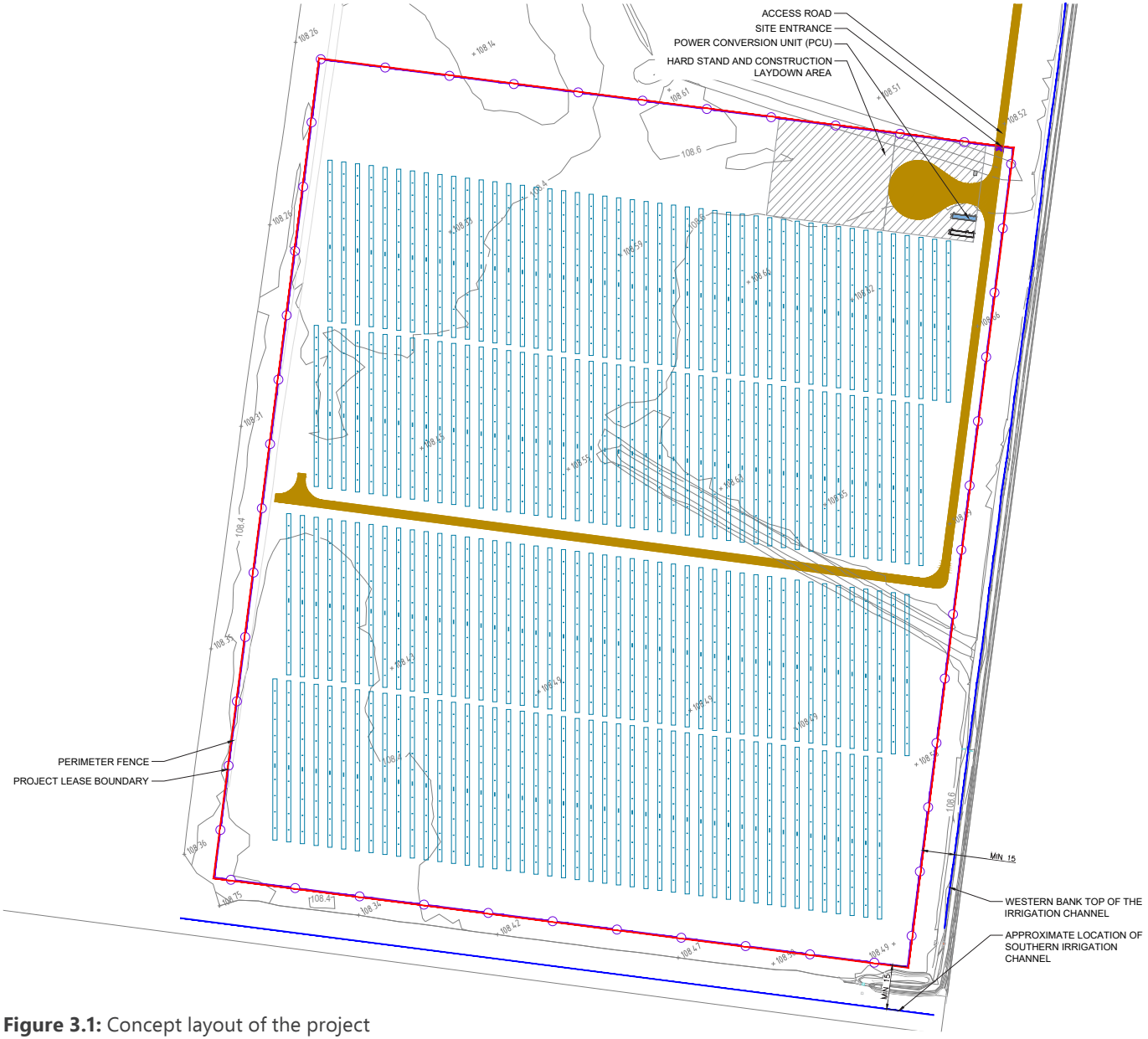


Figure 3.1: Concept layout of the project

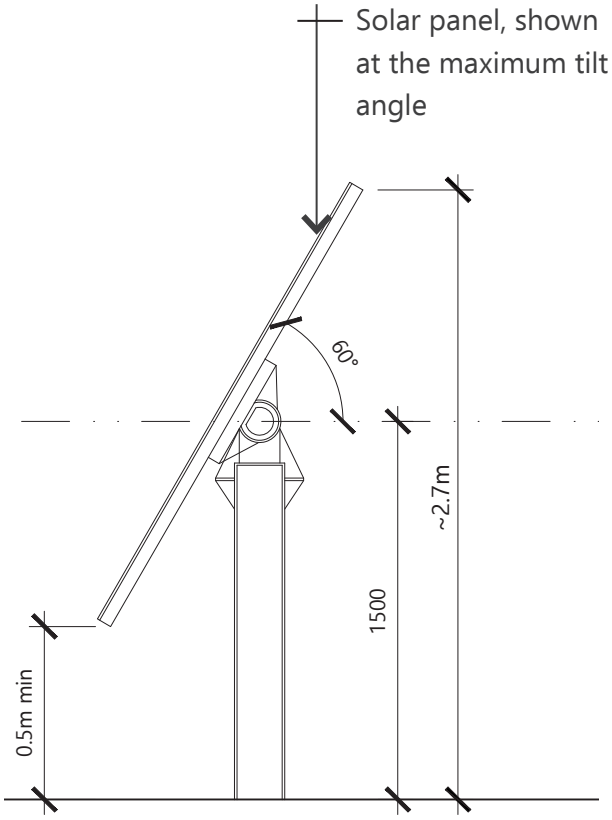


Figure 3.2: Solar panel on the tracking system

4. Visual impact assessment

4.1. Viewpoint Analysis

This section of the visual assessment considers the likely impact that the proposed development may have on the views toward the site. This is done by identifying and selecting particular sites, referred to as viewpoints, conducting inspections and determining what part of the development will be visible from those viewpoints and the visual impact of that development proposal.

The viewpoints, as shown on Figure 2.4, were selected on the basis of where the development would appear to be most prominent either based on degree of