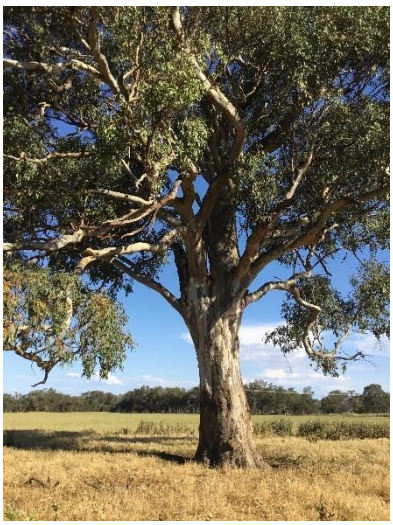
Visual Impact Assessment

JINDERA SOLAR FARM



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1 INTRODUCTION

This Visual Impact Assessment (VIA) has been prepared for the proposed Jindera Solar Farm (the proposal). The proposal is located on two properties bounded by Urana Road, Klinberg Road, Walla Walla Jindera Road, Glenellen Road and Ortlipp Road, approximately 5.5 km north of the Jindera community (Figure 1-2). This report has been prepared by NGH Environmental with input from Urbaine Architecture on behalf Jindera Solar Farm Pty Ltd (the proponent) to assess the potential visual impacts of the proposal.

As visual amenity values and visual impacts can be subjective, the assessment includes a transparent, systematic evaluation with reference to existing guidelines, to address subjectivity as much as possible.

1.1 PROJECT OVERVIEW

1.1.1 Introduction

The proposal would involve the installation and operation of a photovoltaic (PV) solar plant with a capacity of approximately 150 megawatts (MW) direct current (DC). The development footprint would occupy around 337 hectares (ha) of the 522 ha property.

The proposed layout of solar farm infrastructure is shown in Appendix A.

In total, the construction phase of the proposal is expected to take approximately 10 months. The proposal is expected to have approximately a 30-year operating life, at which point the solar farm would either:

- Be decommissioned, removing all above ground infrastructure and returning the site to its existing land capability; or
- Continue operation (which could involve reconditioning), if the lease agreement is renewed. Reconditioning would involve replacing components that were originally installed with new components that reflect technology that is available at that time.

The proposal would involve both construction and operational visual impacts.

1.1.2 Visual characteristics of construction components

During construction, the following elements would be temporarily introduced into the visual environment both within and surrounding the proposed solar farm:

- Site compound areas, site facilities, material storage areas and stockpiles located within the site boundaries.
- Increased traffic and dust creation.
- Site facility sheds, which may generate reflection and glare.
- Areas of bare soil created through excavation, grading or trenching.

These areas may be visible from local and main roads (including Urana Road, Klinberg Road, Walla Walla Jindera Road, Glenellen Road and Ortlipp Road) and nearby sensitive receivers.

1.1.3 Visual characteristics of operational components

Key operation infrastructure components would include:

- Single axis tracker photovoltaic (PV) solar panels, mounted on steel frames over most of the site (up to approximately 393,000 PV solar panels) at about 3 m above ground level at maximum tilt (refer Figure 1-1).
- Battery storage to store energy on-site.
- Inverter station.
- Electrical conduits.
- On site substation.
- Site office, parking, access tracks and perimeter fencing.
- Operations and maintenance buildings with associated car parking.
- Main construction access points via Urana Road and Walla Walla Jindera Road
- Low use operation and maintenance access via Klinberg Road and Ortlipp Road.

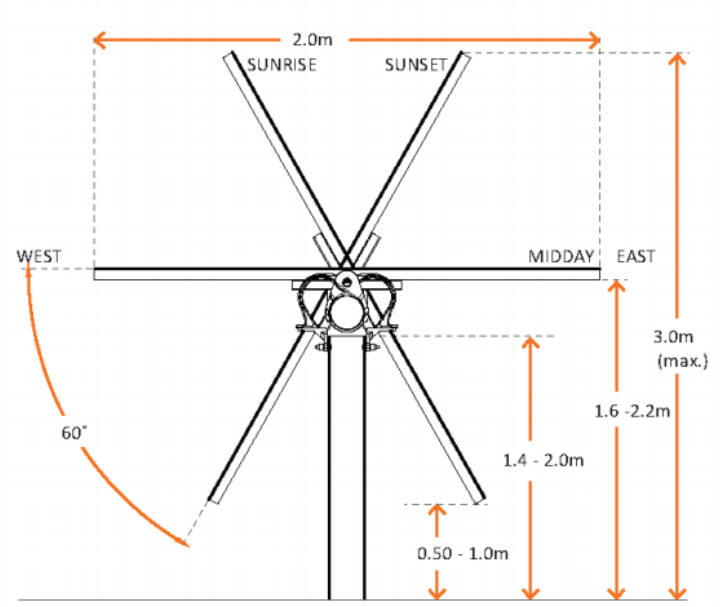


Figure 1-1 Maximum height of solar panel at full tilt

Within the development site, ground disturbance would be limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground.
- Construction of internal gravel access tracks.
- Establishment of inverter/transformer units, construction compound, battery storage facility and solar substation.
- Trenching and possible boring for the installation of cables.
- Establishment of staff amenities and offices.
- Construction of parking area.
- Construction of perimeter security fencing.
- Installation of underground and above ground 132 kv transmission lines.

1.2 SITE CONTEXT

The proposal is located within the NSW South Western Slopes region in the Greater Hume Local Government Area (LGA), approximately 5.5km north of Jindera in the suburb of Glenellen. The proposal is

located within the Murray River Catchment, with local land use primarily being agricultural (cropping and grazing).

The subject land (522 ha) and development footprint (337 ha) comprises Lot 2 DP213465, Lots 70, 90, 133-136, 138-141, 147, 148, and 153-155 DP753342, and Lots 1-3 DP1080215 (Figure 1-2).

The proposal area is agricultural land comprising several large paddocks that are generally flat and largely cleared and cultivated for pastures and grazing (Figure 1-4 and Figure 1-5). Native vegetation remains in the form of scattered paddock trees (Figure 1-6) or small isolated patches of remnant woodland (Figure 1-7) and/or roadside vegetation. Two watercourses run through the property, Deadhorse Creek and Kilnacroft Creek (Figure 1-8). These creeks are generally dry, experiencing water flow only at times of high rainfall. Within the development site, sections of these creek lines are bordered by native vegetation. Eight farm dams occur within the proposal area.

The land is classed as follows under the Land and Soil Capability Assessment Scheme:

- Class 3: sloping land that is capable of sustaining cultivation on a rotational basis. This land can be readily used for a range of crops including cereals, oilseeds and pulses. Productivity will vary with soil fertility.
- Class 6: steeply sloping lands (20–33% slope) that can erode severely even without cultivation, or land that will be subject to severe wind erosion when cultivated and left exposed. Land generally is suitable only for grazing with limitations and is not suitable for cultivation (OEH 2012).

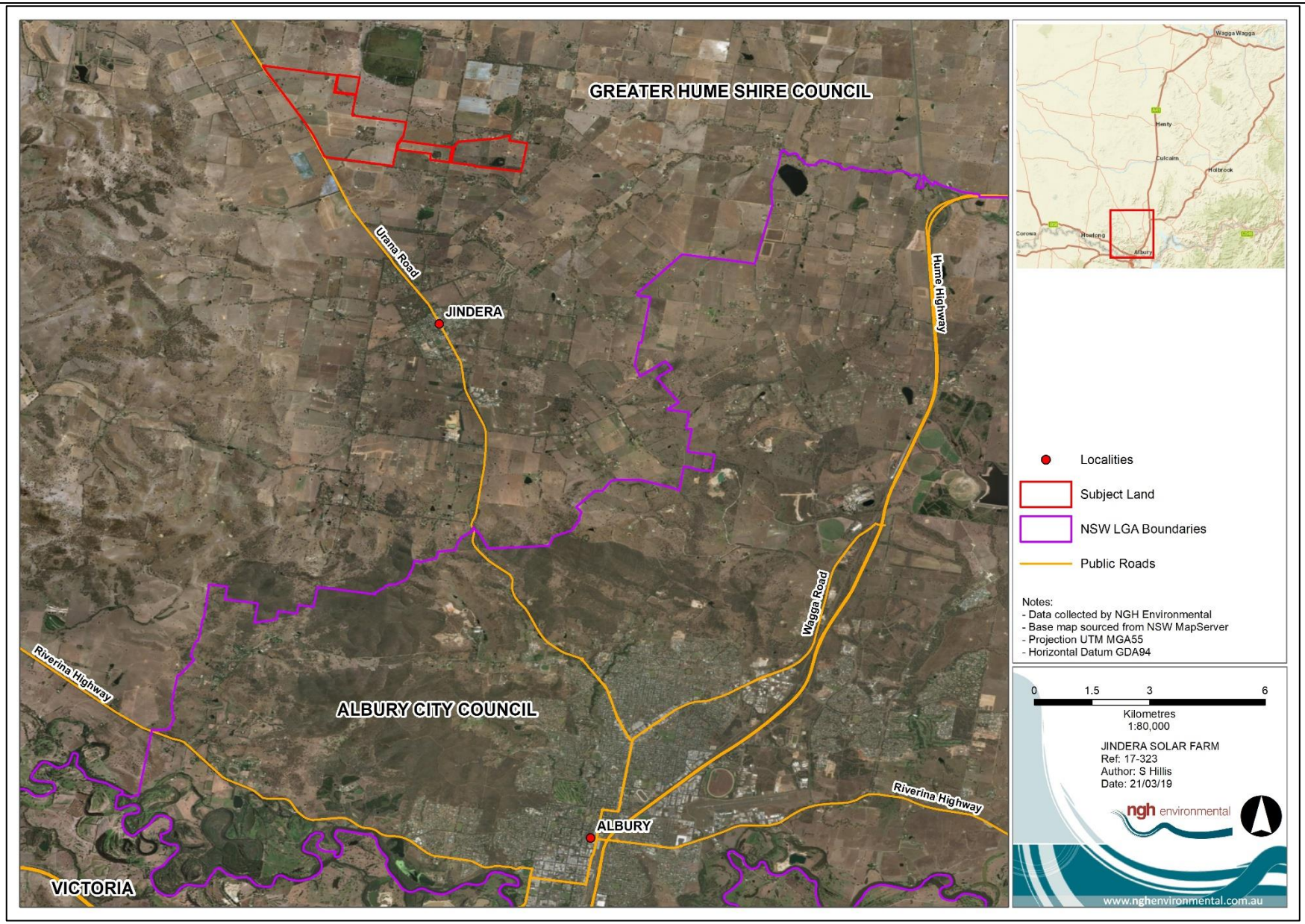


Figure 1-2 Location of the Jindera Solar Farm

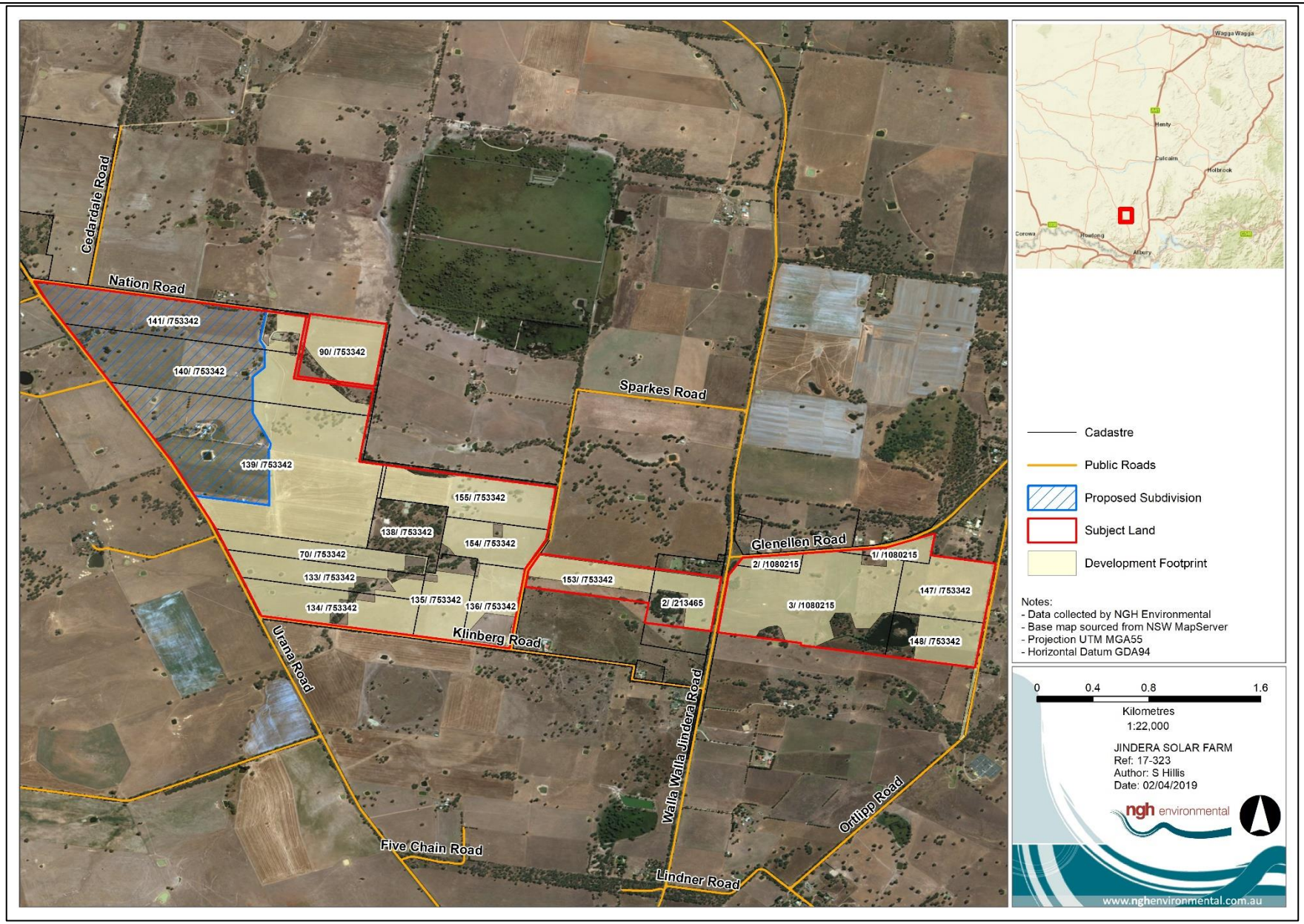


Figure 1-3 Development site

Figure 1-4 Example of cleared, highly modified agricultural paddocks.

Figure 1-5 Example of cleared, highly modified agricultural paddocks.

Figure 1-6 Example of an isolated paddock tree

Figure 1-7 Example of a patch of remnant vegetation

Figure 1-8 Example of watercourse that runs through the site (Kilnacroft Creek)

1.3 OBJECTIVES OF THIS REPORT

This VIA includes a full assessment of the potential visual impacts associated with the proposal. Specifically, it includes an assessment of:

- Landscape character of the locality.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints, including residences and road corridors.

Secretary's Environmental Assessment Requirements (SEARs) for the proposal were provided by NSW Department of Planning and Environment (DPE) and other relevant agencies on 14 September 2018. The SEARs are intended to guide the structure and content of the Environmental Impact Statement (EIS) and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal. This report addresses the SEARs for the proposal where relevant to potential visual impacts, as shown in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements for visual impact assessment of proposal

Requirement	Addressed in this report
DPE – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	The following matters are addressed in this report: • Likely visual impacts on surrounding residences, road corridors, scenic or significant vistas. • Glare, air traffic, reflectivity and night lighting. • A draft landscaping plan for on-site perimeter planting (Appendix B). • Consultation with affected landowners regarding the proposal and perimeter planting.
RMS – consideration should be given to the establishment of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road.	A draft landscaping plan for on-site perimeter planting (Appendix B).

The NSW Large-scale Solar Energy Guidelines (DPE 2018) also identify visibility and topography as a key site constraint of the development of solar farms:

"Sites with high visibility, such as those on prominent or high ground positions, or sites which are located in a valley with elevated nearby residences with views toward the site. This is particularly important in the context of significant scenic, historic or cultural landscapes."

While visibility and topography does not preclude development, it indicates an issue that may exist to be considered in the design and consultation of the proposal.

1.4 TERMINOLOGY

Terminology used in this report includes:

Study Area Defined as the community of Jindera and surrounding areas.

Development Footprint The area of land that is directly impacted by the proposal.

Development Site The area of land that will experience works related to the solar farm and any additional infrastructure required for the operation of the proposed solar farm.

The proposal All infrastructure and activities required for the construction, operation and decommissioning of the proposed solar farm.

Subject Land All land within the affected lot boundaries.

Landscape Character Unit (LCU) LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to categorise the existing scenic quality of the receiving environment and consider the ability of the environment to absorb visual change at the landscape scale.

Property	The boundary of a property. A property can be made up of multiple lots, and can have an associated residence or be a vacant agricultural lot.
Receiver	Landowners within the vicinity of the proposal. Receivers are made up of landowners involved/associated with the proposal, landowners that are not involved/non-associated with the proposal and vacant agricultural properties.
Residence	A home or occupied dwelling.
Viewer sensitivity	Viewer sensitivity is subjective but can be discussed in terms of factors such as whether the view relates to recreational or work environments, or whether the view is experienced continuously or intermittently.
Landscape Management Zone (LMZ)	LMZs are derived by combining scenic quality with viewer sensitivity and proximity to the proposed infrastructure at the landscape scale. A three-tiered management hierarchy sets out appropriate management objectives for each zone.

2 METHODOLOGY

2.1 OVERVIEW

The VIA has been completed in the following stages:

1. Background investigations and mapping.
2. Field survey including reconnaissance, ground truthing and photography.
3. Consultation.
4. Impact assessment.
5. Development of a visual impact mitigation strategy.

These methods are detailed below.

2.2 BACKGROUND INVESTIGATIONS, MAPPING AND MODELLING

Background investigations included identifying key landscape features that may be affected by the visual impacts of the proposal. This was done using existing literature and aerial photos.

Mapping and modelling were undertaken to:

- Identify and classify LCUs within the study area. LCUs are a way to summarise differences in landscape amenity and the sensitivity of different areas within the landscape to visual impacts.
- Define areas in which the infrastructure of the proposal may be visible using topographic information.
- Identify key viewpoints such as major travel routes, potential receivers (dwellings and other structures), and built up areas.
- Understand the feasibility of screening to mitigate visual impacts.

The results were used to inform the field survey.

2.3 FIELD SURVEY

With reference to the mapping and modelling, field reconnaissance and ground truthing was undertaken to:

- Verify and document the existing LCUs in the study area.
- Identify representative viewpoints within the LCUs.
- Understand the likely sensitivity of the LCUs to views of the proposed solar farm.

Urbaine Architecture identified the representative viewpoints, which involved driving along major roads and publicly accessible minor roads, investigating and documenting dominant visual character elements and potential views to the proposed infrastructure. Photographs were taken at representative locations. Some roadside viewpoints have also been identified as ‘residential’ where they occur near a residence.

2.4 COMMUNITY CONSULTATION

Community consultation specific to this assessment of visual impacts is required to:

- Understand how the community values existing visual amenity in the study area.
- Document the perceptions of the community to the proposed development.

Community consultation has been undertaken in accordance with:

- Establishing the social licence to operate large scale solar facilities in Australia: Insights from social research for industry, Australian Renewable Energy Agency (ARENA).
- Beyond Public Meetings: Connecting community engagement with decision making, Twyford Consulting 2007.
- Community and Stakeholder Engagement: Draft Environmental Impact Assessment Guidance Series June 2017. Guideline 6.
- NSW Large-scale Solar Energy Guideline for State Significant Development December 2018.

Opportunities to raise concern about visual views (and others) were made available to the public through:

- A Project Website (http://jinderasolarfarm.com.au) that went live in November 2018 with a dedicated email address and contact section for feedback.
- Direct engagement with neighbours though phone calls, letters, emails and face to face meetings.
- Advertisements and fliers in the local newspaper.
- Community Open Days held on 5 and 7 December in Jindera.

