



Visual Impact Assessment Jemalong Solar Station 1 Jemalong, NSW



FRESH
landscape design

REPORT

July 2015

Contents

Executive summary	3
1 Introduction	5
1.1 Purpose of this report	5
1.2 Objectives	5
1.3 Assumptions	6
2 Methodology	7
2.1 Overview	7
2.2 Values for landscape character	7
2.3 Viewpoint selection	7
2.4 Assessment of significance of effects	8
2.5 Technical details	8
3 Project description	9
3.1 Solar array modules	10
3.2 Thermal storage and heat exchangers	11
3.3 Condenser	12
3.4 Turbine and generators	12
3.5 Transformer station and switchgear	12
3.6 Control and amenities kiosk	13
3.7 Perimeter security fencing	13
3.8 Evaporation ponds	13
3.9 Flood levies	13
3.10 Transmission line	13
3.11 Access tracks and parking	14
4 Visual baseline study	15
4.1 Study area	15
4.2 Existing landscape character	15
5 Visual impact assessment	23
5.1 Introduction	23
5.2 Opportunities to view the proposed solar plant and transmission line	23
5.3 Reflectivity	25
5.4 General visual effects	25
5.5 Visual impact from specific locations	26
5.6 Cumulative impacts	53
5.7 Summary of significant visual impacts	53
6 Visual impact mitigation	54
7 Conclusion	55
8 References	56
Appendix A: Visual landscape quality indicators	
Appendix B: Maps	
Appendix C: Photomontages	

Executive summary

A commercial-scale demonstration concentrating solar thermal plant with thermal energy storage to be known as JSS – Hallidays No.1, or 'JSS1' is proposed to be constructed and operated on rural land at Jemalong Station approximately 36km west of Forbes NSW by Australian company Vast Solar.

The purpose of this visual impact assessment is to identify the nature and degree of visual change that would be introduced into the landscape by the proposal, assess whether it is an adverse or beneficial change, evaluate its significance and recommend mitigation measures where appropriate. This assessment is part of a suite of environmental assessments that form part of the Environmental Impact Statement for the project. The report addresses the requirements related to the preparation of a visual impact assessment for the project as outlined in the Secretary's Environmental Assessment Requirements dated 26 August 2014.

The methodology used in this study is based on the process described by the Landscape Institute and Institute of Environmental Management and Assessment (IL & IEMA 2013) and Tudor (2014). There are two major components: a baseline study and an impact assessment. The visual impact assessment makes an assessment of the significance of the visual impact of the proposal. It does not conclude whether the visual impact is acceptable or not to an individual viewer as that judgement is subjective and depends on the viewer.

The proposal is for a 30MW concentrating solar thermal plant with thermal energy storage. The key elements of the proposed development are:

- approximately 90 solar array modules, each comprising a field of heliostats (tracking mirrors) and a 30m high receiving tower
- a 'power island' within a fenced compound, located at the northern end of the site comprising:
 - two thermal storage tanks with associated pumps, valves and piping
 - an air cooled condenser
 - a steam generator and heat exchanger
 - a noise hood – a light structure to limit noise from the electricity generator and steam turbine (but not a turbine shed structure)
 - a weatherproof kiosk containing control and communications equipment
 - a weatherproof kiosk, housing 415V to 55V transformers and batteries, for each group of three solar arrays
- a 66kV transformer station and switchgear in a separate, smaller fenced enclosure
- field piping network
- one control kiosk (typical 40' (10.1m) storage container) for each group of six modules, housing 55kV electrical services, communications equipment and software systems
- internal gravel access tracks and parking to allow for site maintenance
- two 2400 square metre evaporation ponds (1.5m deep) located to the east of the solar field
- minimal flood levy earthworks comprising a bund approximately 300mm in height, installed around the central 'power island' and transformer station
- perimeter security fencing, approximately 2.3m high.
- a 66kV overhead line to connect into the existing Essential Energy substation at the junction of Whispering Pines Lane and Lachlan Valley Way approximately 3km north of the site
- an unsealed all weather access track, within Jemalong Station, along the route of the existing farm gravel road access (requires only minimal upgrading).
- materials laydown areas
- temporary construction site offices
- basic staff amenities

- temporary car and bus parking areas for construction worker transportation, reducing post construction to a small car park for staff and occasional visitors.