exposure or the number of people likely to be affected. Sites were further selected on the basis of significant features, significant viewpoints and significant ridge lines.

The following viewpoint worksheets provide photographs and analysis data from each of the viewpoints. The images were taken using a digital camera with a focal length equal to a standard 50mm for a conventional 35mm camera. This focal length is widely accepted as closely approximating the vision of the human eye.

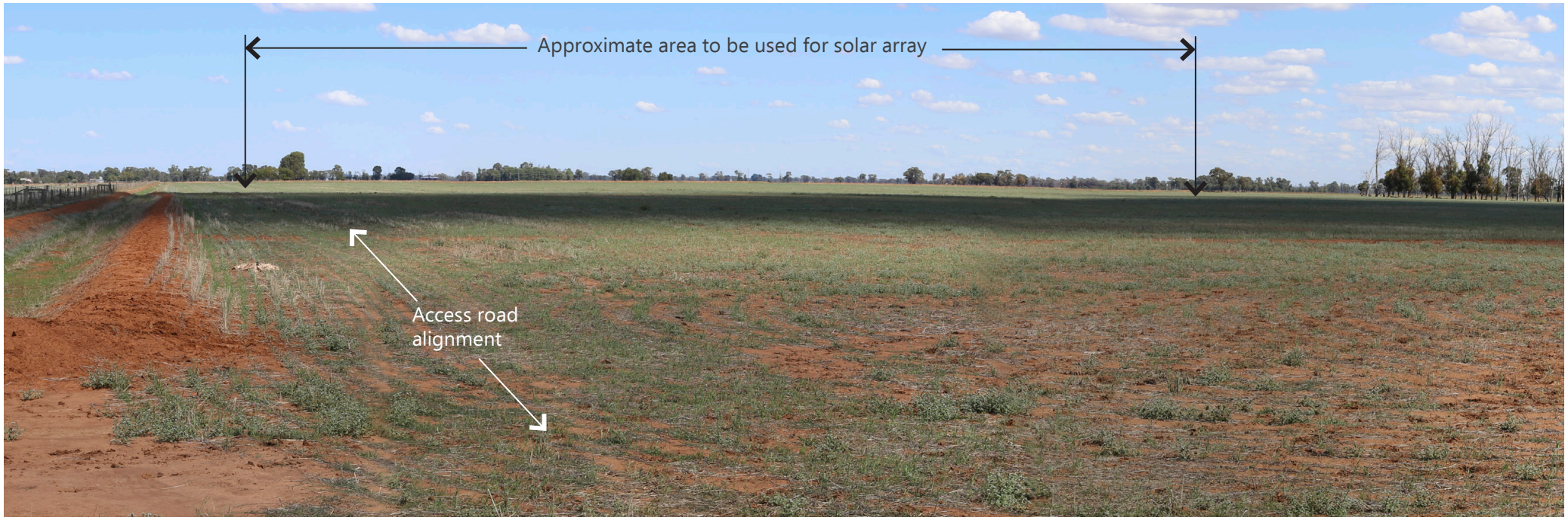
4.1.1. Site Visit

A two-day site visit was undertaken on 17 and 18 February 2020 by a registered landscape architect and environmental planner who has substantial experience analysing and mitigating visual impacts on the landscape.