The feedback form is included in Appendix C. The results are used in the impact assessment and are summarised in Section 3.3.2.

2.5 IMPACT ASSESSMENT

The potential impact of the proposed activity on visual amenity during construction has been assessed qualitatively given the construction period would be short in duration.

The impact assessment methodology adopted by NGH Environmental, approved previously by the NSW Department of Planning and Environment, and used in this VIA for operational impacts is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d.). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project.

Key steps undertaken to assess the visual impact are as follows:

- Define LMZs for the representative viewpoints, based on:
    - The scenic quality of the study area's LCUs.
    - The expected sensitivity at representative viewpoints.
    - The proximity of each representative viewpoint.
- Evaluate the degree of contrast the solar farm would generate at representative viewpoints in consideration of the management objectives of the relevant LMZ.

- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

Criteria for scenic quality, sensitivity, proximity, contrast and visual impact are included in the assessment in Section 3.

Mitigation measures are considered to be required for high impact receivers, where unmitigated impacts are deemed greater than what is acceptable. For medium impact receivers, the contrast is considered acceptable and mitigation may be recommended. For low impact receivers, the contrast is deemed unlikely to be perceived and therefore acceptable with no mitigation required.

2.6 PHOTOMONTAGES

Photomontages were prepared for selected viewpoints to provide a realistic impression of the operational solar farm. The viewpoints for the photomontages were selected based on distance to the development site, frequency of view from a public place, and the location of the nearest sensitive receiver. These are considered to be either the most potentially sensitive viewpoints, or representative of a range of similar viewpoints.

A number of photomontages were also prepared for selected residences that have specific visual concerns about the proposal. Four premises were visited, and montages were produced. These were R09, R22, R23 and R25. Two are within close proximity of the proposed solar farm (R23 and R09), and two have more elevated views (R22 and R25). The montages, where landowners agreed to them being exhibited, are shown Table 5-5. Each montage shows a specific view from a particular residence and has been provided to the relevant resident. The photomontages were produced to facilitate discussion between the affected resident and the proponent.

The photomontages in Table 5-4 show artist impressions of the proposed solar farm and the extent of the view based on available knowledge of the proposed activity at the time of preparation. Actual infrastructure types and location may be subject to change.

For the purpose of the assessment, a height of 3.5 m was used to model onsite infrastructure (which includes the maximum height of inverters, on-site substation, operations and maintenance building and security fencing). However, the posts for any overhead transmission lines would exceed 3.5 m in height. Specific assessment of impacts to sensitive receivers from the transmission line has been conducted. The model does not take into account screening such as vegetation or infrastructure. On this basis it is considered a 'worst case' model.

2.7 VISUAL IMPACT MITIGATION STRATEGY

The Visual Impact Mitigation Strategy was developed after consideration of the above methods. The mitigation strategy is outlined in Section 6.

3 EXISTING ENVIRONMENT

3.1 GREATER HUME LOCAL GOVERNMENT AREA

The Greater Hume Shire is located in southern New South Wales, between the major regional centres of Albury and Wagga Wagga. The shire has several small towns including Culcairn, Henty, Holbrook, Jindera and Walla Walla, and the smaller villages of Brocklesby, Burrumbuttock, Gerogery, Gerogery West, Morven, Walbundrie, and Woomargama. The LGA is 5,929 km² with a population of 10,351 as of the 2016 Census (ABS 2018a).

Major attractions to the area include the Wilksch Estate Winery, John McLeans Memorial, Morgans Lookout, the Holbrook Submarine Museum, Woomargama National Park, and several other museums.

3.2 JINDERA

The town of Jindera is located approximately 40 km south-west of the major town of Culcairn, with a population of 2,222 as of the 2016 Census (ABS 2018b). Jindera has a number of attractions including the Jindera Pioneer Museum, the Jindera Country Golf Club, Four Mile Creek, Jindera Wetland, Jindera Village Green and a number of recreational reserves.

3.3 COMMUNITY VALUES

3.3.1 General attitudes to solar infrastructure

Research indicates that there is widespread support for solar energy as a source of electricity generation in Australia (ARENA n.d.); 78% of respondents of the social research that the ARENA report is based on are in favour of large-scale solar energy facilities and 87% are in favour of domestic installations. The large-scale solar energy sector is still at a relatively early stage of development in Australia. While most members of the community are aware of large-scale solar energy, many do not know a great deal about its impacts (ARENA n.d.), including visual impacts.

Three approaches to improving community understanding of the visual impacts of large-scale installations include:

- Provision of images (from many angles) of large-scale solar facilities, particularly in the early stages of a proposal.
- Understanding the similarities between highly supported domestic scale installations and large-scale facilities.
- Understanding the current function of the proposed subject land and the additional value the installation of the proposal allows for.

(Source: extracted from ARENA n.d.).

This report addresses these issues.

3.3.2 Perceptions of the local community, regarding solar farm visual impacts

Community consultation specific to the assessment of visual impacts for the proposal was conducted for near neighbours and the broader community.

Nearest neighbours

During June 2018, a letter was hand delivered to every residence within a 1km radius of the proposal (Figure 3-1). For those who were home, discussions were had about the proposal and opportunities for early feedback provided. For those who were not home, the letter was left in their mailbox or at their front door. The letter briefly outlined the proposal and provided details to make contact with the proponent.

In October 2018, another letter was extended to all residences within a 1 km to 2 km radius of the proposal (Figure 3-1). As before, for those who were home, discussions were had about the proposal and opportunities for early feedback provided. For those who were not home, the letter was left in their mailbox or at their front door. The letter briefly outlined the proposal and provided details to make contact with the proponent.

In November 2018, Urbaine Architecture visited the homes of residents that through the consultation exercise had requested a visual montage. Montages of what the proposal may look like, including rendered images of solar panels, were created and provided to the relevant landowners in December 2018.

Also, in November 2018, a flier with details of the Community Information Sessions was posted to all residents within 2km of the proposal, placed within every post office box at the Jindera Post Office and advertised in the local newspaper, the Border Mail. This was also followed up with an email detailing the Open Day to anyone who had provided an email address.

All residents within a 2km radius that requested follow up with the proponent during the consultation period were contacted as per their requested contact method. This included face-to-face meetings, phone calls, emails and letters.

Broader community

A project website was developed to provide information and updates. The website went live in November 2018 and is updated regularly. An online comments section was also made available for the public to leave feedback or comments.

Community Open Days were held on 5 and 7 December 2018, inviting all interested parties to query and comment on the proposal. The open day was advertised through the local paper, and via posters hung at the IGA grocery store and the bulletin board near the Jindera Post office. A flyer was also distributed by Australia Post into every post office box at the Jindera Post Office. Details of the open day were also provided on the website.

Feedback forms

A feedback form was prepared to better understand the community's values and concerns regarding the proposal. Forms were distributed at the community open days, with the public encouraged to return the forms (Appendix C).

Results and visual concerns

A number of visual concerns were raised by near neighbours and the general public. This includes devaluation of properties and homes that are reliant on their visual aspect (not productivity of land), glare, removal of vegetation and change in land use.

A number of adjacent landowners agreed that vegetation planting would assist in breaking up the views, but also requested temporary fencing and/or earthen bunds for a more immediate solution:

- Temporary fencing has been considered on landowner's properties affected by 270-degree views in consultation with affected landowners. Fencing will be in the form of green shade cloth placed on security fences to screen view of infrastructure until proposed planted vegetation has established an effective screen.
- 1.5 m to 2 m high earthen bunds/mounds have been proposed to visually screen gaps in existing native vegetation until the proposed planted vegetation has established an effective screen. The location of the proposed bunds was chosen due to limited site constraints. Any earthen bunds within drainage lines/flood storage areas are not proposed due to erosion risk and maintenance.

Proposed vegetative screening locations and earthen bunds based on initial consultation and visual concern can be seen below in Figure 3-2.

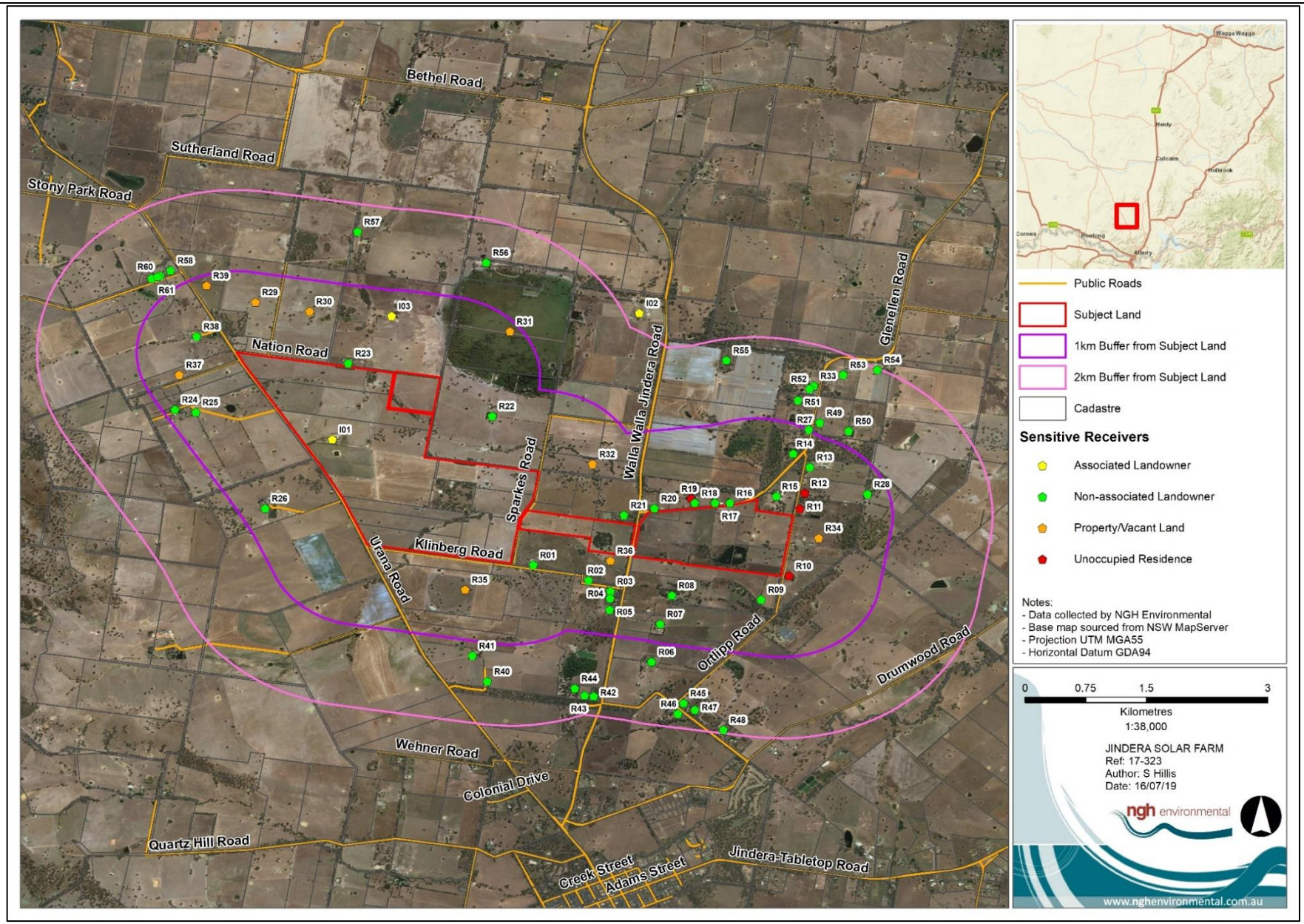


Figure 3-1 Nearest sensitive receptors

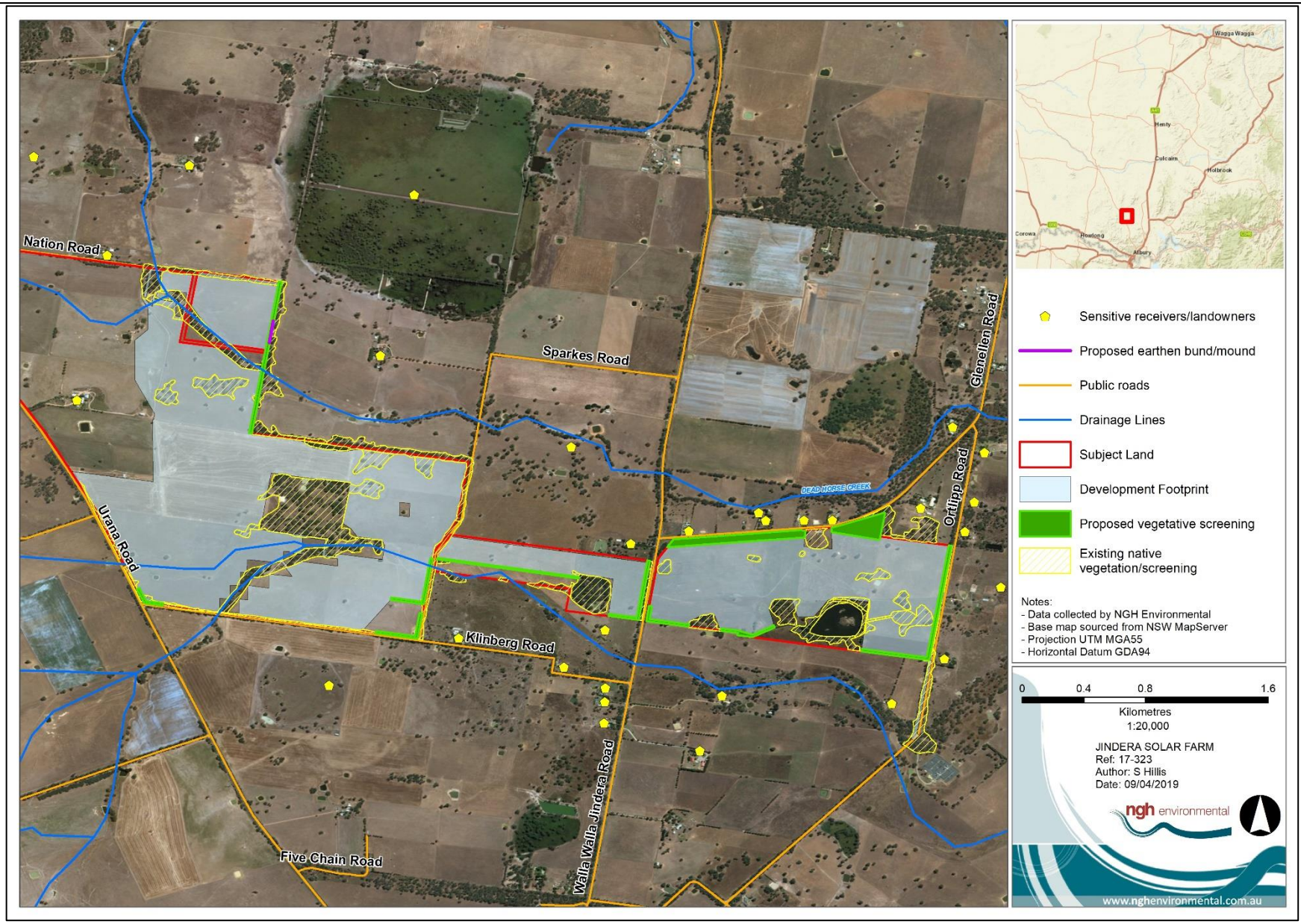


Figure 3-2 Proposed vegetative screening

3.4 LANDSCAPE CHARACTER UNITS (LCU)

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to summarise differences in the receiving environment that may affect the visual impact of the proposed solar farm at different locations.

Four LCUs were identified within Jindera and surrounding areas:

- Rural (including agricultural lands).
- Residential (viewpoints near rural residence/homes).
- Industrial (major roads, electrical and other built infrastructure).
- Commercial (businesses, town centre).

The scenic quality was rated in each LCU as follows:

- A high scenic quality rating describes areas with outstanding, unusual or diverse features.
- A moderate scenic quality rating applies to areas with the features and variety normally present in the character type.
- A low scenic quality rating is given to areas lacking features and variety.

The four LCUs identified are characterised in Table 3-1 in terms of their scenic quality.

Table 3-1 Key features of LCUs within Jindera and surrounds

Rural LCU
Rural and agricultural lands within the study area are used predominantly for agriculture, grazing and rotational cropping of grains, cereals and pulses. The site is relatively flat to undulating. Expansive views within this LCU are generally limited given the undulating relief and screening provided by vegetation. Limited relief and elevation can be seen from properties on Urana Road. Secondary sealed roads such as Urana Road, Walla Walla Jindera Road and Glenellen Road are the main vantage points from which to view agricultural areas. From the road corridors, agricultural and grazing land can be viewed openly. Patches of native and planted vegetation screen views of agricultural land from roadways. In addition to sections of road, overhead transmission lines are visible that reinforce rectilinear shapes and are common in rural landscapes. Surrounding blocks are made up of primary production and hobby farms, with residences within this landscape being a mix of broadly and relatively closely distributed. Residence are commonly associated with some additional vegetation plantings. Other infrastructure includes agricultural sheds, buildings and low open fences. **Scenic quality is moderate. Built elements are production related and include linear fences, powerlines, roads, agricultural buildings and rural homes. Forms are typically uniform, of undulating elevation and linear. This LCU is common and the dominant LCU in the study area. The proposed solar farm is located within this LCU.**
Residential LCU
Residential areas of Jindera and surrounds include Jindera township, the new Pomegranate Estate and viewpoints from the road near resident's homes. However, the Jindera township does not have a view of the proposal. As such, it is excluded from this assessment.

Much like the Rural LCU, the area is relatively flat to undulating with expansive views generally limited given the undulating relief and screening provided by vegetation. Residences are broadly and unevenly distributed over the landscape, with properties commonly associated with additional vegetation planting and screening (boundary planting, fences etc.).

Residence are located on Urana Road, Nation Road, Sparkes Road, Klinberg Road, Walla Walla Jindera Road, Glenellen Road and Ortlipp Road.

Scenic quality is considered moderate. These areas have variety in colour and form normal in this character type. Elements include linear fences, powerlines, roads, agricultural buildings and rural homes. This LCU is common in the study area.

Industrial LCU

Industrial areas within Jindera and surrounds include the major Urana Road, Walla Walla Jindera Road, the Jindera Substation and powerlines, and the Jindera industrial area. Common features in the LCU include two-way sealed roads, road reserve, fencing, powerlines, a substation, industrial buildings and regular small and large vehicles.

The Jindera industrial area does not have a view of the proposal, as such is excluded from this assessment.

Scenic quality is considered low, with features matching the land use. Screening is present for the majority of surrounding roads, with broken views of surrounding rural land visible through existing native vegetation. The undulating landform also breaks up expansive views of surrounding rural and residential land. This LCU is common in the study area, with the development site located along major roads and adjacent to the Jindera substation and major overhead transmission lines.

Commercial LCU

Commercial lands within the study area includes the Jindera central business district, made up of local shops, eateries, supermarket and post office. Commercial areas of Jindera do not have a view of the proposal, and as such is excluded from the assessment.

3.5 VIEWPOINT SENSITIVITY

3.5.1 Identifying viewpoints

The BLM methodology requires identification of representative viewpoints in the study area. These may be travel routes such as roads, waterways and recreational tracks, residential areas, tourist facilities, houses and farmland.

14 representative viewpoints were identified using topographic information and the BLM methodology, and are mapped in Figure 3-3.

3.5.2 Rating proximity and assessing sensitivity of viewpoints

The predicted sensitivity of each viewpoint can be determined considering its proximity to the development site and factors such as use, scenic quality and regional significance.

Criteria for proximity are as follows:

- Foreground 0 – 1 km.
- Middle ground 1 – 2 km.
- Background More than 2 km.

Criteria for scenic quality are as follows:

- High sensitivity:
    - high use routes or areas.
    - routes or areas of national or state significance.
    - areas with high scenic quality.
- Moderate sensitivity:
    - moderate use routes or areas.
    - routes or areas of regional or local significance.
    - areas with moderate scenic quality.
- Low sensitivity:
    - low use routes or areas.
    - routes or areas of low local significance.
    - areas with low scenic quality.