The existing landscape was categorised into six landscape character units and the visual qualities described. Areas including the Lachlan River corridor, Bedgerabong, Jemalong Ridge, Jemalong Weir picnic area and some heritage locations were identified as being more highly valued by the community. Opportunities to view the proposal from public and private lands were identified and representative viewpoints were used to identify the visual effects of the proposed solar farm and transmission line (refer to Appendix C Map 6). The following visual effects are identified as significant.

Viewpoint	Description of significant visual impact
V4 Willawang Road 1	Possible glare from individual heliostats on occasions
V12 House 1 – Whispering Pines Lane	Possible glare from individual heliostats when viewed from southern parts of property through any gaps in the vegetation Tops of receiving towers will be visible above the treetops across the breadth of views to the south
V13 House 2 - Whispering Pines Lane	Location of transmission line pole in centre of view looking east would increase size of negative effect for susceptible residents

The following mitigation and management measures are proposed

- Stagger the focal direction of heliostats in standby mode (not to target) to minimise potential for glare from a cluster of heliostats if such glare is identified through complaints
- Consult with neighbouring properties to west, north and east of JSS1 in relation to potential glare from heliostats when not on target and adjust the focal direction of heliostats in standby mode if such glare is identified through complaints
- Additional screen planting around JSS1 or installation of shade material on security fence if complaints are received about heliostat glare experienced on neighbouring properties that cannot be mitigated by adjusting focal direction of heliostats
- Offer option of screen planting south of house area to residents of V12 House 1 – Whispering Pines Lane to screen views to receiving towers
- Locate new transmission line poles to minimise impacts of views from House 2 in Whispering Pines Lane
- Select colours for above ground structures, including the construction site offices, sympathetic to the landscape character of the site

Overall the visual impact of the proposed development is of low significance. This is a consequence of the relatively low height of the proposed design, the presence of screening vegetation throughout the study area, the relatively low population density and the distance of publicly available views from the JSS1 site. Where significant visual impacts have been identified, there are not expected to be any significant residual visual impacts if the mitigation and management measures are implemented.

1 Introduction

1.1 Purpose of this report

Vast Solar is an Australian company developing solar energy generating technology known as concentrating solar thermal power (CSP). A commercial-scale demonstration concentrating solar thermal plant with thermal energy storage to be known as JSS – Hallidays No.1, or 'JSS1' is proposed to be constructed and operated on rural land at Jemalong Station approximately 36km west of Forbes NSW.

Landscape architecture consultant Fresh Landscape Design was commissioned by **ngh**environmental to prepare a visual impact assessment (VIA) for the proposed Jemalong Solar Station. Fieldwork for this assessment was undertaken in October 2014. The maps and photomontages were provided by SW Environmental. Unless otherwise acknowledged, all the photographs included in this report are by Fresh Landscape Design.

The purpose of the visual impact assessment is to identify the nature and degree of visual change that would be introduced into the landscape by the proposal, assess whether it is an adverse or beneficial change, evaluate its significance and recommend mitigation measures where appropriate.

The report describes the results of the fieldwork, records the existing landscape character, documents the assessment of visual impact of the proposal and makes recommendations for mitigation measures. This VIA is part of a suite of environmental assessments that form part of the Environmental Impact Statement for the project.

1.2 Objectives

The report addresses the requirements related to the preparation of a visual impact assessment for the project as outlined in the Secretary's Environmental Assessment Requirements dated 26 August 2014. The secretary's requirements relating to the assessment of visual impacts for the proposed development and the sections of this report that address them are listed in Table 1.1.

Table 1.1 Report requirements

Requirement	Report sections
Provide an assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the development. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the development based on surveys and consultation.	Section 4
Include a full assessment of the visual impacts associated with the solar farm, including identification and documentation of all key viewing points and corridors particularly from identified sensitive lands. Alternative pole designs should be presented and assessed and the potential for undergrounding in sensitive locations should also be assessed.	Section 5 Section 3.10
Provide an assessment of the potential for reflectivity from the panels, receiving towers and associated infrastructure, and any safety impacts for motorists or aircraft.	Section 5.3 Ocular Hazards from Glint and Glare Report (refer to EIA)

Include photomontages of the development taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for the solar farm.	Section 5.5 Appendix C
Provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.	Section 6 Section 7

The visual impact assessment makes an assessment of the significance of the visual impact of the proposal. It does not conclude whether the visual impact is acceptable or not to an individual viewer as that judgement is subjective and depends on the viewer.