During the site visit, viewpoints were confirmed and an assessment was made of each potential representative public viewpoint against the extent of the solar farm project.

At the time of the site visit, the weather was fine with good visibility.

Viewpoint 1



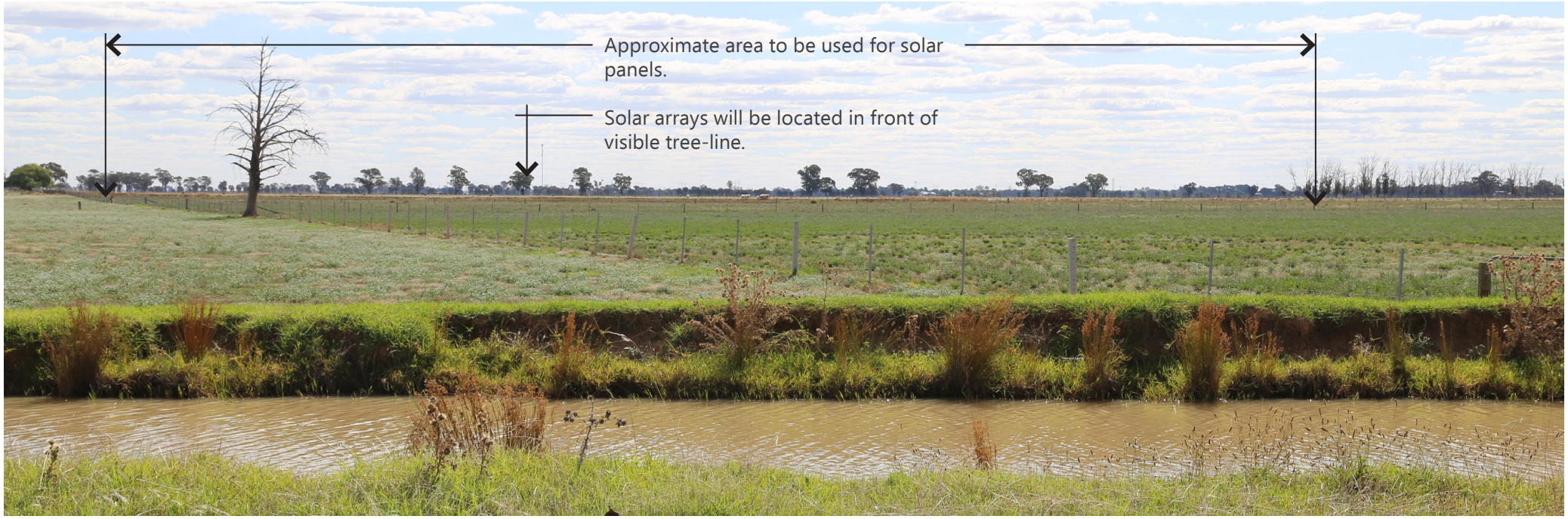
Viewpoint 1	138 Broockmanns Road, Finley
Viewing situation	Immediately adjacent to the site facing south
Category of view	Immediate vicinity
Context of view	Panoramic view from roadway adjacent to site
Relative number of viewers	Moderate
Distance of view	650m
Likely period of view	Low (traffic) Long (1 resident)
Visibility	Moderate
Visual absorption capacity	Medium
Visual impact rating	Moderate

Description:
View from Brookmanns Rd looking into the solar farm site.

Comments:
This is the location of the proposed entry road. There will be a new driveway from this location.

This location is the closest publicly accessible point to the site. Only the one resident living on the site is closer to the solar arrays.