Considering the sensitivity of local viewpoints, the following assessments were made:

- **Rural viewpoints** were assessed as generally having a moderate to low scenic quality given the surrounding agricultural and industrial activities. Rural views are located on moderate to low routes, or areas only accessed by local traffic. As motorists use local roads, views increase as vehicles approach the development site. View durations are generally short as vehicle speeds are up to 100 km/hr, and the expected number of local vehicles on these local roads is considered to be low to moderate. Regional and local significance is low, with scenic quality being moderate.
- **Residential viewpoints** were assessed as generally having a moderate to high sensitivity. If there was a view to the solar farm, the view duration could be expected to be high for a receiver.
- **Industrial viewpoints** were assessed as having low sensitivity. Any views from these areas would be fleeting due to vehicle speed, hard to discern, and fragmented by existing roadside vegetation and overhead transmission lines. Built structure is more commonly functional than aesthetic in these settings.

The sensitivity of each viewpoint is provided in Table 3-2.

Table 3-2 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	Distance to site	Scenic quality	Sensitivity
1	Industrial	Foreground	Moderate	Low
2	Rural	Foreground	Moderate	Moderate
3	Rural/Residential	Foreground	Moderate	Moderate
4	Rural	Foreground	Moderate	Moderate
5	Rural	Foreground	Moderate	Moderate
6	Industrial	Middle ground	Moderate	Low
7	Industrial	Middle ground	Moderate	Low
8	Residential	Foreground	Moderate	**High**
9	Residential	Foreground	Moderate	**High**

ID	LCU	Distance to site	Scenic quality	Sensitivity
10	Residential	Foreground	Moderate	Moderate
11	Residential	Foreground	Moderate	Moderate
12	Residential	Foreground	Moderate	**High**
13	Industrial	Foreground	Moderate	Low
14	Residential	Foreground	Moderate	Moderate

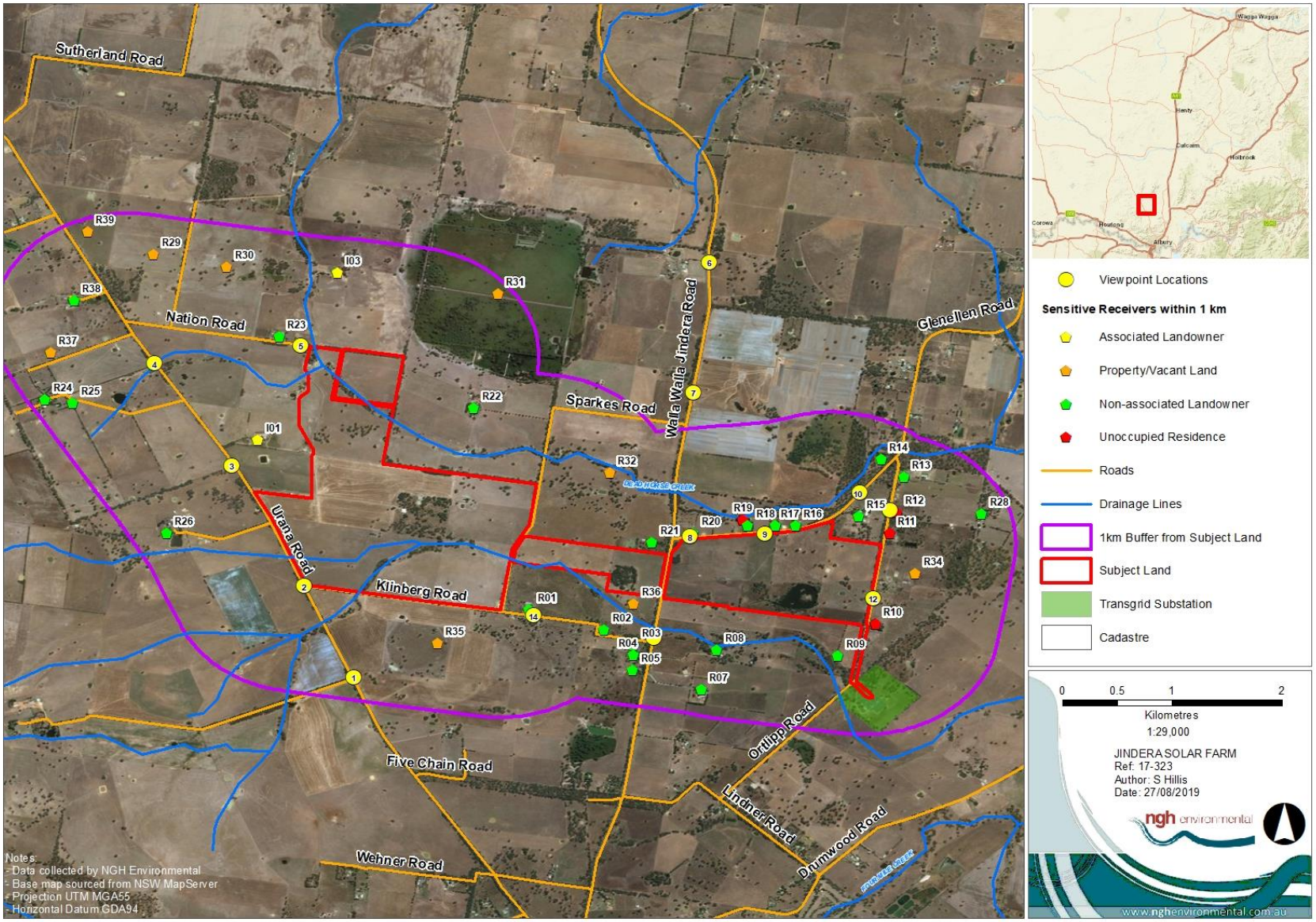


Figure 3-3 Location of viewpoints

4 VISUAL CHARACTERISTICS OF KEY INFRASTRUCTURE COMPONENTS

The key infrastructure components of the proposal, with reference to the stage of the project and the potential visual amenity impacts they may generate, are discussed below and referenced in the Visual Impact Assessment, Section 5.

4.1 INFRASTRUCTURE COMPONENTS

Infrastructure components of the proposed solar farm are detailed in Section 1.1.

As illustrated on the Proposed Infrastructure map in Appendix A the development footprint that would include the solar arrays covers the majority of the development site, with 80 hectares of horizontal panels (based on an area of 2 m^2 for each individual panel and 393,000 panels). However, the ground disturbance from pile installation (approximately 57,000 piles at 40 cm^2) would disturb only about 0.05% of the total development footprint. Panels within the solar array area would sit above the ground and ground cover vegetation would be maintained under the panels. Shading on-site will be affected by the time of day, location of the sun and the tilt of the panel (Refer to Shading Analysis in Appendix D). Additional ground disturbance outside the solar arrays would result from construction of the internal access tracks, trenches for cabling and footings for other equipment.

The following construction ancillary facilities would be located within the development site:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction workers transportation. Once the solar farm has been commissioned a small car park would remain for the minimal staff required and occasional visitors.
- Staff amenities. Once constructed, the solar farm would be monitored and operated remotely and would therefore require a minimum number of maintenance personnel to be onsite.
- Parking for staff and visitors.

These facilities would be designed in line with the relevant Australian standards.

Staff amenities would be designed to accommodate the number of workers at the peak of the construction period and would include:

- Car park.
- Sanitary modules with septic tank.
- Changing rooms.
- Administrative office.
- Undercover storage area.
- Muster point in case of emergency.
- Genset for electrical supply.

4.2 CONSTRUCTION COMPONENTS

Construction impacts would be temporary, confined to approximately 12 months. Visual impacts could be generated during this time by:

- Development of site compound areas, site offices and stock piles located within the site boundaries. Steel sheds can generate reflectivity and glare although would be a similar look to existing farm sheds. Material stockpiles may detract from visual amenity, particularly if dispersed across broad areas.
- Construction traffic will increase visual impacts and (if not controlled) add to dust generation on the entry to Urana Road and Walla Walla Jindera Road. Onsite parking areas, material laydown, site offices etc. would also be visible from main roads.
- Areas of bare soil created through grading or trenching cables could contribute to dust and detract from visual amenity until they are rehabilitated.
- Security lighting is likely to be used overnight at the construction compounds and any storage areas.

4.3 OPERATIONAL COMPONENTS

Operational impacts centre on the look of the solar farm, once construction is complete:

- The solar array would be up to 3 m high.
- Inverters could measure up to 3.5m high.
- Electricity cables would be installed between the array modules, either underground or mounted to the underside of the array, producing negligible additional visual impact.
- The electrical connection from the site would be via an aboveground cable from the proposed on-site substation to the Jindera substation. Visual impact of this would be negligible.
- The delivery stations and site offices would add visual impact, mostly to motorists along main roads.
- Fencing would be up to 2.3m high security fencing along the site boundaries. It is expected to be cyclone fencing. Barbed wire is not recommended due to known threatened wildlife that resides on the site. Views would be afforded beyond the fence, as the fence is not solid.
- Vegetation screening/plantings will be incorporated into the development, planted on the outside of the security fencing to break up views of all infrastructure.
- The main access to the site would be off Urana Road and Walla Walla Jindera Road. This would provide minimal visual impact to local traffic.
- An area for parking would be included within the site boundaries. No offsite parking is permitted.

Glare

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare or reflection. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity. The panels will not generally create noticeable glare compared with an existing roof or building surface (NSW Department of Planning 2010). Seen from above (such as from an aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

Other onsite infrastructure that may cause glare or reflections if not mitigation is applied depending on the sun angle, include:

- Steel array mounting - array mounting would be steel, but generally shaded from direct light under the solar panel.
- Temporary site offices, sheds, inverters.
- The onsite delivery station/construction compound.
- Perimeter fencing.
- Permanent staff amenities.

This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to residences, motorists or aircraft.

In addition to the above, Clean Technology Partners were commissioned by the proponent to prepare a Glare Study for the proposal (Appendix E). A number of observation points were nominated for roads and properties surrounding the proposal, as well as observation points for flight paths from the Albury and Corowa Airports.

Glare hazard that classified based on the size of the glare viewed by the observer and the intensity of the glare impacting the retina of the observer (retinal irradiance). No glare risk was found to be present for any of the observation points for the flight path around the proposal. Existing and proposed vegetative screening was not included in the analysis of glare, further reducing any glare potential.

Night lighting

Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations) and will comply with the *Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting*. It would be directed away from roads and residences so as not to cause light spill that may be hazardous to motorists.

Lighting would be similar in scale and less frequent than lighting in adjacent residences. Night lighting is unlikely to present a hazard or impact to motorists or residences.

Night lighting would be used on a very infrequent basis for:

- Construction security.
- Delivery of oversized, over mass vehicles.
- Operational maintenance.

Mitigation measures for night lighting are detailed within the Mitigation Strategy in Section 6.

5 IMPACT ASSESSMENT

5.1 CONSTRUCTION IMPACT ASSESSMENT

Visual impacts during the construction period would be generated by the following construction activities and elements:

- Temporary site office and amenities buildings.
- Earthworks.
- Delivery and stockpiling of materials.
- Stockpiling of excavated soil.
- Construction and installation of proposed solar farm infrastructure.

The use of excavation machinery would contribute to the visual impact of the proposed activity.

Visual receptors for the proposed activity during the construction period would include some residences in the immediate vicinity, road users travelling along all main roads, and some members of the community of Jindera. Some residences in the immediate vicinity would have broken views of construction.

Given the relatively short duration of the construction period compared to the lifetime of the proposal, moderate to low use of local roads and few residences with any view of the proposal, it is considered that the potential visual impact during construction would be minimal. A general mitigation measure for the management of the development site during construction has been included in Section 6.

5.2 OPERATIONAL IMPACT ASSESSMENT

5.2.1 Methodology

An operational visual impact assessment has been conducted considering:

- The proposed solar farm components described in Section 1.1.
- The potential for the proposed solar farm to be viewed from representative viewpoints.
- The degree of contrast the proposed solar farm would have within the identified LMZ. LMZs were assigned to viewpoints based on the results of the field work, and the contrast at that viewpoint was evaluated, as described below.
- Concerns raised by residents and the community.
- The potential impact from glare.

5.2.2 Definition of landscape management zones

Visual LMZs were assigned to each representative viewpoint. The zones were derived by combining scenic quality (from the LCUs described in Section 3.4), viewer sensitivity and the distance to the proposed solar farm (from Section 3.5.2). Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 5-1.

Table 5-1 Visual Landscape Management Zone decision matrix

Scenic quality	Proximity / sensitivity						
	Foreground High	Middle ground High	Background High	Foreground Moderate	Middle ground Moderate	Background Moderate	Foreground Low
High	A	A	A	A	B	B	B
Moderate	A	B	B	B	B	C	C
Low	B	B	B	B	C	C	C

Each zone has associated objectives to guide management of visual change and to help evaluate proposed project impacts. These are shown in Table 5-2.

Table 5-2 Visual Landscape Management Zone management objectives

Management priority	Management objectives
A	Maximise retention of existing visual amenity. Landscapes are least able to absorb change. Developments may lead to a major change.
B	Maintain existing visual amenity, where possible. Protect dominant visual features. Developments may be allowed to be visually apparent.
C	Less importance for retaining existing visual amenity. Landscapes are able to absorb change. Developments may be allowed to dominate but should reflect existing forms and colours where possible.

5.2.3 Visual impact assessment at representative viewpoints

Evaluation criteria

The ratings for the degree of contrast created by the proposed solar farm at each viewpoint have the following definitions (BLM n.d.):

- High contrast: the proposed activity would be dominant within the landscape and generally not overlooked by the observer; the visual change would not be absorbed.
- Medium contrast: the proposed activity would be moderately dominant and noticed; the visual change would be partially absorbed.
- Low contrast: the proposed activity would be seen but would not attract attention; the visual change would be well absorbed.
- Indistinct: contrast would not be seen or would not attract attention; the visual change would be imperceptible.

To determine if the objectives for the VLM zone are met, the contrast rating for the viewpoint is compared with the relevant management objectives to give a visual impact level. The visual impact level is consequently defined as:

- High impact: contrast is greater than what is acceptable.
- Medium impact: contrast is acceptable.
- Low impact: visual contrast is little or not perceived and is acceptable.

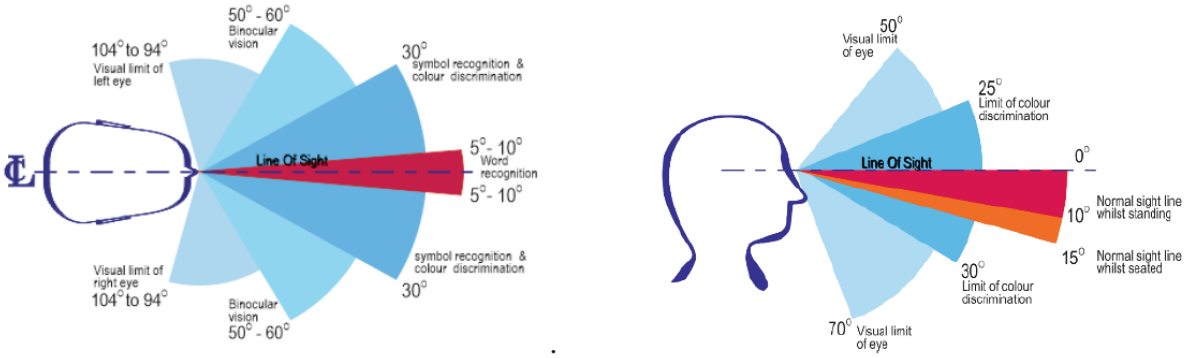
For high impact viewpoints, mitigation must be considered.

5.2.4 Photomontages

Photomontages of the project shown within the existing context were prepared by Urbaine Architecture to assist in the impact assessment of the proposal. Seven viewpoints were selected for the production of photomontages as they were determined to have the greatest potential for visual impact and best represent a range of distances and locations with differing views. Photomontages are based on a worst-case scenario of the project without the inclusion of proposed mitigation measures (i.e. vegetative screening). Where infrastructure is discernible in the landscape, rendered images in red have been included to provide clarity.

The horizontal field of view for human vision represents the central cone of view in which symbol recognition and colour discrimination can occur, which is 60°. The vertical field of view is between 10° and 15°. The field of view of human vision is shown below in Figure 5-1.

The photomontages show the change in a 120° horizontal field of view to capture the full extent of the proposal. The panoramic views and photomontages are technically accurate, but not perceptually accurate due to the field of view and appear "curved".



5.2.5 Figure 5-1 Horizontal and vertical fields of viewEvaluation results

Table 5-3 details a panoramic photo of each viewpoint and evaluates the expected level of visual impact from the representative viewpoints, while Table 5-4 shows the proposed expected view (photomontage) of the solar farm without any mitigation measures (i.e. vegetative screening), except Viewpoint 9. Photomontages from the selected residences (R09, R22, R23 and R25) are shown Table 5-5. A summary of the potential visual impact, proposed mitigation measures and residual visual impact following mitigation for potentially affected adjacent residences is detailed within Table 5-6. The viewpoint that best represents each potentially impacted receiver is shown in Table 5-7.

Viewpoint 9 includes an indicative view of the proposal with established vegetative screening, as indicated in the proposed Landscape Plan. It is important to note that overstorey vegetation is likely to take some years to mature as an effective vegetative screen, but the chosen species within the midstorey and shrubs are fast growing and dispersive/spreading species, capable of fast establishment and screening. The majority of these midstorey species (7 to 10m) and shrubs (2.5m) have a short lifespan and will be replaced as required. However, it is also likely that the overstorey vegetation will have established enough as an effective vegetative screen by this time.

A summary of the operational visual impact assessment is presented in Section 5.2.6.