1.3 Assumptions

The methodology used to conduct this assessment assumes that:

- some viewing locations and views will be considered more important than others
- some viewers will be more concerned about the appearance of the landscape than others
- views seen for short periods will be considered less important than views experienced over a sustained time
- the importance of a view may be partly determined by its popularity, the number of people seeing it, the facilities provided for its enjoyment and its inclusion in tourism information, other literature or cultural records
- the significance of visual effects is not an absolute measure but can be assessed for a proposed development based on consideration of typical community values related to the landscape and susceptibility of viewers to change in the landscape from typical viewpoints, along with the nature, scale and duration of the change
- the visual management objectives for landscapes are maximum protection and maintenance of existing visual landscape character for areas of high value and restoration and enhancement of visual character for areas with low value.

2 Methodology

2.1 Overview

The methodology used in this study to assess the visual impacts of the proposal is based on the process described by the Landscape Institute and Institute of Environmental Management and Assessment (IL & IEMA 2013) and Tudor (2014). There are two major components: a baseline study and an impact assessment.

The baseline study is an inventory of the existing landscape character and values in the places from where the development could be visible. It involves the following steps:

- **definition of study area**
- **desk study** including collection and review of existing literature, tourism information, maps and aerial photos, review of the description of the proposed development, identification of approximate visibility of the development based on the topography (view shadow areas) and identification of potential viewing opportunities for residents, workers, visitors and travellers
- **field survey** to familiarise the consultant with the visual qualities of the study area, check the actual extent of visibility, identify key and representative viewpoints and make a comprehensive photographic record
- **visual baseline analysis** including landscape character assessment and values for the study area.

The visual impact assessment describes, for the available views, the changes in visual character and visual amenity that are expected to result from the development. It involves the following considerations:

- **identification of the views** likely to be affected by the proposal
- **identification of susceptibility of viewers to change** at those locations based on general principles and the results of community consultation
- **identification of visual effects** introduced by the development for key and representative viewpoints including the scale of change, level of contrast, duration, distance, angle of view affected and cumulative effects; photomontages are prepared to illustrate visual effects for viewpoints most likely to be impacted by the proposed solar plant
- assessment of **options for mitigation** of adverse visual effects
- evaluation of the **significance of effects** with and without mitigation.

2.2 Values for landscape character

Information provided during community consultation for this project along with planning documents from Forbes Shire Council (Edge Land Planning 2008 and 2009, Forbes Shire Council 2013a and 2013b) were used to identify landscape character values for the study area. Where precise information was not available from these sources, the WAPC (2007) visual landscape character preference indicators (summarised in Appendix A) have been used as a guide to assessing community landscape character values in the study area. Typically areas with more outstanding, unusual or diverse landscape features are most valued by the community while areas lacking features and variety are least preferred.

2.3 Viewpoint selection

A series of observation points in the study area were used to sample views that might be affected by the proposed development. Of these observation points, some were selected as key viewpoints to examine two types of views:

- critical viewpoints – sensitive views from where the proposed development is likely to be prominent
- typical viewpoints – representing views that will be seen from many locations (such as from residential areas and roads in rural areas or from within an area with a particular landscape character) with emphasis on selecting worst case viewing locations.

2.4 Assessment of significance of effects

In this methodology, visual effects are changes to the landscape character and views caused by human activity. Assessment of the significance of visual effects for a proposed development is a value judgement. The judgement is made after considering

- the susceptibility of the viewers to change
- the value related to the view
- the size or scale of the visual effect
- the geographic extent of the effect
- the duration and reversibility of the effect.