Viewpoint 2



Viewpoint 2	Cnr Dales Road and Edwards Road, Finley
Viewing situation	Same elevation as the site
Category of view	Local Area
Context of view	From roadway / golf course east of site
Relative number of viewers	Moderate
Distance of view	730m
Likely period of view	Low (traffic)
Visibility	Moderate
Visual absorption capacity	Medium
Visual impact rating	Moderate

Description:
View from Dales Road looking west toward the site.

Comments:
This is the view available from Dales Rd at the point nearest the site. This represents the view from the golf course.

This view is available from the road and golf course and will typically be seen from a moving vehicle or as the viewer moves through the western extremities of the golf course.

The golf course has heavily planted boundaries along Dales Rd, which block most views of the site from inside the golf course and any location beyond.

Viewpoint 3

Viewpoint 3	311 Broockmanns Road, Finley
Viewing situation	On slope below the site
Category of view	Immediate vicinity
Context of view	From roadway east of site
Relative number of viewers	Medium
Distance of view	1.0km
Likely period of view	Low (traffic)
Visibility	Low
Visual absorption capacity	High
Visual impact rating	Low

Description:
View from Broockmanns Road west of the site looking toward the proposed development.

Comments:
This viewpoint is the first location from which the solar arrays can be seen from Broockmanns Rd while travelling from the west.

Even though the view appears wide open, only the tops of the solar arrays will be visible from this distance.

Viewpoint 4

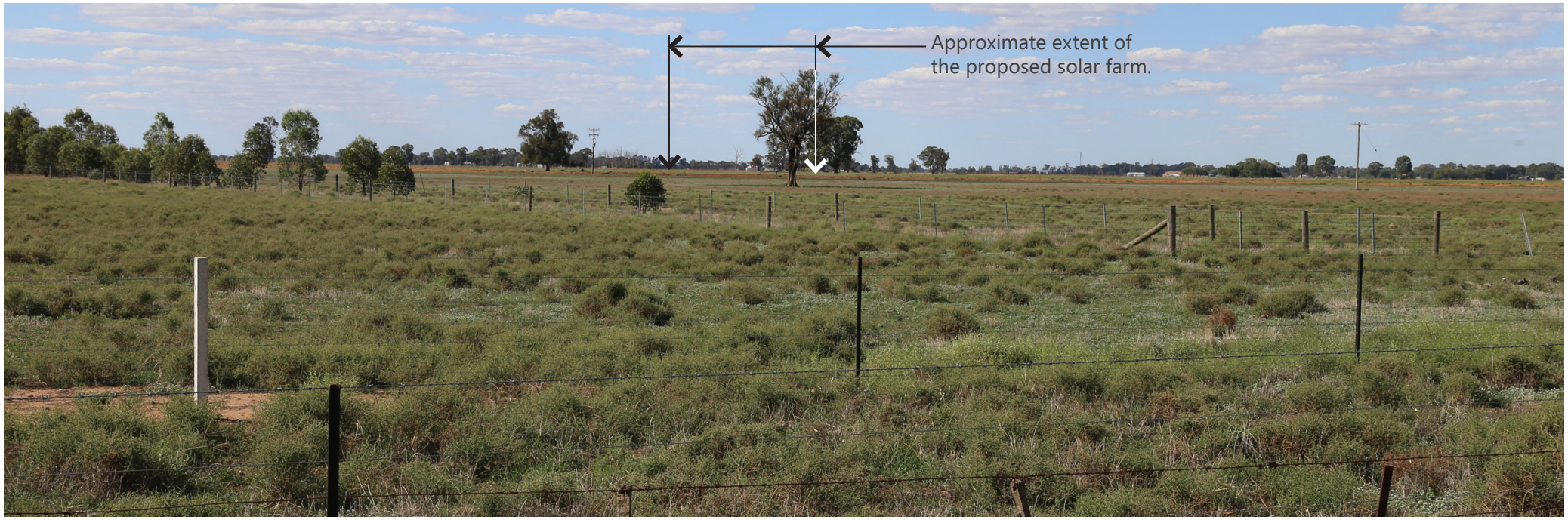
Viewpoint 4	231 Broockmanns Road, Finley
Viewing situation	Same elevation, across grazing paddocks
Category of view	Immediate vicinity
Context of view	From residence west of site
Relative number of viewers	Low
Distance of view	1.0km
Likely period of view	Long (1 residence)
Visibility	Low
Visual absorption capacity	Medium
Visual impact rating	Low

Description:
View from residence front gate, looking eastward to the site. The land is level with open paddocks and two fences between viewer and site.