Table 5-3 Visual impact at representative viewpoints with reference to the proposal

VIEWPOINT 1		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from Urana Road facing north-east towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Urana Road. Dominate features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not likely to be discernible by residence or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 2		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural	Taken from the intersection of Urana Road and Klinberg Road facing north-east towards the proposed solar farm. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominate features include the tree lined, sealed and unsealed roads, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominately cleared and flat. The location represents the first point where motorists will gain a view of the proposal as they drive north on the high to moderately used Urana Road. Broken views of the proposed infrastructure through vegetative screening will be noticeable and may cause initial distraction to motorists at an intersection. Views would however be fleeting due to speed of travel. **Refer to Photo Montage 1** (Table 5-4) **Mitigation recommended** A 15 m wide vegetative buffer is recommended on the intersection of Urana and Klinberg Road to reduce any motorist distraction at the intersection. This will increase overall safety of the intersection by screening the view of infrastructure from road users.
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Medium	
Inherent Visual Impact	MEDIUM	
Residual Visual Impact	LOW	

VIEWPOINT 3		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural	Taken from Urana Road facing east towards the proposal. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominate features include the tree lined, sealed Urana Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominately cleared and flat. Broken views of the proposal are likely through breaks in existing vegetation. However, proposed infrastructure is unlikely to be discernible by residence or motorists due to distance, vegetative screening and speed of travel. The form of the infrastructure, low (<4m) and in rectangular arrays, is also not incongruous with the existing low-lying rectangular forms in this agricultural area. **Refer to Photo Montage 2** (Table 5-4) **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 4		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural	Taken from Urana Road facing east towards the proposal. The viewpoint is representative both of the rural nature of the area and the industrial view of Urana Road. Dominate features include the tree lined, sealed Urana Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominately cleared and flat. Views of the proposal are unlikely to be discernible by residence or motorists due to distance, vegetative screening and speed of travel. The form of the infrastructure, low (<4m) and in rectangular arrays, is also not incongruous with the existing low-lying rectangular forms in this agricultural area. **Refer to Photo Montage 3** (Table 5-4) **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 5		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural/Residential	Taken from Nation Road facing south towards the proposal. The viewpoint is representative of both the rural nature of the area and residential view of Landowner R23. Dominate features include the tree lined, unsealed Nation Road, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominately cleared and flat. The viewpoint is directly adjacent the associated landowners retained property, where no development is proposed. Broken views of the proposal are likely through breaks in existing vegetation. However, proposed infrastructure is unlikely to be discernible by residence or motorists due to very low use of the road (private access) and vegetative screening. No views are affordable from the residence itself. **Refer to Photo Montage 4** (Table 5-4) **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 6		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from Walla Walla Jindera Road facing south towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Walla Walla Jindera Road. Dominate features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Middle Ground (1 – 2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 7		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from Walla Walla Jindera Road facing south towards the proposal. The Viewpoint is representative of the industrial view of the moderate to highly used Walla Walla Jindera Road. Dominate features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure is not discernible by residence or motorists due to distance, vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Middle Ground (1 – 2 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 8		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Glenellen Road at its intersection with Walla Walla Jindera Road, facing south towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Glenellen Road that are directly adjacent the proposal boundary. Dominate features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. The land is predominately cleared and flat with minimal vegetative screening. The location represents the first point where motorists will gain a view of the proposal as they drive south on the moderately used Walla Walla Jindera Road, and as they turn east onto Glenellen Road. Clear views of the proposed infrastructure will be noticeable and may cause initial distraction to motorists at an intersection due to limited existing vegetative screening. Views would however be fleeting due to speed of travel. It is important to note that the view does not take into consideration existing vegetative screening on the northern side of Glenellen Road within the boundary of the residences. **Mitigation recommended** A 50 m wide buffer incorporating vegetative screening (as per Figure 3-2 and the Landscape Plan Appendix B) is recommended for the length of Glenellen Road to screen views of the proposal. Existing vegetative screening on the Walla Walla Jindera Road intersection is to be retained. This will increase overall safety of the intersection by screening the view of infrastructure from turning vehicles and reduce any potential for collision. The buffer width with also maximise the screening potential for residences along Glenellen Road.
Scenic Quality	Moderate	
Proximity	Foreground (<1 km)	
Sensitivity	High	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	
Residual Visual Impact	MEDIUM	

VIEWPOINT 9		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Glenellen Road facing south towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Glenellen Road that are directly adjacent the proposal boundary. Dominate features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. Currently, the land is predominately cleared and flat with minimal vegetative screening. Clear views of the proposed infrastructure will be noticeable and may cause distraction to motorists due to limited existing vegetative screening. Views would however be fleeting due to speed of travel. It is important to note that the view does not take into consideration existing vegetative screening on the northern side of Glenellen Road within the boundary of the residences. **Refer to Photo Montage 5** (Table 5-4) **Mitigation recommended** A 50 m wide buffer incorporating vegetative screening (as per Figure 3-2 and the Landscape Plan Appendix B) is recommended for the length of Glenellen Road to screen views of the proposal. This will increase overall safety for motorists travelling along Glenellen Road by screening the view of infrastructure from turning vehicles and reduce any potential for collision. The buffer width with also maximise the screening potential for residences along Glenellen Road.
Sensitivity	High	
Proximity	Foreground (<1 km)	
Scenic Quality	Moderate	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	
Residual Visual Impact	MEDIUM	

VIEWPOINT 10		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Glenellen Road facing south-west towards the proposal. The Viewpoint is representative of the residential views of residences north-east of the proposal. Dominate features include the tree lined, sealed road, grazing and cropping paddocks, fencing, and dense vegetation. Proposed infrastructure is not discernible by residence or motorists due to dense existing vegetative screening and undulating nature of the area. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 11		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Ortlipp Road facing south-west towards the proposal. The Viewpoint is representative of the residential views of residences along the northern end of Ortlipp Road. Dominate features include the tree lined, unsealed road, grazing and cropping paddocks, fencing, and dense vegetation. Proposed infrastructure is not discernible by residence or motorists due to dense existing vegetative screening. **No mitigation is required**
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Indistinct	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 12		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Rural	Taken from Ortlipp Road facing west towards the proposal. The viewpoint is representative of the rural nature of the area. Dominate features include the tree lined, unsealed roads, grazing and cropping paddocks, fencing, and vegetation. The Jindera substation is also located within 1 km of the viewpoint. Currently, the land is predominately cleared and flat with low vegetative screening. Clear views of the proposed infrastructure will be noticeable and may cause distraction to motorists due to limited existing vegetative screening. The form of the infrastructure, low (<4m) and in rectangular arrays, is however not incongruous with the existing low-lying rectangular forms in this agricultural area, and infrastructure blends with the existing views of the industrial Jindera Substation and mass of overhead transmission lines. It is important to note that the view does not take into consideration existing vegetative screening on the eastern side of Ortlipp Road within the boundary of the residences and the current lack of occupied homes. **Refer to Photo Montage 6** (Table 5-4) **Mitigation recommended** A 15 m wide vegetative buffer and 50 m offset from the boundary of the proposal is recommended for the length of Ortlipp Road to screen views of the proposal. The current offset as per the design is 80 m from the edge of the subject land to the nearest panel array, incorporating the existing transmission line easement. This will increase overall safety for motorists travelling along Ortlipp Road by screening the view of infrastructure to reduce any potential for collision. The buffer width with also maximise the screening potential for future residences along Ortlipp Road.
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	High	
LMZ Objective	A	
Contrast	High	
Inherent Visual Impact	**HIGH**	
Residual Visual Impact	LOW	

VIEWPOINT 13		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Industrial	Taken from the intersection of Walla Walla Jindera Road and Klinberg Road facing north towards the proposal. The Viewpoint is representative of the industrial view of the moderately used Walla Walla Jindera Road. Dominate features include the tree lined, sealed roads, grazing and cropping paddocks, fencing, and vegetation. Proposed infrastructure barely discernible by motorists due to distance and existing dense vegetative screening. **Refer to Photo Montage 7** (Table 5-4) **No mitigation is required** Mitigation is however required where infrastructure is first viewed on Walla Walla Road. A 15 m wide vegetative buffer is recommended on both the east and western side of Walla Walla Jindera Road to reduce any motorist distraction. This will increase overall safety by screening the view of infrastructure from vehicles and reduce any potential for driver distraction.
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Low	
LMZ Objective	C	
Contrast	Low	
Inherent Visual Impact	LOW	
Residual Visual Impact	LOW	

VIEWPOINT 14		
Summary of Viewpoint		Viewpoint Description / Impact
LCU	Residential	Taken from Klinberg Road facing north towards the proposal. The viewpoint is representative both of the rural nature of the area and the residential homes along Klinberg Road. Dominate features include the tree lined, unsealed road, grazing and cropping paddocks, fencing, large overhead transmission lines and vegetation. Currently, the land is predominately cleared and flat with moderate vegetative screening. Broken views of the proposed infrastructure will be noticeable by residences but are unlikely to cause distraction to motorists due to existing vegetative screening and distance from the proposal. The infrastructure blends with the existing views of the overhead transmission lines. **Mitigation recommended** A 15 m wide vegetative buffer is recommended to screen views of the proposal from residences. Screening should be on the subject land boundary for the full length of Klinberg Road, from its intersection with Walla Walla Jindera Road to the western boundary of the residence location on Klinberg Road. Proposed screening and distance from infrastructure will provide maximum screening potential for residences on Klinberg Road. Temporary fencing in the form of shade cloth may also assist screening until vegetation has established an effective screen.
Scenic Quality	Moderate	
Proximity	Foreground (>1 km)	
Sensitivity	Moderate	
LMZ Objective	B	
Contrast	Medium	
Inherent Visual Impact	MEDIUM	
Residual Visual Impact	LOW	

Table 5-4 Photomontages of representative viewpoints

PHOTOMONTAGE 1 (TAKEN FROM VIEWPOINT 2 (refer to Figure 3-3))


PHOTOMONTAGE 2 (TAKEN FROM VIEWPOINT 3 (refer to Figure 3-3))

PHOTOMONTAGE 3 (TAKEN FROM VIEWPOINT 4 (refer to Figure 3-3))

PHOTOMONTAGE 4 (TAKEN FROM VIEWPOINT 5 (refer to Figure 3-3))

PHOTOMONTAGE 5 (TAKEN FROM VIEWPOINT 9 (refer to Figure 3-3))

PHOTOMONTAGE 6 (TAKEN FROM VIEWPOINT 12 (refer to Figure 3-3))

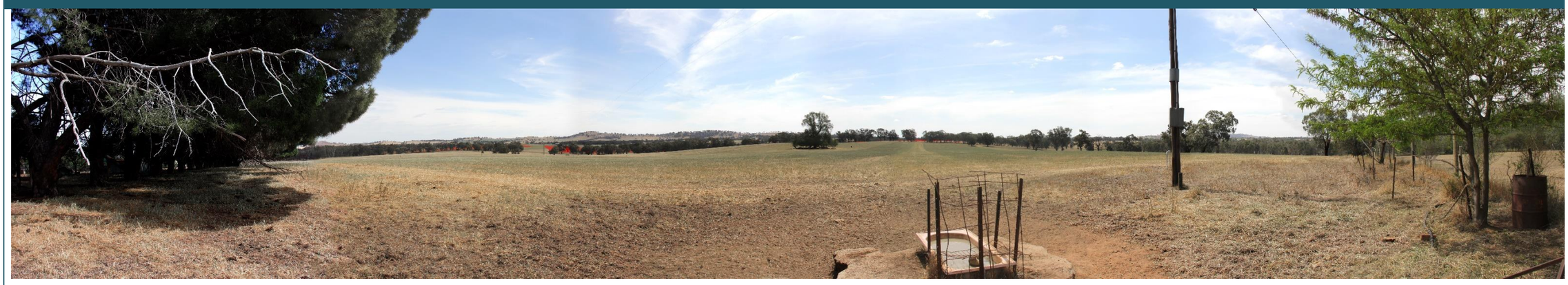
PHOTOMONTAGE 7 (TAKEN FROM VIEWPOINT 13 (refer to Figure 3-3))

Table 5-5 Photomontages of representative viewpoints from selected residences.

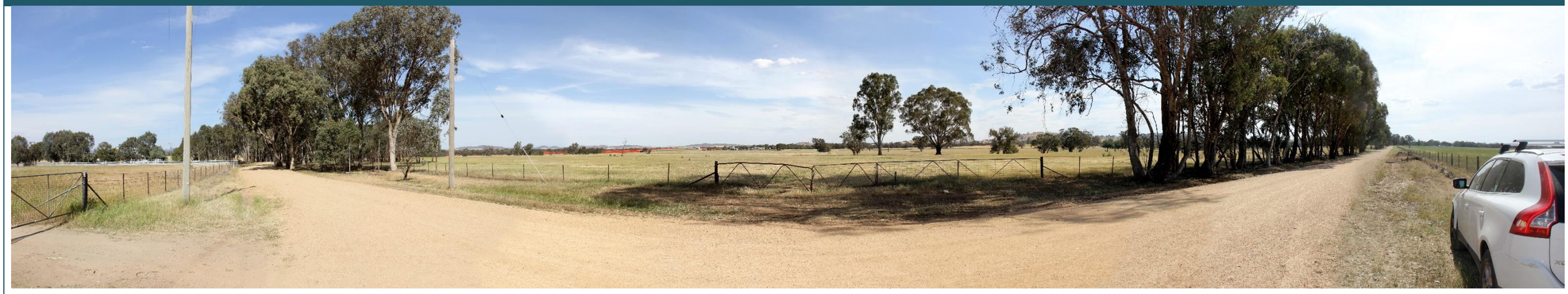
Photomontage taken from R09 (viewpoint 8c)

Photomontage taken from R22 (viewpoint 10c)

Photomontage taken from R22 (viewpoint 11c)



Photomontage taken from R23 (viewpoint 17c)



Photomontage taken from R25 (viewpoint 22c)

Table 5-6 Potentially affected residences adjacent to the proposal (including clearing for transmission line where relevant)

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
R01 Klinberg Road: The receiver will have solar infrastructure visible to the north and west of the residence. Views to the north-west and west will indistinct due to placement of panels and existing native vegetative screening. The closest panel infrastructure is located approximately 300 m to the north-east, and 500 m to the north of the residence. Existing large 330 kv transmission lines cross the property to the north and west, in front of proposed infrastructure. Refer to **Viewpoint 14** in Table 5-4.	MEDIUM	• Ongoing consultation with the receiver. • A 15 m wide vegetative buffer would be established to the north and west of the residence within the project boundary to screen views of the proposal. Additional screening outside of the TransGrid transmission line easement would be implemented to fill gap in lieu of planting in the easement itself. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Temporary fencing in the form of shade cloth may also assist screening until vegetation has established as an effective screen.	LOW
R02 Klinberg Road: The receiver will have solar infrastructure partially visible to the north-east and north-west of the residence. Views will be broken due to existing native vegetation screening. The closest panel infrastructure is location approximately 500 m north-east of the residence. Existing large 330 kv transmission lines cross the adjacent property to the north, in front of proposed infrastructure.	LOW	• A 15 m wide vegetative buffer would be established to the north-east and north-west of the residence within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW
R03, R04, R05, R07 and R08 Walla Walla Jindera Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R08, is approximately 450 m from the closest panel infrastructure to the north-east. Refer to **Viewpoint 13** in and **Photomontage 7** in Table 5-4. None are likely to perceive any clearing required for Ortlipp Road, given intervening riparian vegetation and distance (greater than 1.5km for closest receiver).	LOW	No mitigation is required. However, vegetation screening is proposed on the southern boundary of the proposal to fill in any gaps in existing native vegetation screening. This increases biodiversity connectivity to existing vegetation from the artificial wetland.	LOW
R09 Ortlipp Road:	MEDIUM	• Ongoing consultation with the receiver.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
The receiver will have solar infrastructure visible to the north of the residence. Views will indistinct due to placement of panels and existing native vegetative screening. The closest panel infrastructure is located approximately 450 m to the north of the residence. If any clearing is required for Ortlipp Road it may be perceived (approximately 200m away from residence) however vegetation around the house lot is likely to screen this direction to a large extent (views to the north east are obscured).		• A 15 m wide vegetative buffer would be established to the north of the residence within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure.	
R10, R11 and R12 Ortlipp Road: Face to face consultation with landowners was undertaken in July of 2018. Receivers 10, 11 and 12 on Ortlipp Road were visited, and the residences were considered unoccupied but were still assessed. The current offset as per the design is 80 m from the edge of the subject land to the nearest panel array, incorporating the existing transmission line easement. If any clearing is required for Ortlipp Road it may be perceived from R10 (less than 100m away from residence) however vegetation around the house lot is likely to screen this direction to a large extent (views to the south are obscured).	LOW	• While abandoned, if the landowners chose to develop the properties and inhabit the dwellings/residences in the future, a 15 m vegetative buffer for the full length of Ortlipp Road would be established to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW
R13 and R14 Ortlipp Road and Glenellen Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R13, is approximately 710 m from the closest panel infrastructure to the north-east.	LOW	• No mitigation is required.	LOW
R15 Glenellen Road: The receiver will have solar infrastructure partially visible to the south of the residence. Views will be broken due to existing native vegetation screening. The closest panel infrastructure is location approximately 270 m south of the residence. Existing 30 kv	LOW	• Up to 250 m of vegetative screening is proposed to the west of the residence. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
transmission lines cross the subject land to the south of the residence, in front of proposed infrastructure.			
R16, R17, R18, R19 and R20 Glenellen Road: All receivers will have solar infrastructure clearly visible to the south of the residence. The closest receiver residence, R20, is approximately 100 m from the closest panel. Refer to **Viewpoint 8** and **Viewpoint 9** and **Photomontage 5** in Table 5-4.	**HIGH**	• Ongoing consultation with the receivers. • A 50 m wide vegetative buffer would be established for the full length of Glenellen Road within the project boundary to screen views of the proposal. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure. • Existing vegetative screening to be retained.	MEDIUM
R21 Walla Walla Jindera Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening. The receiver is located approximately 110 m from the closest panel infrastructure to the south and 200 m to the direct east.	LOW	No mitigation is required.	LOW
R22 Sparkes Road: The receiver is elevated in the landscape, with partial views through existing native vegetation screening from the residence to the west and south. The residence is located approximately 630 m at it's closest point to panel infrastructure in both directions.	MEDIUM	• Ongoing consultation with the receiver. • A 15 m wide vegetative buffer would be established to the west of the residence within the project boundary to screen views of the proposal. • Additional earthen bund proposed in large gap in existing native vegetative screening to screen elevated views and for immediate effectiveness. • Vegetative screening to be placed in front of security fence to obscure views of infrastructure.	LOW
R23 Nation Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening. The residence is located approximately 300 m from the closest panel infrastructure to the south-east. Refer to **Viewpoint 5** and **Photomontage 4** in Table 5-4.	LOW	No mitigation is required.	LOW
R24 and R25 Urana Road:	LOW	No mitigation is required.	LOW

Receiver	Unmitigated Impact	Mitigation Measures	Residual Impact
Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The residences are located approximately 1.6 km from the closest panel infrastructure to the east. Refer to **Viewpoint 4** and **Photomontage 3** in Table 5-4.			
R26 Urana Road: Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The residence is located approximately 870 m from the closest panel infrastructure to the east. Refer to **Viewpoint 3** and **Photomontage 2** in Table 5-4.	LOW	No mitigation is required.	LOW
R27 and R28 Ortlipp Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R28, is approximately 960 m from the closest panel infrastructure to the north-east.	LOW	No mitigation is required.	LOW
R38 and R61 Ortlipp Road Views of the proposal will be barely discernible or indistinct in the landscape due to existing native vegetative screening and distance to infrastructure. The closest receiver residence, R38, is approximately 1890 m from the closest panel infrastructure to the north-west.	LOW	No mitigation is required.	LOW

Table 5-7 Representative viewpoints with reference to the receivers.

Receivers located within 1 km	Representative viewpoint
1 (involved)	3
1 (uninvolved)	14
2 (involved)	6
2 (uninvolved)	13
3 (involved)	5
3 (uninvolved)	13
4 (uninvolved)	13
5 (uninvolved)	13
7 (uninvolved)	13
8 (uninvolved)	13
9 (uninvolved)	12 (montage also provided)
10 (unoccupied)	12
11 (unoccupied)	11
12 (unoccupied)	11
13 (uninvolved)	10 and 11
14 (uninvolved)	10 and 11
15 (uninvolved)	10 and 11
16 (uninvolved)	9
17 (uninvolved)	9
18 (uninvolved)	9
19 (unoccupied)	9
20 (uninvolved)	8
21 (uninvolved)	8
22 (uninvolved)	Montage provided
23 (uninvolved)	5 (montage also provided)

24 (uninvolved)	4
25 (uninvolved)	4 (montage also provided)
26 (uninvolved)	2 and 3
27 (uninvolved)	10 and 11
28 (uninvolved)	10 and 11
34 (uninvolved)	11 and12
38 (uninvolved)	4 and 5
61 (uninvolved)	4

5.2.6 Results summary

High Impact – mitigation required

High impacts were assessed for three viewpoints. Screening as a mitigation strategy are recommended from these viewpoints.

Viewpoints 8, 9 and 12 are adjacent to the proposal boundary along Glenellen Road and Ortlipp Road. Glenellen road is of moderate use by the general public and by residences, while Ortlipp Road is of low use by local traffic and industry.

Views along Ortlipp Road do however present the most dominate view of the proposed infrastructure due to the closeness to the road and direction of the panel (i.e. receivers along Glenellen Road face the end of the trackers with up to 5.5 m spacing in between trackers, while receivers along Ortlipp Road face the side of the panel. Refer to photomontages 5 and 6 in Table 5-4 above). Minor to moderate vegetative screening exists along the roadside and within the proposal boundary. It is however important to note that residences near these viewpoints either have vegetative screening on their properties, or the homes are vacant. The form of the infrastructure, low (<4m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area Whilst not in direct contrast with the existing Jindera substation and overhead transmission lines, the solar farm will be visible to residences and motorists. Infrastructure will blend with the existing infrastructure in the area

A 15 m vegetative buffer has been proposed for the length of Ortlipp Road (refer Figure 3-2).

High impacts are expected for receivers 16 to 21 along Glenellen Road, represented by viewpoints 8 and 9. Receivers have been assessed as having a high impact due to closeness to the proposal, aspect of the property and visual concern from landowners.