In general:

- changes affecting large numbers of people will be more significant than those affecting a small group of viewers
- in wilderness areas the value related to the view may be very high so the significance of change will be higher
- changes in views from recognised or important viewpoints are likely to be more significant than changes affecting less important paths and roads
- large-scale changes introducing a high level of contrast are likely to be more significant than small changes or lower contrast changes.
- changes in views seen for short durations are likely to be less significant than views seen for extended periods
- changes in views seen by residents at home, visitors to heritage sites or people engaged in outdoor recreation related to landscape or views are likely to be more significant than changes affecting travellers on non-scenic routes or workers.

2.5 Technical details

Photographs were taken in the field using a 35mm SLR digital camera with the lens set at 55mm, which closely represents the central vision of the human eye. Locations were recorded using a GPS unit in a compact digital camera.

Photomontages are digital simulations of how a view might appear with the proposed development in place. Representations of the proposed structures are superimposed onto a photograph of the view. The photomontages are an artist's representation of what the proposed development might look like based on the proposed infrastructure at the time of preparation. Infrastructure types and locations shown in the photomontages may vary from that actually built. Vegetation removal was not included in the montages. For this project, the effect of viewing up to 89 receiving towers at a distance of approximately 2km is that the towers will not be seen as distinct elements but rather as a massed conglomeration which has been represented as a white band to indicate the expected location, scale and colour in the view.

Since the receiving towers are the tallest structures in the proposed development, their heights of 30m were used as the basis for calculating the view shadow and it was assumed that there was no vegetation. The view shadow was calculated using the ArcGIS 10.0 viewshed tool, based on 25 x 25m elevation data from NSW Land and Property Information (2014). The analysis allowed for a viewer height of 1.5m and used default earth curvature and light refraction settings.

3 Project description

The proposed site for JSS1 is located on rural land in Central West NSW, approximately 36km west of Forbes (refer to Appendix B Map 1) within the Forbes Shire Local Government Area.

The 165 hectare site known as 'Hallidays', part of the 15,478 hectare Jemalong Station, is a cleared, relatively flat area of farmland with a band of mature trees and shrubs located along the lagoon to the north. The area surrounding Jemalong Station is predominantly large holdings engaged in rural activities with low population density. The nearest non-involved residential dwelling is approximately 1.7km from the proposed JSS1 site. The nearest non-involved residential dwelling is approximately 200m from the proposed transmission line.



Figure 3.1 View looking south to south east across the proposed site

The proposal is for a 30MW concentrating solar thermal plant with thermal energy storage. The key elements of the proposed development that would be located within the site (refer to Appendix B Map 2) are:

- approximately 90 solar array modules, each comprising a field of heliostats (tracking mirrors) and a 30m high receiving tower
- a 'power island' within a fenced compound, located at the northern end of the site comprising:
 - two thermal storage tanks with associated pumps, valves and piping
 - an air cooled condenser
 - a steam generator and heat exchanger
 - a noise hood – a light structure to limit noise from the electricity generator and steam turbine (but not a turbine shed structure)
 - a weatherproof kiosk containing control and communications equipment
 - a weatherproof kiosk, housing 415V to 55V transformers and batteries, for each group of three solar arrays
- a 66kV transformer station and switchgear in a separate, smaller fenced enclosure
- field piping network
- one control kiosk (typical 40' (10.1m) storage container) for each group of six modules, housing 55kV electrical services, communications equipment and software systems
- internal gravel access tracks and parking to allow for site maintenance
- two 2400 square metre evaporation ponds (1.5m deep) located to the east of the solar field
- minimal flood levy earthworks comprising a bund approximately 300mm in height, installed around the central 'power island' and transformer station
- perimeter security fencing, approximately 2.3m high.

The following elements would connect to the site:

- a 66kV overhead line to connect into the existing Essential Energy substation at the junction of Whispering Pines Lane and Lachlan Valley Way approximately 3km north of the site
- an unsealed all weather access track, within Jemalong Station, along the route of the existing farm gravel road access (requires only minimal upgrading).

Ancillary facilities would include:

- materials laydown areas
- temporary construction site offices
- basic staff amenities
- temporary car and bus parking areas for construction worker transportation, reducing post construction to a small car park for staff and occasional visitors.

3.1 Solar array modules

JSS1 would contain approximately 90 solar array modules, each approximately 130m x 100m and containing approximately 700 heliostats and a 30m high lattice-steel style tower, with a thermal receiver at its top, located to the north of the heliostats. The thermal receiver would face downward (towards the heliostats) and to the south and would glow during daylight hours.