Comments:
This view is from a private residence. It is the only residence in this vicinity, west of the solar farm. It will therefore not be seen by anyone other than the residents or those working in the paddocks.

While it appears to be visually open, the 1km distance diminishes the visibility of the solar arrays. The solar panels will further blend in with the structures and trees in the background.

Viewpoint 5



Viewpoint 5	299 Broughans Road, Finley
Viewing situation	Slightly lower than the site, looking across paddocks
Category of view	Local area
Context of view	From roadside near 2 residences
Relative number of viewers	Moderate (from roadway) Low (residences)
Distance of view	1.8km
Likely period of view	Low (traffic) Long (residents)
Visibility	Low
Visual absorption capacity	High
Visual impact rating	Low

Description:
View from the southeast, over grassy paddocks and fencelines. Scattered trees occur within the line of site.

Comments:
This is the first location along Broughmans Road from which the site is visible while travelling east. There are a number of scattered trees between the road and the solar farm.

The trees, fences and pasture grasses create an effective visual screen from this distance.

Viewpoint 6

Viewpoint 6	1808 Newell Highway, Finley
Viewing situation	Similar elevation, across uneven terrain
Category of view	Local area
Context of view	From Newell Highway
Relative number of viewers	High
Distance of view	1.9km
Likely period of view	Short
Visibility	Low
Visual absorption capacity	High
Visual impact rating	Low

Description:
View from Newell Highway across the airstrip., canals and numerous paddocks.

Comments:
There are very few vantage points from which to view the development from Newell Highway. This view illustrates the difficulty in seeing the site from the highway, which offers only a few of these glimpses between trees.

Viewpoint 7

Viewpoint 7	16731 Riverina Highway, Finley
Viewing situation	Same elevation as the site
Category of view	Local area
Context of view	From Riverina Highway across paddocks
Relative number of viewers	High
Distance of view	2.8km
Likely period of view	Low (traffic) Long (residents along the road)
Visibility	Low
Visual absorption capacity	High
Visual impact rating	Low

Description:
View from the furthest distance from which the site is discernible. It looks across a valley with grassy paddocks and clumps of intermittent trees.

Comments:
This represents the furthest location from which the site is be visible with correct atmospheric conditions. The flatness of the topography limits the distance that the solar farm can be seen from. The vegetation and fences also screen views effectively.

Viewpoint 8

Viewpoint 8	2-10 Hamilton Street, Finley
Viewing situation	Same elevation across a road and canal
Category of view	Regional area
Context of view	Edge of the Finley township
Relative number of viewers	Moderate
Distance of view	2.0km
Likely period of view	Low (traffic) Long (residents along the road)
Visibility	Low
Visual absorption capacity	High
Visual impact rating	Low

Description:
From a residential road looking over paddocks, a canal, a road and trees.

Comments:
This is a typical view from the residential community north of the golf course. Constructed elements in the landscape and the trees effectively block most views of the site.

4.2. Visual impact assessment summary

This section of the report summarises the findings of the visual impact assessment of views in the immediate vicinity, local views and regional views of the site.

4.2.1. Views from the immediate vicinity (< 1.5km)

The visual impact on the nearest residents (R1-R4 in Figure 2.3), which are 650m away, is that they will be able to see the proposed development. Due to the close proximity and the open agricultural landscape with few trees and without mitigation, the visual impact is noted as moderate. It should be noted, the solar panels are approximately 2.7m when at full height. Additionally, the rectilinear forms and rigid linear arrangement of the solar panels contrasts with the surrounding forms.

Beyond the properties adjacent the development, views of the site are diminished substantially due to the distance from the site. With distance, the scattered trees begin to form solid screens as they overlap. Fences and tall grasses also become a factor as they screen up to 1.5m.

The photographs from the viewpoints illustrate the visual impact will be moderate within view of up to 800m. Beyond 800m, the visual impacts diminish to low.

4.2.2. Local views (1.5 – 3km)

The proposed development is barely discernible from this distance. The photographs illustrate that the location of the site can be determined (using distinct tree shapes) but the site itself can not be seen.

The visual impact is low from this distance.

4.2.3. Regional Views (3 – 6km)

No regional views were found from which the site is discernible.