Expected views will be long-term, however a 50 m buffer incorporating vegetative screening (as per Figure 3-2 and the Landscape Plan Appendix B) is proposed for the length of Glenellen Road to maximise vegetative screening of the proposal. The width and infrastructure buffer from Glenellen Road was a decision made by the proponent based on the concerns of local residents. On-site vegetative screening as a mitigation strategy has also be considered in consultation with the landowners, with minimal success.

Medium impact – mitigation considered

Medium impacts are seen for two viewpoints. Screening as a mitigation strategy has be considered for these viewpoints.

Viewpoint 14 is representative of receiver 1, a property which is adjacent to the southern side of the proposal along Klinberg Road. Minor vegetation screening exists in the form of roadside vegetation or boundary plantings, which provides minimal screening of the development site. Dominant views will be that of the solar farm and associated infrastructure. The form of the infrastructure, low (<4m) and in rectangular arrays, is not incongruous with the existing low-lying rectangular forms in this agricultural area. Infrastructure will however not be in direct contrast with the existing overhead transmission lines that run along the northern and western boundary of receiver 1. The solar farm will, however, be moderately visible to motorists and receivers.

Receiver 1 have been assessed has having a medium impact due to the closeness of the proposal and long-term expected views. On-site vegetative screening as a mitigation strategy has be considered in consultation with the landowner and is included in Figure 3-2. Temporary fencing is also being considered to block views while the vegetation screening matures.

Viewpoint 2 is adjacent to the western boundary of the proposal site along Urana Road which is a road of high use. Viewpoint 2 has been assessed as having a medium impact due to the potential visual hazard for motorists at an intersection. On-site vegetation screening as a mitigation measure has been considered to break up any views of the proposal and remove distraction at the intersection (Figure 3-2).

Receiver R09 and R22 have also been assessed as having a medium impact due to topography, closeness to infrastructure and partial/broken views through existing native vegetative screening. On-site vegetative screening as a mitigation strategy has be considered in consultation with the landowners and is included in Figure 3-2. An earthen bund has also been proposed for immediate screening results for the elevated receiver R22.

Low impact – no mitigation

Low impacts are seen for roads and residences, where views of the solar farm infrastructure would be difficult to perceive or indistinct. Low impacts are expected for the majority of the study area and representative viewpoints due to existing vegetative screening, retained on-site vegetation and the overall undulating nature of the area. No mitigation is required for these locations, as detailed above in Table 5-3.

5.3 CUMULATIVE IMPACTS

Adverse cumulative impacts occur when the infrastructure or activities at the solar farm site exacerbate the negative impacts of other infrastructure or activities occurring nearby.

5.3.1 Glenellen Solar Farm

Due to the location of the proposed Glenellen Solar Farm (Figure 5-2), cumulative traffic impacts during construction may occur for the Jindera community if both proposals have similar construction timelines. Cumulative impacts would be however limited to Urana Road to the Walla Walla Jindera intersection as traffic enters Jindera, and Walla Walla Jindera road to its intersection with Lindner Road. No residences within 2km of the Jindera Solar Farm proposal will be cumulatively impacted by traffic, as all receivers are located after the Urana Road / Walla Wall Jindera Road intersection.

There would be no cumulative impact from material haulage as the two projects have different haulage routes (Figure 5-3). As part of the TMP, consideration of cumulative impacts with Glenellen Solar Farm will be detailed.

Cumulative visual impacts may also occur where the proposed Glenellen Solar Farm site is adjacent to the Jindera Solar Farm for specific properties on Ortlipp Road (Receivers 9, 10, 11, 12 and 28) (Figure 5-4). It should be noted that three receivers along Ortlipp Road with potential for visual impact are currently unoccupied, (R09, R10 and R11), these were still assessed. However, if the landowners choose to develop the properties and inhabit the dwellings/residences in the future, a 15 m vegetative buffer for the full length of Ortlipp Road is proposed to screen views of the Jindera Solar Farm. The proposed Glenellen Solar Farm would not be visible through existing native vegetative screening to the east of each residence. Each residence is also more than 250 m from the boundary of the proposed Glenellen Solar Farm, with distance also a screening buffer.

Receiver R09 is unlikely to have any view of the proposed Glenellen Solar Farm due to existing on-site native vegetation screening and views of the TransGrid Jindera Substation, and Receiver R28 is unlikely to have any views of the proposed Jindera Solar Farm due to distance from the residence to closest solar infrastructure (970 m approximately) and existing on-site native vegetation screening.

5.3.2 Other Construction

During construction, the additional traffic and dust generation impacts have the greatest potential for cumulative visual impacts. The visual impact of increased traffic movements to the site would be predominantly limited to construction. A Traffic Management Plan (TMP) will be developed to minimise vehicle movements as much as practical for construction.

5.3.3 Other Operation

The operational view of the solar farm may generate a cumulative impact, being in direct contrast to the previous agricultural views. The array site requires security fencing and operational buildings.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles are all that will be required. Cumulative visual traffic impacts are considered negligible.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the existing and retained vegetative screening and undulating nature of the site that blocks out the majority of views. Specifically, screening to soften cumulative impacts has been recommended.

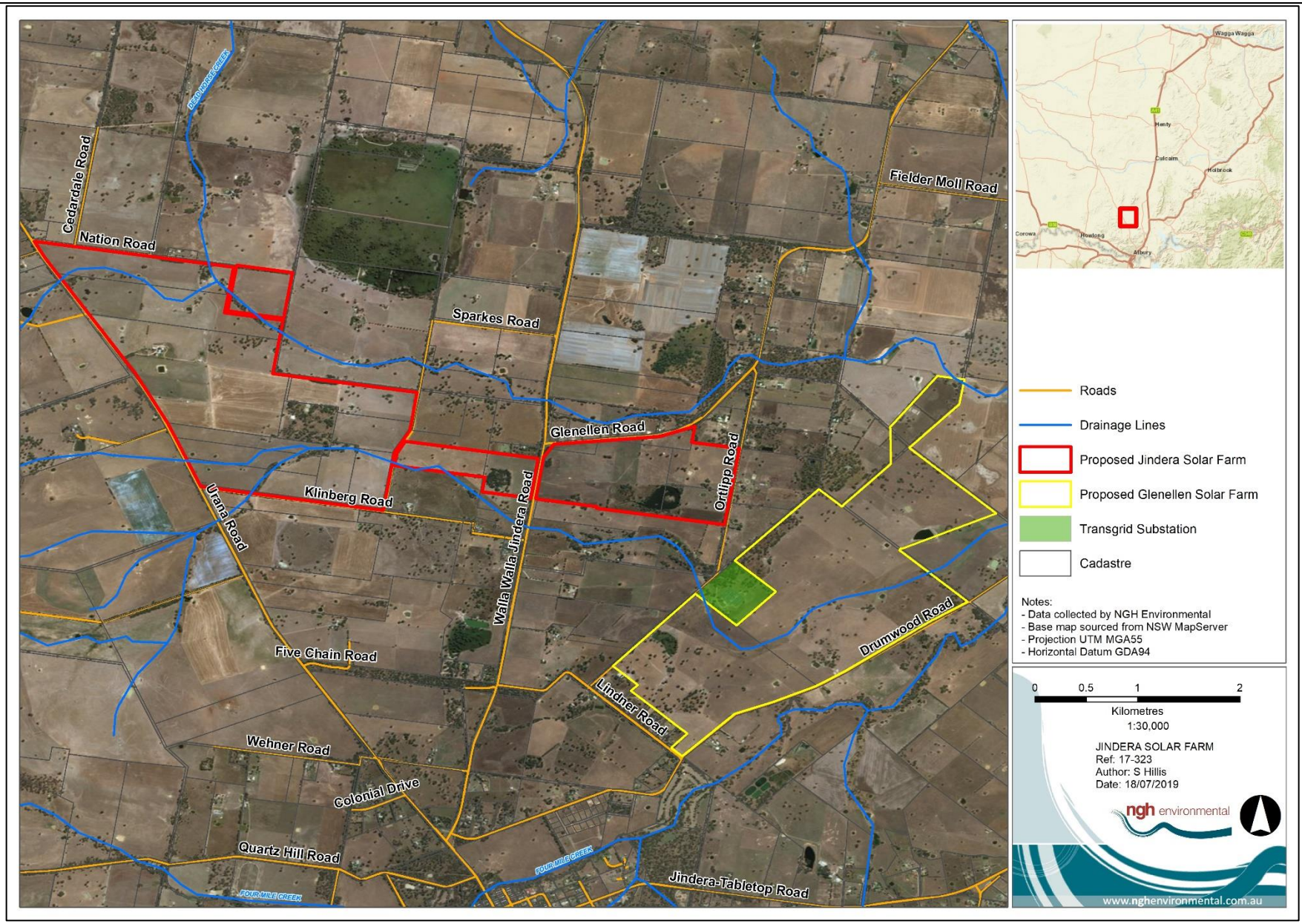


Figure 5-2 Location of the proposed Jindera and Glenellen Solar Farm

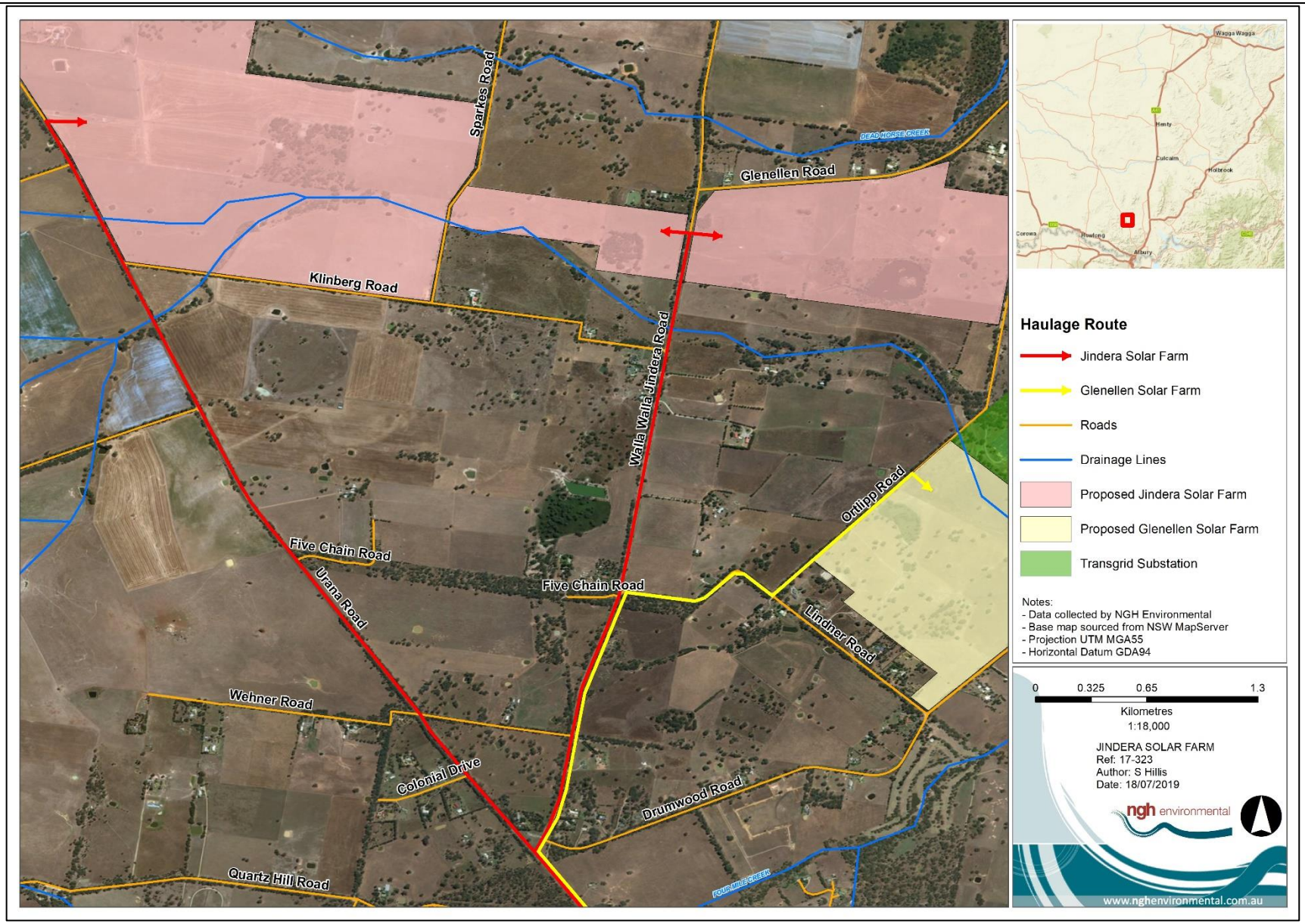


Figure 5-3 Proposed haulage routes for the Jindera and Glenellen Solar Farms

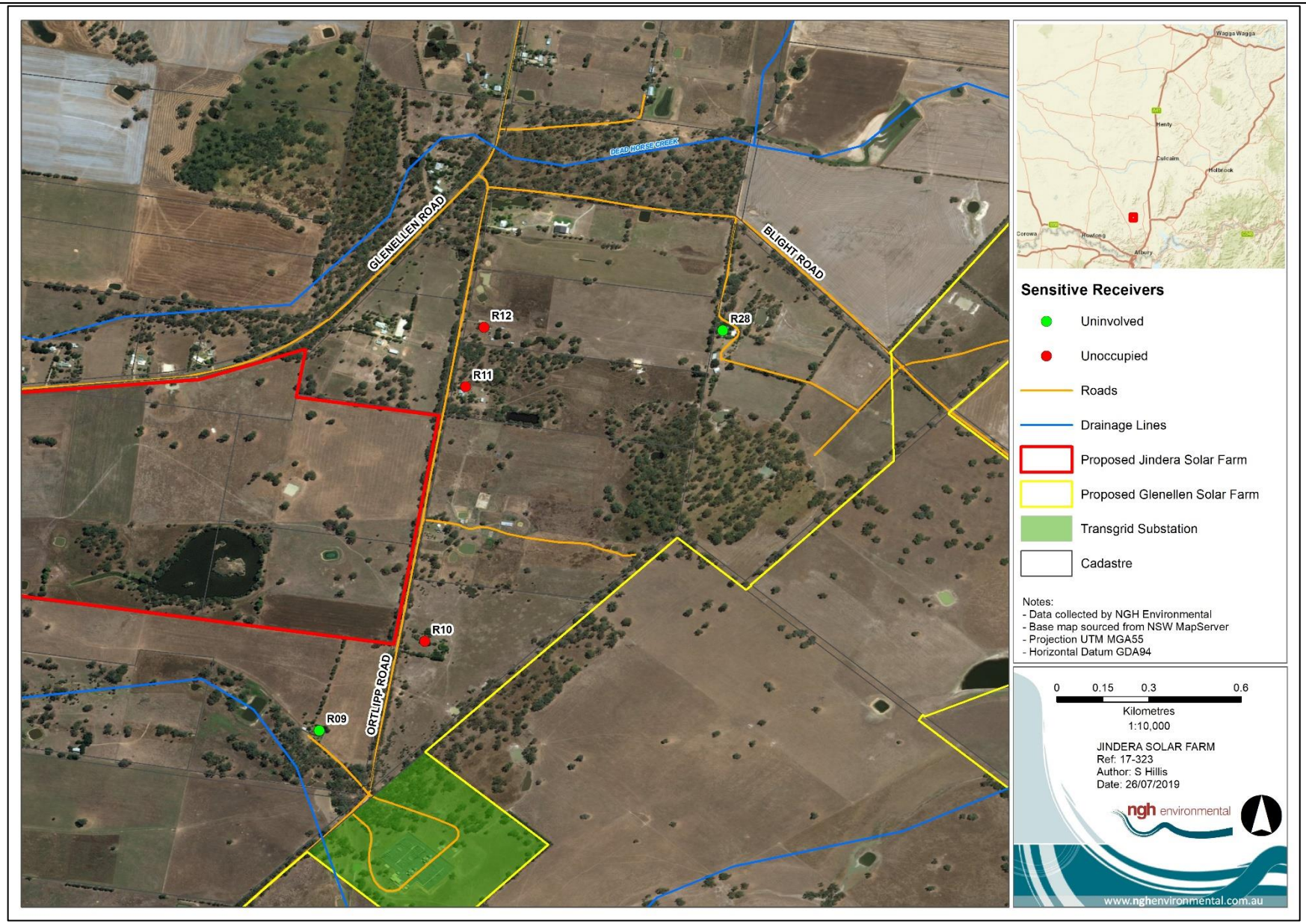


Figure 5-4 Receivers potentially visually affected by both the Jindera Solar Farm and Glenellen Solar Farms

6 MITIGATION STRATEGY

6.1 SCREENING

6.1.1 Screen location

Screening vegetation has been considered in accordance with the draft planting layout provided in Figure 3-2 and Appendix B. The purpose of the screening is to break up the view into the site.

6.1.2 Screen requirements

- Plantings would be more than one row deep and where practical, planted on the outside of the permitter fence, to break up views of infrastructure including the fencing. The majority of proposed visual screening is 15 m wide, with a 50 m buffer incorporating vegetative screening on the boundary of the proposal and Glenellen Road.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. They should be fast growing with mixed canopy height. Species selection could be undertaken in consultation with affected near neighbours and a botanist, horticulturalist or landscape architect. Species most suitable for planting based on existing plant community types, availability, spread, rate of growth and the Landscape Plan (Appendix B) in the area include:
    - *Eucalyptus blakelyi* (Blakely's Red Gum) – overstorey.
    - *Eucalyptus melliodora* (Yellow Box) – overstorey.
    - *Eucalyptus polyanthemos* (Red Box) – overstorey.
    - *Acacia dealbata* (Silver Wattle) – mid-storey.
    - *Acacia implexa* (Lightwood) – mid-storey.
    - *Allocasuarina luehmannii* (Bulloak) – mid-storey.
    - *Allocasuarina verticillata* (Drooping Sheoak) – mid-storey.
    - *Acacia acinacea* (Gold-dust Wattle) – shrubs.
    - *Acacia rubida* (Red-stemmed Wattle) – shrubs.
    - *Bursaria spinosa* (Sweet Bursaria) – shrubs.
    - *Dodonea viscosa subsp. angustissima* (Narrow-leaf Hop-bush) – shrubs.
    - *Poa labillardieri* (Tussock Grass) – grasses.
    - *Themeda triandra* (Kangaroo Grass) – grasses.
- The timing is recommended to be chosen to ensure the best chance of survival and can commence during the construction of the proposal if timing suits.
- The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.

It is noted that the aim of plant screens is to break up the view and not eliminate it entirely. Partial views will occur, particularly while vegetation is developing to maturity. Temporary fencing in the form of shade cloth has been suggested/requested by immediately affected residences.

6.2 LANDSCAPE PLAN

Prior to the commencement of construction, a detailed Landscape Plan will be prepared including:

- Screening location.
- Species type.
- Planting density and spacing.
- Method for planting.
- Descriptive measures that would be implemented to ensure vegetative screening is successful (i.e. irrigation or other watering method).
- A program to manage, monitor and report on the effectiveness of implemented measures.

6.3 GENERAL MEASURES

The following measures are recommended to reduce the general visual impact of the development for all other receivers:

6.3.1 Design

The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:

- Buildings will be non-reflective and in eucalypt green, beige or muted brown.
- Pole mounts/piles will be non-reflective.
- Security fencing posts and wire will be non-reflective.
- Avoidance of unnecessary lighting, signage and logos.
- Retain and protect existing boundary landscaping.

6.3.2 Construction

- During construction, dust would be controlled in response to visual cues.
- Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.

6.3.3 Night lighting

- Comply with all relevant standards, codes of practice and policies.
- Light spill is light that fall outside the area that is intended to be lit and can contribute to glare and waste energy. Spill light above the horizontal plane also contributes to artificial skyglow. All light fittings should be located aimed or shielded to avoid spill. Measures to prevent spill include:
    - Installing light fittings with an opaque cover and flat glass, mounted horizontally on both axes.
    - Mounting lights under part of a building (including awnings, verandah or roof) so light is blocked above the horizontal plane.
    - Design buildings to internalise lights.
- Wherever possible, light should be directed downwards. Mitigation measures include:
    - Installing direction fittings, such as floodlights or spot lights.