Image: Example of similar solar panels from approximately 700m away in a similar landscape setting

5. Photomontages

5.1. Photomontage development

A photomontage is a visualisation based on superimposing an image (of proposed development) onto a photograph. Its purpose is to simulate a realistic representation of proposed or potential changes to a view (Horner and Maclennan et al, 2006). The photomontages used in this VIA are to assist in the assessment of the impacts from the proposed development.

5.1.1. Photomontage development process

Since a photomontage is a representation of the development superimposed on a photograph, an image of the proposal must be developed. This is done as a digital model of the solar panels and structures. The digital model is then captured from the perspective of the photograph, and then superimposed on it.

In these photomontages, the solar panel are shown at their maximum height to simulate a worst-case scenario.

5.1.2. Selection process

The photomontages selected represent key views to demonstrate the visibility of the proposed solar farm within the existing context. Photomontages have been prepared for Viewpoint 1, Viewpoint 2 and Viewpoint 4. These viewpoints illustrate the general visibility of the site from locations of the highest visibility and those affected most.

Photomontage 1 - Viewpoint 3

Existing view

Existing view with proposed solar farm development. This photomontage shows the affect of the solar panels on the landscape from this vantage point without any additional plant screening.

Photomontage 2 - Viewpoint 2

Existing view

Existing view with proposed solar farm development. This photomontage shows the affect of the solar panels on the landscape from this vantage point.

Photomontage 3 - Viewpoint 4

Existing view

Existing view with proposed solar farm development. This photomontage shows the affect of the solar panels on the landscape from this vantage point.

6. Glare Analysis

When sunlight is reflected off a smooth surface, it can result in glint or glare. Glint is a quick reflection or flash of light, while glare is experience for a longer period of time. Both of these can be annoying and dangerous in certain situations.

6.1. Angle of reflection

The angle of reflection of light off a reflective surface is directly related to the angle of incidence of the light from the source (see Figure 6.1 and 6.2). In the case of a solar array, the sunlight will reflect off the panel at the same angle as it arrives from the sun. If the panel is stationary, the sun's angle relative to the solar panel will vary by time of day and therefore reflect toward the west in the morning and eastward in the evening.

The proposed solar arrays will track the sun's movement across the sky. As a result, reflections will be directed upward and away from any ground-based viewers. Geometrically, the lowest angle of reflection will be 30° above the horizon line.

The seasonal change of the sun's movements will vary the refection angles as well. As the sun move southward in the summer months, the reflection will move northward, and vice versa in the winter months (when the sun is north of the equator). While this movement changes the reflection angle in a north-south direction, the reflection angle will not fall below 30° above the horizon line.

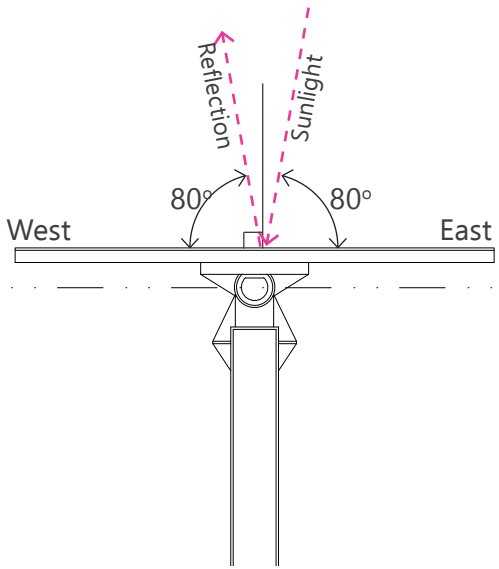


Figure 6.1: Typical reflection and glare angles during the day.

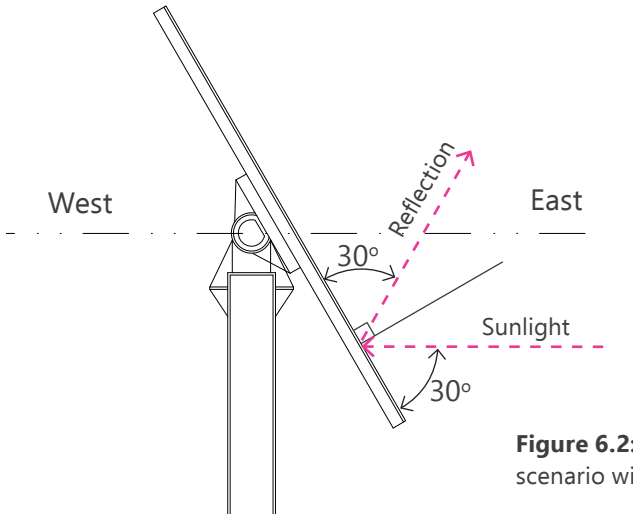


Figure 6.2: Typical sunrise/sunset reflection scenario with direction of reflection and glare.