  - Use higher mounting heights that allow lower main beam angles that are closer to the vertical.
  - Lighting of all-night operations need to be downward facing of a peach colour and shielded.
- Operational light from the proposal must be directed downwards, or inwards towards the work area.
- Light fittings that are specifically designed to minimise light shining near to or above the horizontal plane should be used.
- Energy efficient globes include LEDs and high-pressure sodium.
- Where floodlights are required, wherever possible use fittings with asymmetric beams that permit horizontal glazing. These are to be kept at or near parallel to the surface being lit, usually the ground and should prevent light spill. An asymmetric beam also allows the light fitting to be mounted on the edge of an area and avoids the need for fittings to be tilted upwards. Flat glass light fittings should be installed with the glass horizontal to make efficient use of the brightest part of the beam and to eliminate light spill.

7 CONCLUSION

This report has been prepared to assess the potential visual impacts of the proposed Jindera Solar Farm north of Jindera. A systematic evaluation has been undertaken to address subjectivity as much as possible. The report was informed by background investigations including consultation, mapping and modelling, field survey including reconnaissance, ground truthing, photography and photomontages.

The proposed solar farm would be located in an agricultural area of generally moderate scenic quality. Visual characteristics are important to the members of the local community. Onsite vegetation screening is suggested as a feasible way to break up views of the proposed infrastructure from key locations, also addressing cumulative impacts. A draft landscape plan is provided based on this assessment.

General measures to reduce impacts for all receivers have also been recommended. These centre on use of design elements to reduce visual contrast, mitigation of construction impacts such as dust and traffic that may reduce visual amenity, and mitigation of operational impacts such as maintaining ground cover beneath the panels to break up side-on and back views of infrastructure and soften the appearance of the facility.

Large scale solar farms are still relatively new in Australia. While they enjoy support from many in the community, provision of information on expected visual impacts and involvement in mitigating impacts (for affected receivers) is considered very important to obtaining social licence to operate. By taking into consideration concerns from potentially affected landowners in the mitigation strategy set out in Section 6, the visual impacts of the proposal are considered acceptable and manageable.

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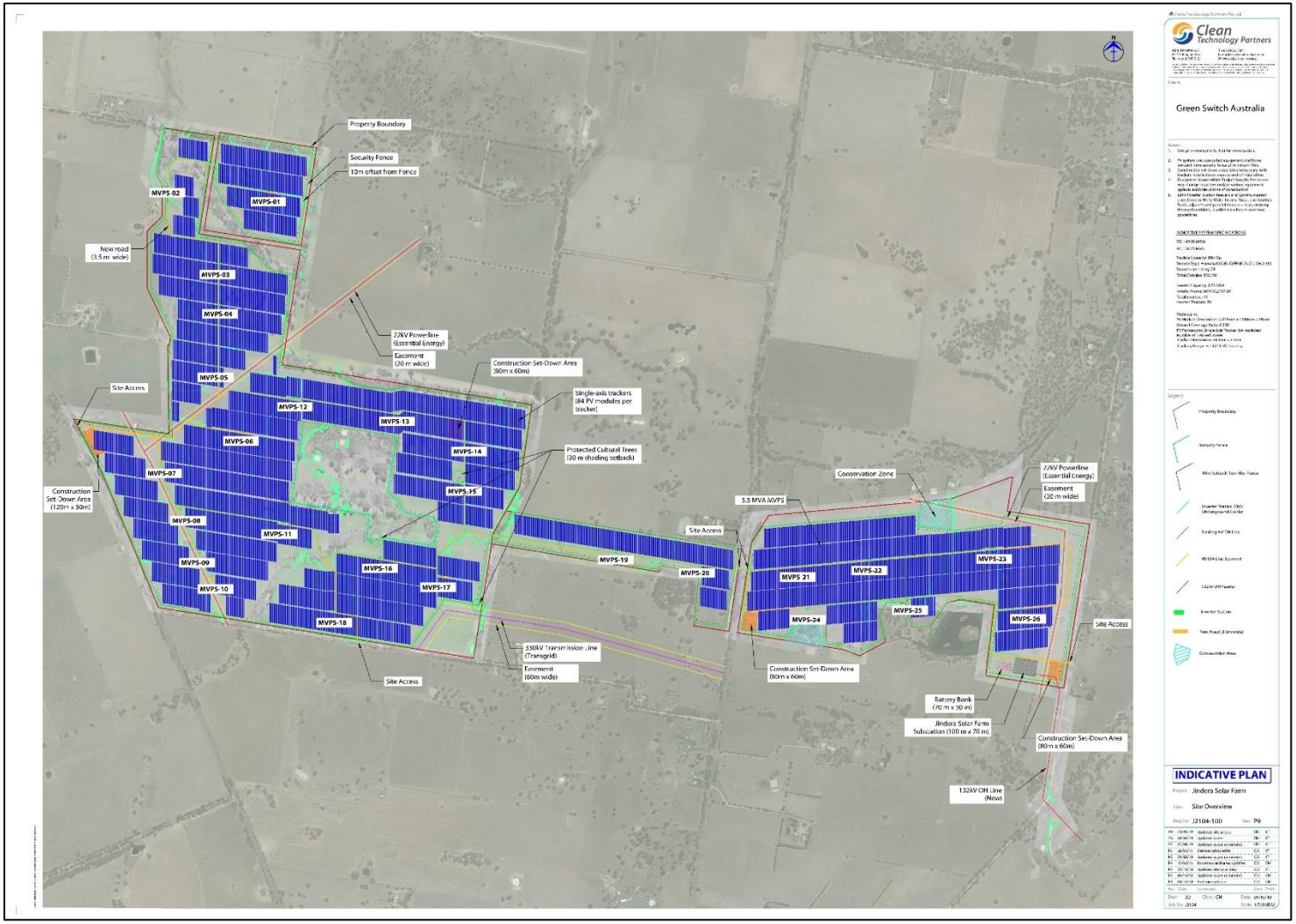
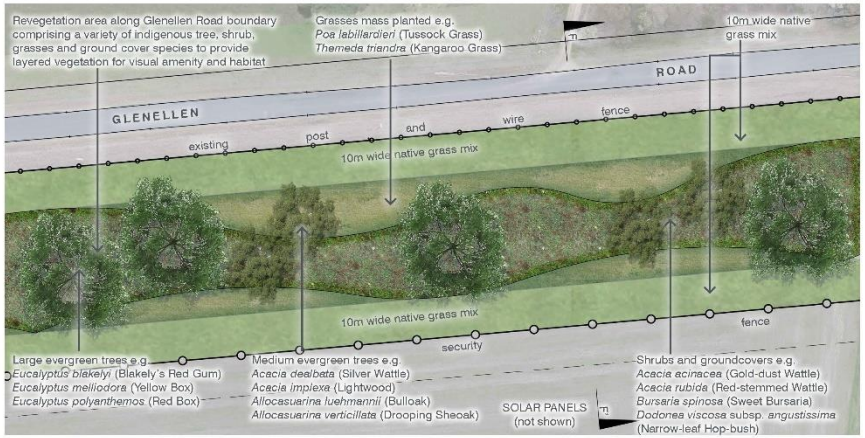
APPENDIX A PROPOSED INFRASTRUCTURE LAYOUT



APPENDIX B LANDSCAPING PLAN



INSET 1 DETAIL PLAN GLENELLEN ROAD BUFFER PLANTING (1:1000 @ A3)

SITE PLAN (1:10000 @ A3)

INSET 2 DETAIL PLAN GLENELLEN ROAD BUFFER PLANTING (1:4000 @ A3)

DRG NO. 306019 LMP 01 | REV C | DATE 15/04/2019 | DES/DOC SME/SLM | AUTH SME/CME | AMENDMENTS FOR DEVELOPMENT APPLICATION

JINDERA SOLAR FARM LANDSCAPE BUFFER
SITE PLAN | JINDERA

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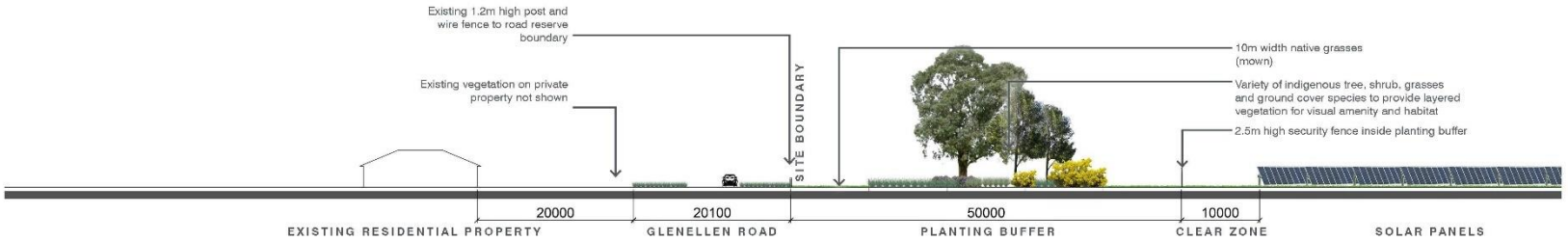

SECTION A-A' (1:500 @ A3)

SECTION B-B' (1:500 @ A3)

SECTION C-C' (1:500 @ A3)

0 2.5 5 7.5 10 12.5m
SCALE 1:500@A3

JINDERA SOLAR FARM LANDSCAPE BUFFER
CROSS SECTIONS SHEET 1 | JINDERA

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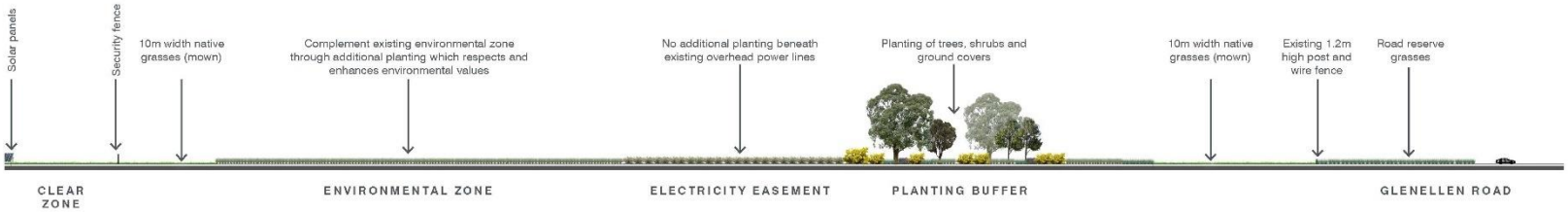
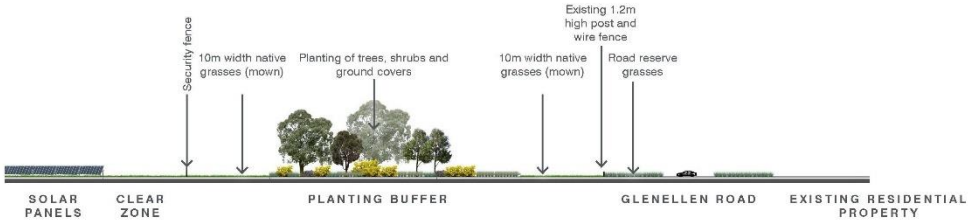


SECTION D – D' (1:1000 @ A3)



SECTION E – E' (1:1000 @ A3)

0 5 10 15 20 25m
SCALE 1:1000@A3

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CROSS SECTIONS SHEET 2 | JINDERA

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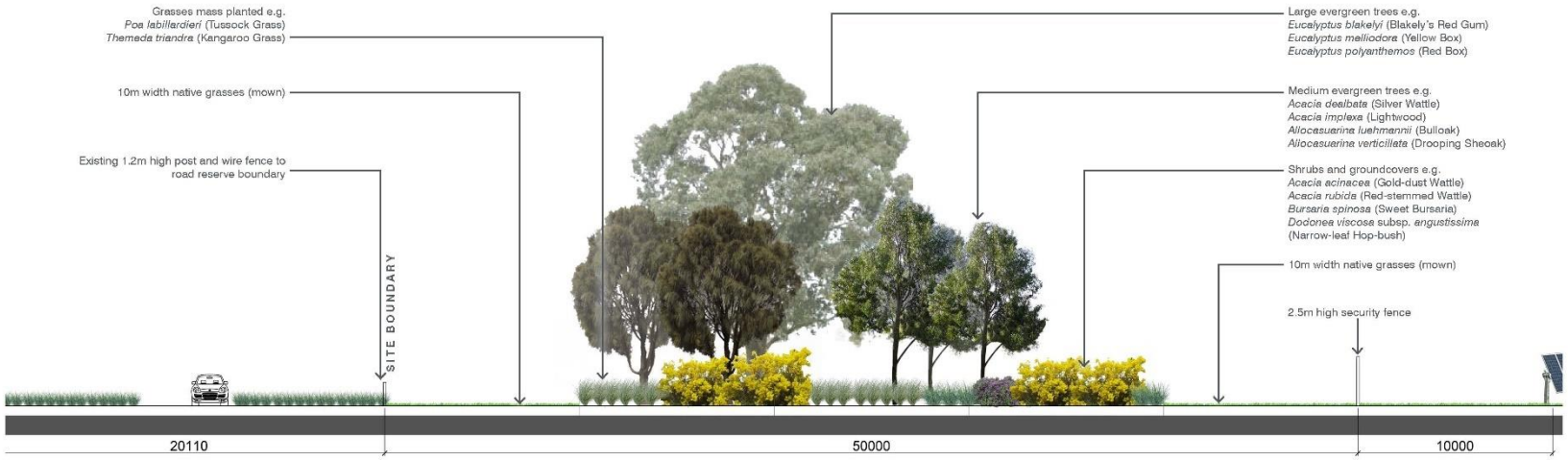

SECTION F – F' (1:200 @ A3)

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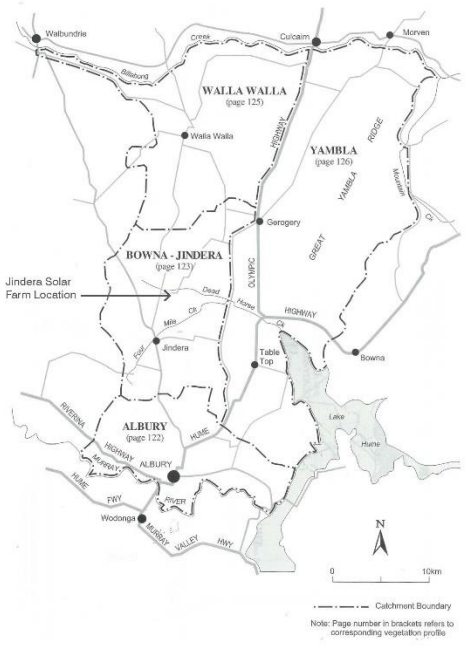
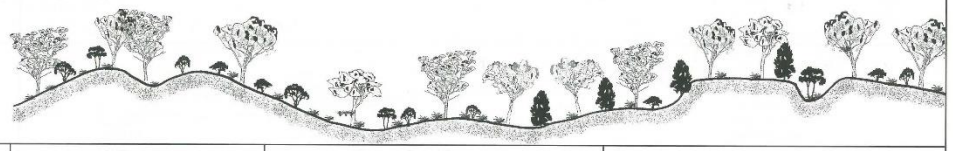
Districts: **Walla Walla; Bowna - Jindera; Albury & Yambla**



Note: For general re-planting (creeklines, windbreaks etc.), select 50% trees and at least 50% shrubs. If enhancing sites with remnant trees, select shrubs only and allow trees to regenerate.
Additions of locally native species for this list are gratefully accepted. Contact your local Vegetation Management Officer at DLWC.

General Native Vegetation Profile: *Bowna - Jindera District*



LANDFORM	Hill country	Low, gently undulating country	Rocky outcrop
VEGETATION TYPE	White Box woodland, Blakely's Red Gum woodland & Red Stringybark dry forest	Box woodland (Yellow Box & White Box) & Blakely's Red Gum woodland	Dwyer's Red Gum woodland & Currawang/Long-leaf Box woodland
GEOLOGY & SOILS	Residual & colluvial deposits from underlying meta-sediments. Shallow red & yellow loams.	Riverine deposits of clay, silt, sand & gravel, and residual & colluvial deposits from underlying granite. Red & yellow earths.	Residual & colluvial deposits from underlying granite. Sandy granite soils.
LOCATION EXAMPLE	Spring Hill (Jindera Gap hills)	Jindera vicinity, including Four Mile Creek	Stringybark Hill (west of Gerogery)
TREES > 8 m	*Acacia dealbata* Silver Wattle *A. implexa* Hickory Wattle/ Lightwood *Allocasuarina verticillata* Drooping Sheoak *Brachychiton populneus* Kurrajong *Callitris glaucophylla* White Cypress Pine *Eucalyptus albens* White Box *E. blakelyi* Blakely's Red Gum *E. goniocalyx* Long-leaf Box * *E. macrorhyncha* Red Stringybark *E. nortonii* Silver Bundy *E. polyanthemos* Red Box *Exocarpos cupressiformis* Native Cherry * **mainly SE aspect**	*Acacia dealbata* Silver Wattle *A. implexa* Hickory Wattle/Lightwood *Allocasuarina luehmannii* Bulloak *A. verticillata* Drooping Sheoak *Brachychiton populneus* Kurrajong *Callitris glaucophylla* White Cypress Pine *Eucalyptus albens* White Box *E. blakelyi* Blakely's Red Gum + *E. camaldulensis* River Red Gum *E. bridgesiana* Apple Box *E. melliodora* Yellow Box * *E. microcarpa* Grey Box + **creeklines** *E. polyanthemos* Red Box * **north of Jindera only**	*Acacia doratoxylon* Currawang *A. implexa* Hickory Wattle/Lightwood *Allocasuarina verticillata* Drooping Sheoak *Brachychiton populneus* Kurrajong *Callitris endlicheri* Black Cypress Pine *C. glaucophylla* White Cypress Pine * *Eucalyptus albens* White Box * *E. blakelyi* Blakely's Red Gum *E. dwyeri* Dwyer's Red Gum *E. goniocalyx* Long-leaf Box * **lower slopes of rocky outcrop** * *E. macrorhyncha* Red Stringybark *E. nortonii* Silver Bundy # **mainly SE aspect** * *E. polyanthemos* Red Box *Exocarpos cupressiformis* Native Cherry
SHRUBS 1.5 - 8 m	*Acacia paradoxa* Kangaroo Thorn *A. rubida* Red-stemmed Wattle *A. verniciflua* Varnish Wattle *Dillwynia* spp. Parrot Pea *Dodonaea viscosa* subsp. *angustissima* Narrow-leaf Hop-bush *Grevillea alpina* Cat's Claws *Indigofera australis* Austral Indigo *Platylobium formosum* Handsome Flat-pea *Prostanthera lasianthos* Mint Bush	*Acacia acinacea* Gold-dust Wattle *A. paradoxa* Kangaroo Thorn *A. pycnantha* Golden Wattle *A. rubida* Red-stemmed Wattle *A. verniciflua* Varnish Wattle *Bursaria spinosa* Sweet Bursaria *Daviesia latifolia* Hop Bitter-pea *Dodonaea viscosa* subsp. *angustissima* -Narrow-leaf Hop-bush *Eutaxia microphylla* - Mallee Bush-pea *Indigofera adesmiifolia* - Tick Indigo	*Acacia rubida* Red-stemmed Wattle *A. verniciflua* Varnish Wattle *Correa glabra* Rock Correa *C. reflexa* var. *reflexa* Common Correa *Dillwynia* spp. Parrot Pea *Dodonaea viscosa* subsp. *angustissima* Narrow-leaf Hop-bush *Indigofera australis* Austral Indigo *Pultenaea cunninghamii* Grey Bush-pea
GROUND COVERS	*Austrostipa* spp. - Spear Grass *Bothriochloa macra* - Red-leg Grass *Calotis* spp. - Burr Daisy + *Carex* spp. - Sedge *Cheilanthes* spp. - Rock Fern *Chloris truncata* - Windmill Grass *Desmodium* spp. - Tick Trefoil *Dianella longifolia* - Smooth Flax-lily *D. revoluta* - Spreading Flax-lily *Geranium* spp. - Cranesbill *Glycine clandestina* - Twining Glycine *Hardenbergia violacea* - Purple Coral Pea *Hibbertia obtusifolia* - Grey Guinea-flower *Isotoma axillaris* - Rock Isotome + *Juncus* spp. - Rush *Leucopogon virgatus* - Common Beard-heath *Lissanthe strigosa* - Peach Heath *Microlaena stipoides* - Weeping Grass *Pelargonium australe* - Native Storksbill + *Phragmites australis* - Common Reed *Pimelea* spp. - Rice-flower *Poa labillardieri* - Tussock Grass *Stypandra glauca* - Nodding Blue-lily *Themeda triandra* - Kangaroo Grass* + *Typha* spp. - Cumbungi + **drainage lines, creeks, soaks & poorly drained sites**	

Revegetation Species list informed by:
South West Slopes Revegetation Guide
Murray Catchment Management Committee and Department of Land & Water Conservation (1998)

JINDERA SOLAR FARM LANDSCAPE BUFFER
PLANT SCHEDULE | JINDERA

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DRG NO.	REV	DATE	DES/DOC	AUTH	AMENDMENTS
306019 LMP 05	C	15/04/2019	SME/SLM	SME/CME	FOR DEVELOPMENT APPLICATION

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APPENDIX C COMMUNITY CONSULTATION FEEDBACK FORM

Jindera Solar Farm Pty Ltd
Grosvenor Place
Level 18, 225 George Street
Sydney NSW 2000

To the Resident

Proposed Solar Farm, Jindera

Firstly, thank you for taking the time to open and read this letter. I am contacting to you on behalf of our company, Jindera Solar Farm Pty Ltd, and would like to discuss our plans to seek Development Approval to build a solar farm on land along Glenellen Road, Kimberg Road and Walla Walla Road. We are writing to you as one of the nearest neighbours. We believe it is important to discuss the project with you and seek your views on what is proposed. More information on the project is contained in this letter. We have provided our contact details and would welcome you getting in touch with us, so we can arrange to meet you and discuss the project.

About Our Company

Our company is Jindera Solar Farm Pty Ltd (JSF), based in NSW. The company is a partnership involving Hanwha Energy Corporation and Green Switch Australia. Hanwha Energy are a major owner of solar farms in USA and Asia. Green Switch Australia is a developer who specialises in creating utility scale solar projects. Together we have many years' experience in developing, building and operating solar power projects.

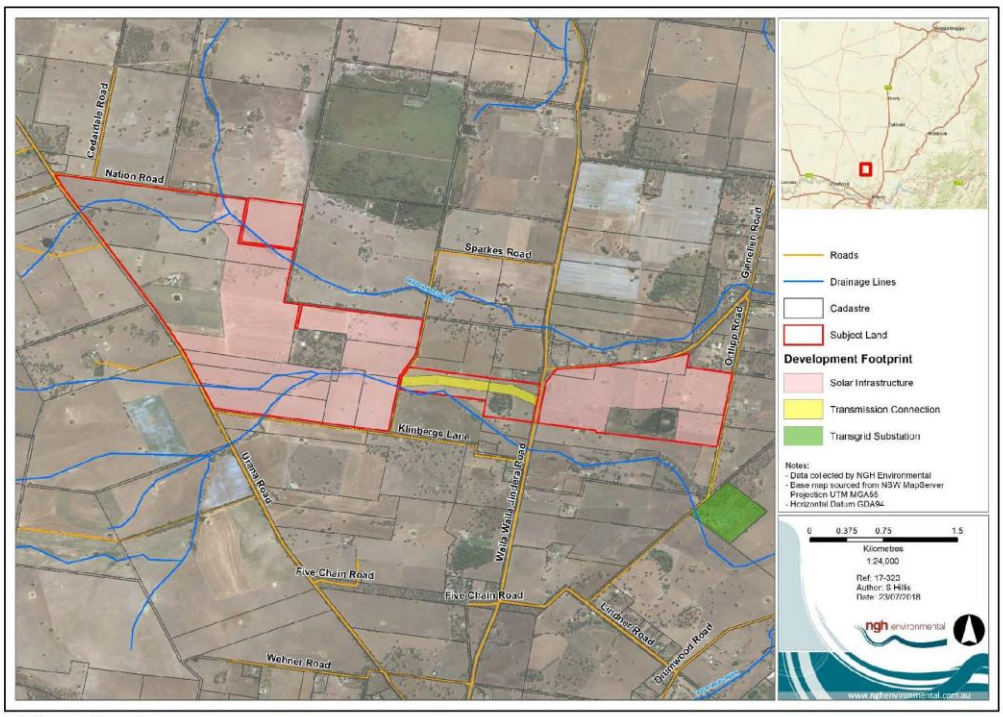


Figure 1: Proposal Location

Jindera Solar Farm Project Site

The proposed project sites are shown in Figure 1 below above.

The project site is split into two distinct parts. The power generated from both sites will be transmitted to the TransGrid Substation on Ortilpp Road, located approximately 600 metres south of the eastern boundary of our development. Locating as we are, near to the main Jindera Electricity Substation provides an excellent opportunity to connect the site to the electricity transmission grid, so that the low carbon electricity created can be distributed to users.

The land we have selected and are now seeking consent to develop is well suited to solar energy generation. It is relatively flat, largely free of items that could cause shade over the solar panels and in an area with good solar resource.

Jindera Solar Farm Project Description

A solar farm uses an array of solar panels, also known as modules, to collect the energy of the sun and convert it into electrical energy. The technology is similar to that used on household solar systems, the modules are the same. A solar farm uses a larger number of modules and in the case of Jindera will use moveable modules that will track the suns progress across the sky each day. Tracking the sun means that more of its energy can be captured. We believe that the future of energy production in Australia should be based, where it can be, on non-fossil fuel energy sources such as wind and solar. We believe this is actually a cheaper way to produce the electricity we all need, and we believe that we all need to try to manage and reduce global warming. Jindera solar project can do that by replacing fossil fuel burning power sources.

The solar panels are typically arranged in banks of 80, controlled by the trackers so that they can follow the sun. Each bank will measure about 2.3 m from the ground to its highest point (Refer to Figure 2).

If our application is successful, the solar plant will have a long and productive life of around 25-30 years. However, we are mindful that the site must be designed, constructed and operated to ensure that the land can be returned to productive agricultural use once the solar farm is no longer needed.

Our formal application for consent will also include information on how we can manage the solar generating plant so that the land is always maintained in good order and we do not cause nuisance to our neighbours.

We also intend to deploy vegetation screening to ensure that our neighbours views are not diminished. We look forward to working with neighbours like yourself to ensure that this screening is effective but also more generally we would welcome your views on the project to help us to shape the design to ensure we have the least effect possible on you.

Figure 2: Typical height of a Solar Farm panel and general arrangement

Figure 3: Example solar farm

The Development Application Process

We have already had some limited discussions with the Greater Hume Shire Council. However, the Jindera Solar Farm is considered a project of State Significance. Therefore, the project will be investigated and determined by the NSW Department of Planning and Environment (DPE). State Significant Development must be assessed through a rigorous planning framework, resulting in an Environmental Impact Statement (EIS) being prepared. We are currently in the early, scoping stages of the development approval process, whereby a Preliminary Environmental Assessment is submitted to the Department for comment and the Secretary's Environmental Assessment Requirements (SEARs) issued to us for inclusion into the final application and EIS. The whole process is likely to take 9-12 months.

Greater Hume Shire Council will provide their views as a formal consultee to the consenting process. You can feed your own views and opinions into the formal process through consultation by submitting them to NSW DPE at the appropriate time.

Community Engagement and Consultation

We want to start our own consultation process by talking to you and our other closest neighbours. We would like to run this in parallel with the SEARs received from the NSW DPE. A Community Consultation Plan has been prepared for the project which identifies several ways in which we will engage with you:

Informal Engagement

This involves discussions with yourselves and your neighbours, through means like this letter, phone calls and meetings. These opportunities allow us to get a better understanding of your views on the project, and hopefully allows us to address any concerns early.

Community Information Sessions

Once we have developed our plans further but before we formally submit our application we will hold drop in sessions for the local and wider community to discuss the project and receive views and ideas on how the project should be designed and managed. – Sarah, you might be able to word this better?

Formal Submissions

Once the EIS is finalised, it is placed on Public Exhibition for at least 28 days. During this time, the community can make formal submissions to NSW DPE.

Contact Us

We will be in contact you again with updates as the project progresses. We would welcome your comments even at this early stage and we would be happy to meet to discuss the project. We appreciate your time is important to you, please get in touch and we will arrange to come to see you at a time that is convenient for you. Alternatively, please send us your thoughts and comments via the email address below.

Project Director for Green Switch Australia – Symon Grasby		
Mobile	0428 878 307	
Email	sg@greenswitchaustralia.com.au	

We look forward to meeting with you soon and the chance it will give us to explain our plans and receive your views and input. In the meantime, we thank you for reading this letter and please get in touch with us.

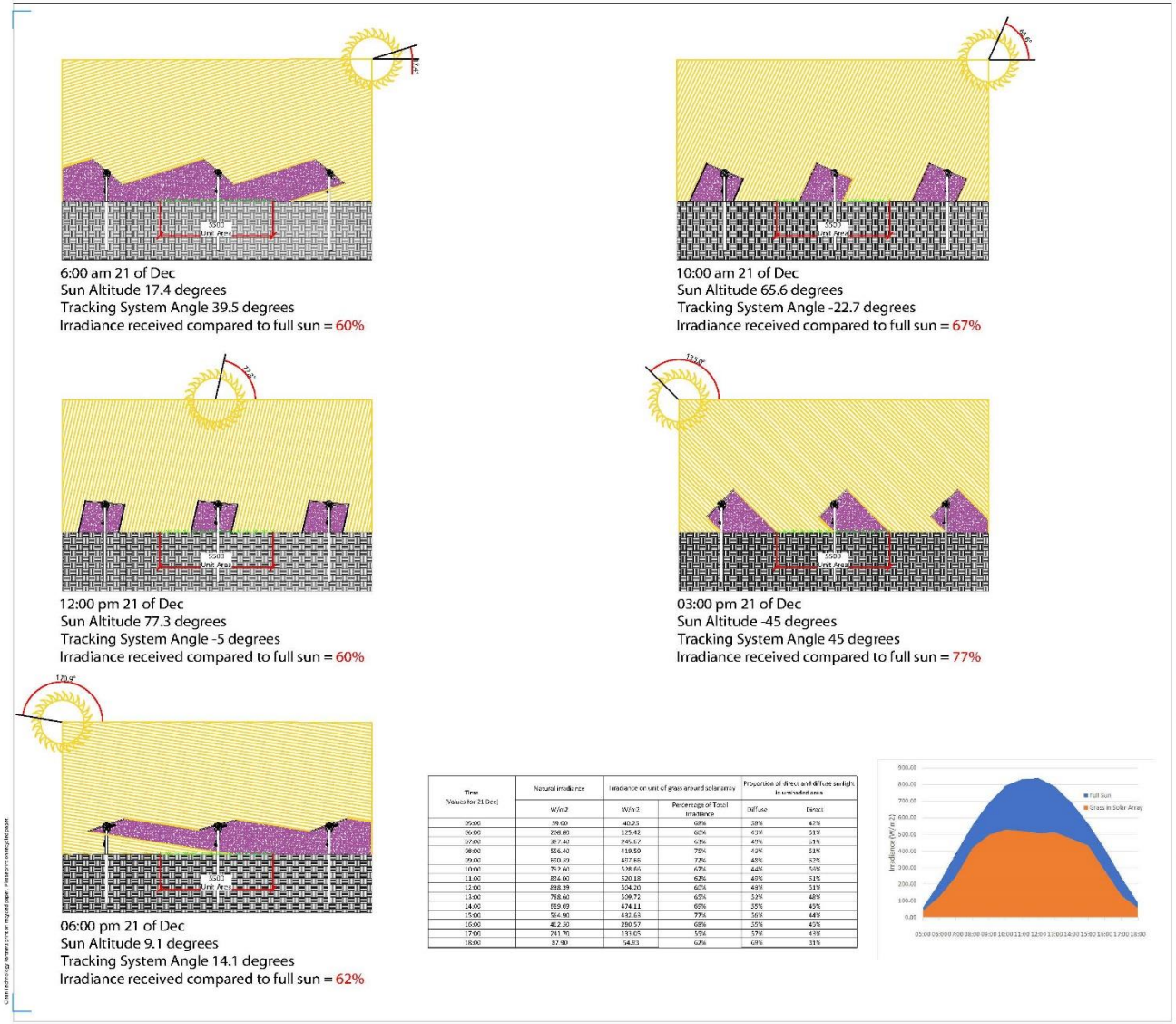
Yours sincerely,

Symon Grasby

Project Director

Jindera Solar Farm Pty Ltd

APPENDIX D SHADING ANALYSIS



Time (Values for 21 Dec)	Natural irradiance	Irradiance on unit of grass around solar array		Proportion of direct and diffuse sunlight in simulated area	
	W/m2	W/m2	Percentage of Total Irradiance	Diffuse	Direct
05:00	58.00	40.25	68%	58%	42%
06:00	208.80	125.42	60%	41%	59%
07:00	397.40	245.67	61%	49%	51%
08:00	556.40	419.59	75%	43%	57%
09:00	670.39	407.66	72%	48%	52%
10:00	752.60	528.86	67%	44%	56%
11:00	824.00	520.18	62%	49%	51%
12:00	868.39	504.20	60%	48%	52%
13:00	768.60	509.72	65%	52%	48%
14:00	659.69	474.11	69%	55%	45%
15:00	564.90	432.63	77%	56%	44%
16:00	412.30	280.57	68%	55%	45%
17:00	241.70	133.65	55%	57%	43%
18:00	87.80	54.83	62%	69%	31%

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Client:

Green Switch Australia

Notes:
1. Concept only. Not for construction.
2. Height of the Tracker assumed to be 1.2m from the pivoting point to the ground.
3. Grass shading table accounts for direct and diffuse sunlight getting to the grass (direct - directly from the sun; diffuse - coming from all angles as light bouncing from clouds, objects, etc.)
4. Percentage of shading presented in the elevation drawings is based on direct sun irradiance. Diffuse irradiance is not shown in this summary - It should be noted that the shading areas will still be receiving diffuse irradiance.
5. The values presented in the table here in are based on simulations carried out using the solar modelling software PV Syst. The grass was simulated as a PV collector below a moving shading object representing the tracking system. This allows for precise calculations of the irradiance (energy in sunlight) received by the grass.
6. The average percentage of shading on unit of grass per year is ~30.09%

LEGEND:
Grass
Soil
Natural Irradiance (Direct + Diffuse)
Diffuse Irradiance

INDICATIVE PLAN

Project: Jindera Solar Farm
Title: Shading Impact Analysis
Dwg No: J2104-400 Rev: P1

Rev	Date	Comments	Dwn	Chkd
P1	09/04/19	Preliminary Issue	DD	CM

Dwn: DD Chkd: CM Date: 09/04/19
Job No: J2104 Scale: NTS

APPENDIX E GLARE STUDY

Clean Technology Partners

Engineering Report

JINDERA SOLAR FARM

Glare Study

Client: Green Switch Australia

Date: 08/04/19
Rev: 01
Author: DD

solar powered engineering www.clean-tech.com.au

Document History & Status

REV	DATE	COMMENTS	AUTHOR	APPROVED
01	08/04/19	First Issue	DD	AW

PROJECT/DOCUMENT DETAILS	
PROJECT NO:	J2104
PROJECT NAME:	Jindera Solar Farm
AUTHOR:	Darcy Denton
PROJECT MANAGER:	Kaushal Trivedi
DOCUMENT TITLE	Glare Study
DOCUMENT REF:	J2104 GLR-REP-001

Table of Contents

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REV: 01 Date: April 2019 REF: J2104 TECH-REP-001

1 General

1.1 Project Background

The Jindera Solar Farm is a proposed 150 MWp Solar Farm located approximately 4km north of the township of Jindera, NSW, shown in Figure 1. The solar farm is to using tracking technology for the PV framework, which means for most of the day it is pointed directly at the sun, however the array will slowly 'backtrack' when the sun is at low altitudes to avoid self-shading. This means that for much of the time the array will be perpendicular to the sun and no glare problem could be present. However, at sunrise or sunset when the sun is lower in the sky, the PV trackers backtrack to limit shading and are no longer perpendicular to the sun, there is a risk of glare. This also occurs when the trackers are stowed and not following the sun. This report presents a glare analysis which was undertaken to determine the risk of glare associated with this project.

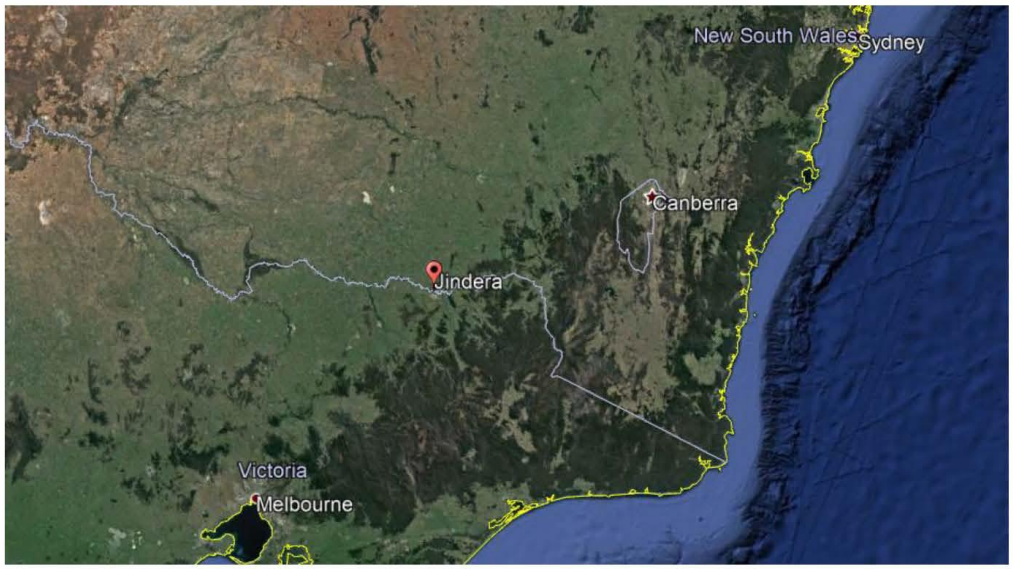


Figure 1 – The location of the Jindera Solar Farm

Of particular interest for the glare analysis are the roads and properties surrounding the site and the Albury and Corowa Airports (located approximately 15km and 25km from the site, respectively).

2 Glare Analysis Methodology

2.1 General

CTP has been engaged by Green Switch Australia on behalf of the Jindera Solar Farm Pty Ltd, to conduct a Glare Study for Jindera Solar Farm. The *ForgeSolar GlareGauge* analysis tool was utilised to carry out the glare assessment under this scope of works. The model assesses the glare at all times of day for a full calendar year. Figure 2 below shows an example of the glare graph produced in the event there is potential for glare.

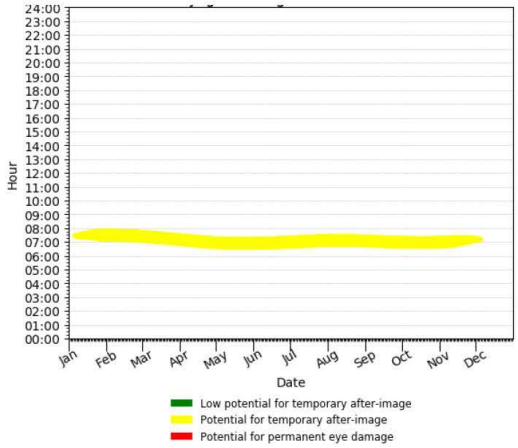


Figure 2: Example of glare graph from ForgeSolar GlareGauge

In the absence of established standards for aviation solar glare modelling in Australia, guidance has been drawn from the US Federal Aviation Administration's (FAA) "Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports" (2013), available at:

https://www.gpo.gov/fdsys/pkg/FR-2013-10-23/pdf/2013-24729.pdf

2.2 Inputs

The model relied on the design developed by CTP with Jindera Solar Farm Pty Ltd. The details are taken from the layout / design in document *J2104 100-P7 Site Overview (Jindera Solar Farm)*.