6.2. Reflectivity

Solar cells are designed to absorb light energy to create electrical currents. As such, they will only reflect a portion of the sunlight that falls on them.

Generally, the light reflected is diminished by first hitting the substrate that reflected it. Typically, solar panels are constructed from a treated glass that is designed to minimise reflection and maximise the amount of light transmitted through the glass to the receptor. Typical treated glass that is used for solar cells reflects about 4% of the light that hits the cell. This is equivalent to a water body (pond or lake), which is considered to be a fairly low amount of reflection.

6.3. Analysis

By knowing the characteristics of reflected light, we can determine where glare is likely to be an issue. In the case of the Finley solar farm, trackers will be used to maximise the sunlight absorbed by the cells. The trackers are designed to keep the panel perpendicular to the sun. We can therefore assume that the sunlight reflected will reflect perpendicular to the cell and directly back toward the sun. At times when the tracking system has reached the limit of its tracking range, the angle of incidence moves from perpendicular and the light that is reflected is expected to reflect up and away from the ground. Given that the tracking stops when the panel is 60° from horizontal, the refection will be at a minimum of 30° above the horizon.

Given the parameters of reflection and the movement of the solar panels, there are no locations surrounding the site where glint or glare are geometrically possible.

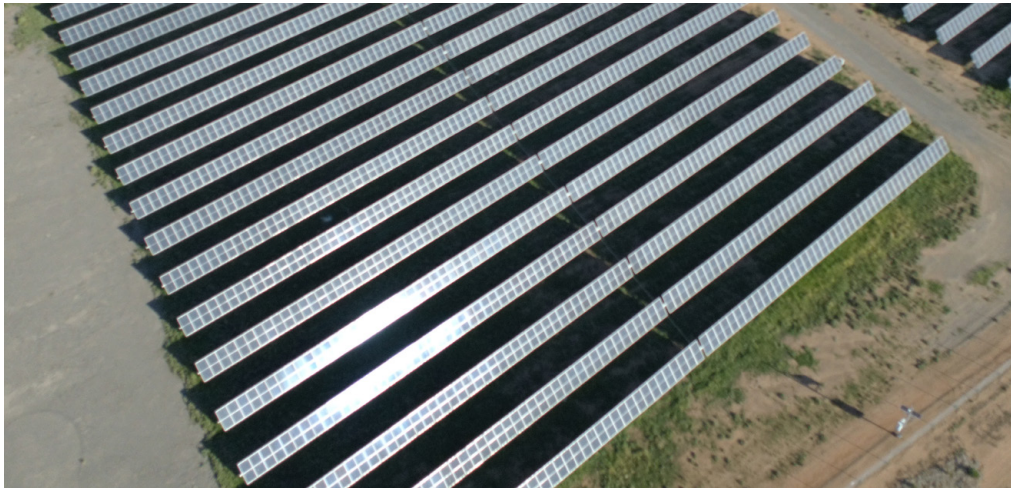


Image: Example of glare from a similar type solar panels (photo captured from above - this type of glare is geometrically impossible from the ground.

Image: Example of similar solar panels viewed from close proximity

7. Visual mitigation measures

7.1. Recommendations

The visual impact assessment in Section 4 of this report assigns either a high, medium or low visual impact rating when viewed from the immediate vicinity, local views and regional views. The following mitigation measures should be considered in the design and assessment of the proposed development.

Visual character

To maintain the visual character of the area around the site, the following recommendations are suggested.

- Trees and large shrubs can be planted along the northern boundary to screen views from Broockmanns Road
- Placement of any trees should maximise visual screening while allowing unobstructed sunlight to reach the solar panels
- Since the solar panels will reach approximately 2.5m in height, large shrubs may be more appropriate for screening.

Built form, materials and colours

- Materials, textures and colour selection should relate to the palette of the surrounding environment to minimise visibility and potential for visual impact
- Bright and contrasting colours should be avoided
- Solar panels should use anti-reflective coatings
- Consideration should be given to controlling the type and height of PCU's storage sheds to ensure the development does not contrast significantly with the surrounding landscape.

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