2.3 Modelling Methodology

2.3.1 Solar Array Location and Tilt Angle

To model the potential glare impact arising from the 150 MWp Solar Farm the layout prepared by CTP was input into ForgeSolar, see Figure 3, with the following parameters:

- Tracking Axis Orientation: 0°
- Tracking Axis Tilt: 0° (horizontal)
- Tracking Range: -60° to +60°
- Panel Reflection Properties: Smooth Glass without Anti-Reflective Coating[1]

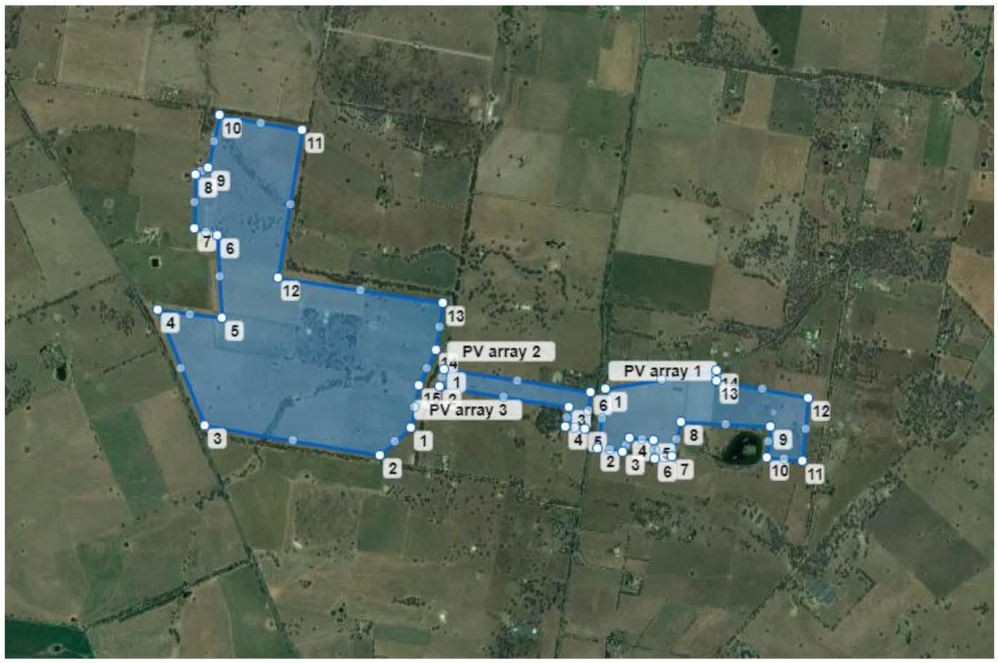


Figure 3 – The area of the Jindera Solar Farm input into ForgeSolar

[1] Using Smooth Glass without Anti-Reflective Coating is a worst case scenario, in reality solar modules do have an anti-reflective coating aiming to maximise light absorbed for generation.

2.3.2 Observation Points paths

The observation points of interest on the roads and properties surrounding the proposed Jindera Solar Farm as well as the flight paths from the Albury and Corowa airports were input into Forge Solar. These are shown below in Figure 4 and detailed in Table 1 and the Appendix.

Figure 4 – The observation points(red markers) and roads (light blue lines) around the Jindera Solar Farm

The following roads were including in the glare assessment:

- Glenellen Road
- Klinberg Road
- Ortlipp Road
- Sparks Road
- Urana Road
- Walla Walla Jindera Road

Table 1 below provides details of the residences where the glare was assessed.

Table 1 – The observation points surrounding the Jindera Solar Farm

Name	Latitude (°)	Longitude (°)	Elevation
OP 1	-35.890032	146.864097	247.03
OP 2	-35.895238	146.859114	250.58
OP 3	-35.892464	146.842874	264.76
OP 4	-35.900887	146.842804	285.56
OP 5	-35.903898	146.857049	255.42
OP 6	-35.911619	146.850435	260.11
OP 7	-35.927469	146.839953	290.74
OP 8	-35.928234	146.873411	245.84
OP 9	-35.921554	146.888773	231.22
OP 10	-35.919455	146.886369	230.32
OP 11	-35.917826	146.880222	236.33
OP 12	-35.921481	146.895586	225.53
OP 13	-35.921798	146.905533	222.73
OP 14	-35.915800	146.909080	223.28
OP 15	-35.911804	146.909766	223.72
OP 16	-35.909831	146.907388	225.44
OP 17	-35.910865	146.902082	225.78
OP 18	-35.910972	146.900373	226.30
OP 19	-35.911002	146.898152	228.46
OP 20	-35.911608	146.893500	230.69
OP 21	-35.912356	146.890238	232.58
OP 22	-35.901199	146.875939	253.97

2.3.3 Flight paths

The observation points of interest on the the flight path from the Albury and Corowa airports were input into Forge Solar. These are shown below in Figure 4 and detailed in the Appendix.

Figure 5 – The observation points and flight path (red line) around the Jindera Solar Farm

2.3.4 Model Parameters

The parameters populated into the GlareGauge modelling software are summarised in Table 2 below.

Table 2 - Glare Model Parameters

Parameter	Value	Comments
Project Parameters		
Timezone offset	UTC +10:00	Based on site location.
PV Array Parameters		
Axis Tracking	+/- 60°	Based on design.
Orientation	0°	Based on design.
Module Surface Material	Smooth Glass without ARC	Worst case scenario.
Reflectivity varies with incidence angle	Yes	Default value.
Correlate slope error with modules surface type	Yes	Default value.
Slope error	9.3 mrad	Default value.
Flight path parameters		
Direction	See Appendix	Based on Aerial Imagery.
Glide Slope	3 °	Based on FAA guidelines.
Threshold crossing height	15.24 m	Based on FAA guidelines.
Max downward viewing angle	30°	User input, based on approximation for viewing angles in aircraft cockpit.
Azimuthal viewing angle	50°	
Note: All ground elevation values are drawn from the Google Maps integration with GlareGauge to maintain consistency, given height data from sources was not verified.		

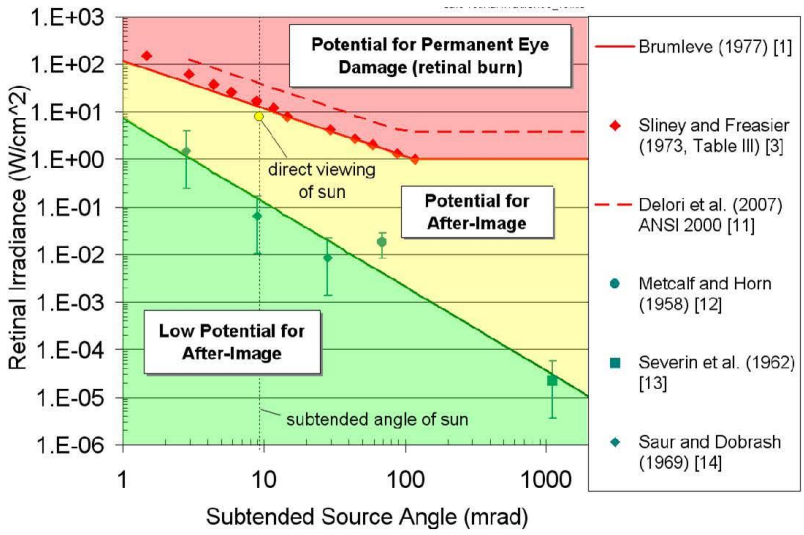
3 Glare Modelling Results

The modelled results for glare potential are summarised in Table 3, where the potential for glare has been quantified in minutes per year. Detailed glare hazard charts are provided in the Appendix for reference.

Glare hazards have been classified based on the size of glare viewed by the observer (subtended angle) and the intensity of the glare impacting the retina of the observer (retinal irradiance), as follows:

- Low potential for after image – for values of irradiance and subtended angles shown in the **green** shaded area in Figure 6.
- Potential for after image – for values of irradiance and subtended angles shown in the **yellow** shaded area in Figure 6.
- Potential for permanent eye damage – for values of irradiance and subtended angles shown in the **red** shaded area in Figure 6.

Figure 6 – Ocular Hazard Plot



Source: SGHAT Technical Reference Manual (2015).

Table 3 – Summary of Modelled Results

Observation Point	Low potential for temporary after image	Potential for temporary after image	Potential for permanent eye damage
Albury Airport flight path 1	0	0	0
Albury Airport flight path 2	0	0	0
Corowa Airport flight path 1	0	0	0
Corowa Airport flight path 2	0	0	0
Glenellen Road	0	0	0
Klinberg Road	0	0	0
Ortlipp Road	0	0	0
Sparks Road	0	0	0
Urana Road	0	0	0
Walla Walla Jindera Road	0	0	0
Residence 01	0	0	0
Residence 02	0	0	0
Residence 03	0	0	0
Residence 04	0	0	0
Residence 05	0	0	0
Residence 06	0	0	0
Residence 07	0	0	0
Residence 08	0	0	0
Residence 09	0	0	0
Residence 10	0	0	0
Residence 11	0	0	0
Residence 12	0	0	0
Residence 13	0	0	0
Residence 14	0	0	0
Residence 15	0	0	0
Residence 16	0	0	0
Residence 17	0	0	0
Residence 18	0	0	0
Residence 19	0	0	0
Residence 20	0	0	0
Residence 21	0	0	0
Residence 22	0	0	0

Note: Potential for glare is quantified in minutes per year.

No Glare was found to be present for any of the observation points or the flight path around the Jindera Solar Farm.

4 Conclusion

The glare from proposed 150 MWp Jindera Solar Farm was modelled using ForgeSolar. The proposed PV array is to be tracking, which means for much of the time the array will be perpendicular to the sun and the not create a glare problem. The times of concern are around sunrise and sunset.

Based on the modelling there was no glare risk found from the Jindera Solar Farm for either the observation points around the perimeter, the nearby roads or the flight paths from Albury and Corowa Airports. It should also be noted that vegetation screening is planned between the solar array and residences, which have not been included in this study.

Appendix A – Forge Solar Glare Report

REV: 01 Date: April 2019 REF: J2104 GLR-REP-001

4/8/2019 Jindera Solar Farm Site Config | ForgeSolar

ForgeSolar

GlareGauge Glare Analysis Results

Site Configuration: Jindera Solar Farm

Single axis tracking solar farm.

Created April 4, 2019 8:07 p.m.
Updated April 7, 2019 9:03 p.m.
DNI varies and peaks at 1,000.0 W/m^2
Analyze every 1 minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone UTC10
Site Configuration ID: 26848.4739

Summary of Results No glare predicted!

PV name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	-
PV array 2	SA tracking	SA tracking	0	0	-
PV array 3	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 60.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.913217	146.892208	228.22	1.50	229.72
2	-35.916832	146.891584	227.20	1.50	228.70
3	-35.917040	146.893493	226.88	1.50	228.38
4	-35.916224	146.894030	226.41	1.50	227.91
5	-35.916397	146.895832	225.94	1.50	227.44
6	-35.917458	146.895897	226.60	1.50	228.10
7	-35.917353	146.897205	225.73	1.50	227.23
8	-35.915268	146.897849	225.28	1.50	226.78
9	-35.915529	146.904565	223.60	1.50	225.10
10	-35.917388	146.904265	224.14	1.50	225.64
11	-35.917614	146.906947	222.36	1.50	223.86
12	-35.913791	146.907398	222.94	1.50	224.44
13	-35.912731	146.900488	225.65	1.50	227.15
14	-35.912140	146.900510	225.15	1.50	226.65

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Name: PV array 2
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 60.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.912070	146.880082	234.91	1.50	236.41
2	-35.913078	146.879739	234.81	1.50	236.31
3	-35.914382	146.880416	229.34	1.50	230.84
4	-35.915529	146.880180	229.42	1.50	230.92
5	-35.915685	146.880639	228.54	1.50	230.04
6	-35.913443	146.881090	228.82	1.50	230.32

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Name: PV array 3
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 60.0 deg
Rated power: -
Panel material: Smooth glass without AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 6.55 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.915596	146.877565	235.73	1.50	237.23
2	-35.917299	146.875291	237.69	1.50	239.19
3	-35.915491	146.862158	246.78	1.50	248.28
4	-35.908470	146.858596	251.76	1.50	253.26
5	-35.908957	146.863405	253.01	1.50	254.51
6	-35.903917	146.863060	242.40	1.50	243.90
7	-35.903500	146.861343	244.65	1.50	246.15
8	-35.900267	146.861429	242.43	1.50	243.93
9	-35.899650	146.862373	242.20	1.50	243.70
10	-35.896651	146.863274	239.88	1.50	241.38
11	-35.897555	146.869454	249.17	1.50	250.67
12	-35.908524	146.867652	246.25	1.50	247.75
13	-35.908018	146.880011	234.22	1.50	235.72
14	-35.910903	146.879496	235.32	1.50	236.82
15	-35.913058	146.878166	235.31	1.50	236.81

2-Mile Flight Path Receptor(s)

Name: Albury Airport FP 1
Description:
Threshold height: 15 m
Direction: 80.1 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.068105	146.948969	163.75	15.24	178.99
2-mile point	-36.073076	146.913891	161.75	185.93	347.68

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Name: Albury Airport FP 2
Description:
Threshold height: 15 m
Direction: 260.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-36.065434	146.969854	162.46	15.24	177.70
2-mile point	-36.069419	147.004921	183.54	162.84	346.38

Name: Corowa Airport FP 3
Description:
Threshold height: 15 m
Direction: 236.5 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-35.992674	146.358573	139.78	15.24	155.02
2-mile point	-35.976733	146.388420	143.87	179.83	323.70

Name: Corowa Airport FP 4
Description:
Threshold height: 15 m
Direction: 147.3 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	-35.983254	146.346271	139.53	15.24	154.77
2-mile point	-35.958924	146.326945	144.12	179.33	323.45

Route Receptor(s)

Name: Glenellen Road
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.912052	146.891768	230.72	0.00	230.72
2	-35.911357	146.901510	225.47	0.00	225.47
3	-35.910592	146.904343	224.69	0.00	224.69
4	-35.909411	146.906102	224.02	0.00	224.02
5	-35.904892	146.910565	220.94	0.00	220.94
6	-35.901033	146.911424	224.88	0.00	224.88

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Name: Kimberg Road
Route type: Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.916059	146.861626	249.10	0.00	249.10
2	-35.915937	146.861959	248.10	0.00	248.10
3	-35.918995	146.865798	229.94	0.00	229.94
4	-35.919969	146.865669	230.07	0.00	230.07
5	-35.920559	146.890261	227.18	0.00	227.18

Name: Orlipp Road
Route type: Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.923417	146.906875	221.03	0.00	221.03
2	-35.918517	146.907947	224.67	0.00	224.67
3	-35.910523	146.909535	224.91	0.00	224.91
4	-35.909591	146.910480	221.09	0.00	221.09
5	-35.905448	146.910136	220.87	0.00	220.87

Name: Sparks Road
Route type: Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.918140	146.877924	237.28	0.00	237.28
2	-35.916055	146.878053	235.13	0.00	235.13
3	-35.915256	146.879439	236.33	0.00	236.33
4	-35.913176	146.878783	235.89	0.00	235.89
5	-35.911050	146.880199	236.19	0.00	236.19
6	-35.903333	146.881744	242.90	0.00	242.90

Name: Urana Road
Route type: Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.890261	146.844291	260.94	0.00	260.94
2	-35.895476	146.847638	266.13	0.00	266.13
3	-35.906322	146.856135	251.37	0.00	251.37
4	-35.913284	146.860170	246.71	0.00	246.71
5	-35.923866	146.865234	251.61	0.00	251.61
6	-35.928288	146.868236	248.73	0.00	248.73
7	-35.936280	146.874332	246.46	0.00	246.46

Name: Walla Walla Jindera Road
Route type: Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-35.946511	146.863481	232.99	0.00	232.99
2	-35.931918	146.857773	237.75	0.00	237.75
3	-35.919129	146.890691	228.73	0.00	228.73
4	-35.908841	146.892497	229.49	0.00	229.49
5	-35.901055	146.892922	228.97	0.00	228.97
6	-35.892433	146.894811	235.71	0.00	235.71
7	-35.887983	146.895326	241.71	0.00	241.71
8	-35.883254	146.895669	247.94	0.00	247.94

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Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-35.890032	146.864097	247.03	0.00	247.03
OP 2	-35.895238	146.859114	250.58	0.00	250.58
OP 3	-35.892464	146.842874	264.76	0.00	264.76
OP 4	-35.900887	146.842804	285.56	0.00	285.56
OP 5	-35.903898	146.857049	255.42	0.00	255.42
OP 6	-35.911619	146.850435	260.11	0.00	260.11
OP 7	-35.927469	146.839953	290.74	0.00	290.74
OP 8	-35.928234	146.873411	245.84	0.00	245.84
OP 9	-35.921554	146.888773	231.22	0.00	231.22
OP 10	-35.919455	146.886369	230.32	0.00	230.32
OP 11	-35.917826	146.880222	236.33	0.00	236.33
OP 12	-35.921481	146.895586	225.53	0.00	225.53
OP 13	-35.921798	146.905533	222.73	0.00	222.73
OP 14	-35.915800	146.909080	223.28	0.00	223.28
OP 15	-35.911804	146.909766	223.72	0.00	223.72
OP 16	-35.909831	146.907388	225.44	0.00	225.44
OP 17	-35.910865	146.902082	225.78	0.00	225.78
OP 18	-35.910972	146.900373	226.30	0.00	226.30
OP 19	-35.911002	146.896152	228.46	0.00	228.46
OP 20	-35.911608	146.893500	230.69	0.00	230.69
OP 21	-35.912356	146.890238	232.58	0.00	232.58
OP 22	-35.901199	146.875939	253.97	0.00	253.97

PV Array Results

PV array 1

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Component	Green glare (min)	Yellow glare (min)
FP: Albury Airport FP 1	0	0
FP: Albury Airport FP 2	0	0
FP: Corowa Airport FP 3	0	0
FP: Corowa Airport FP 4	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
Route: Glenellen Road	0	0
Route: Klinberg Road	0	0
Route: Ortlipp Road	0	0
Route: Sparks Road	0	0
Route: Urana Road	0	0
Route: Walla Walla Jindera Road	0	0

PV array 2

Component	Green glare (min)	Yellow glare (min)
FP: Albury Airport FP 1	0	0
FP: Albury Airport FP 2	0	0
FP: Corowa Airport FP 3	0	0
FP: Corowa Airport FP 4	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
Route: Glenellen Road	0	0
Route: Klinberg Road	0	0
Route: Ortlipp Road	0	0
Route: Sparks Road	0	0
Route: Urana Road	0	0
Route: Walla Walla Jindera Road	0	0

PV array 3

Warning: This PV array encompasses a large surface area. This may reduce the accuracy of certain calculations if receptors are near the array. These calculations utilize the PV footprint centroid, rather than the glare-spot location, due to analysis method limitations. Additional analyses of array sub-sections may provide more information on expected glare. (Note that the subtended source angle is limited by the footprint surface area.)

Component	Green glare (min)	Yellow glare (min)
FP: Albury Airport FP 1	0	0
FP: Albury Airport FP 2	0	0
FP: Corowa Airport FP 3	0	0
FP: Corowa Airport FP 4	0	0
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
Route: Glenellen Road	0	0
Route: Klinberg Road	0	0
Route: Ortlipp Road	0	0
Route: Sparks Road	0	0
Route: Urana Road	0	0
Route: Walla Walla Jindera Road	0	0

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the User's Manual for assumptions and limitations not listed here.