**Figure 3.2 Tower and thermal receiver at Jemalong demonstration site viewed from north
(photo: Vast Solar)**

The heliostats use mirrors facing north and are approximately 2m high. Each mirror is 1.5m x 2.4m (3.6m²). A solar tracking system rotates the heliostats in two axes so that they constantly reflect sunlight to the face of the south-facing thermal receiver. The heliostats are mounted on a steel foundation comprising vertical steel posts driven into the ground and a network of lighter gauge galvanised steel piping. No site preparation, levelling or clearing of vegetation is required for installation of the posts.



Figure 3.3 Heliostat fields at Jemalong pilot plant (photo: Vast Solar)

Hot and cold thermal pipes would connect the thermal receiver on each tower to the central heat exchanger via a field piping network laid at ground level.



Figure 3.4 Thermal piping at Jemalong pilot plant before being insulated (photo: Vast Solar)

3.2 Thermal storage and heat exchangers

The two proposed thermal storage tanks would be approximately 12m high, 20m in diameter and have an aluminium cladding exterior finish.

A typical layout for the heat exchangers is to be mounted on a steel supporting structure between the two storage tanks, at approximately tank-roof level resulting in a total height for the thermal storage and heat exchangers of approximately 20m.

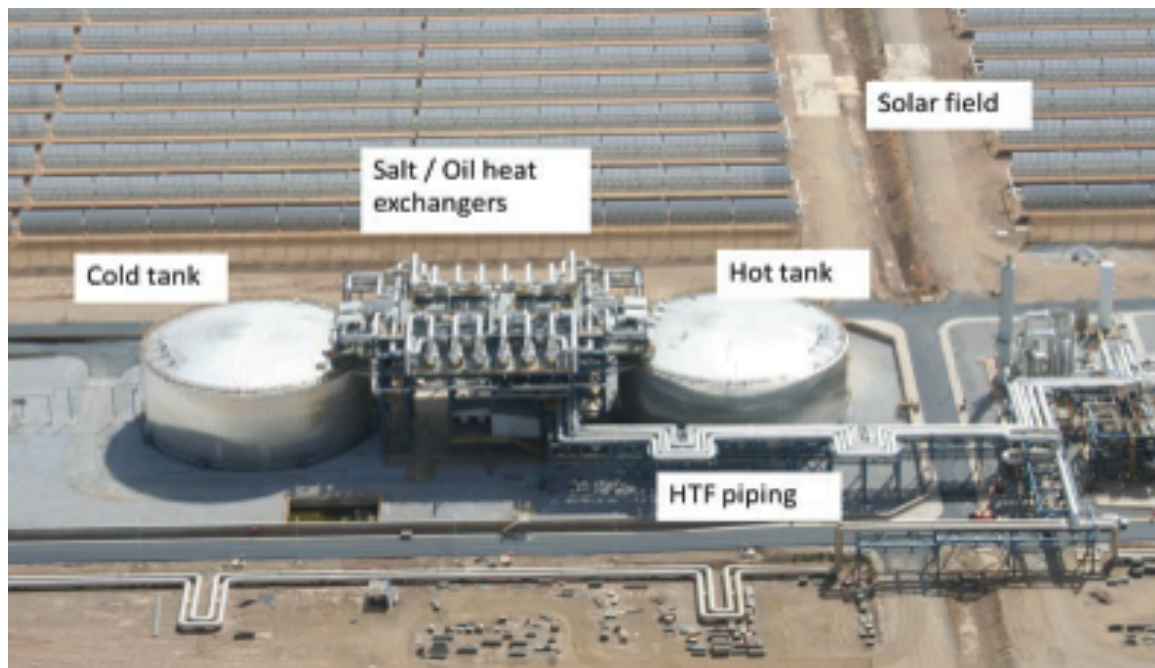


Figure 3.5 Typical molten salt thermal energy storage tanks with heat exchangers mounted between the tanks (image provided by Vast Solar)

3.3 Condenser

The proposed 4-cell, air-cooled condenser is to be mounted on a steel stand and within a sheet-metal clad housing. The dimensions of the proposed condenser structure are approximately 30m wide x 30m long x 20m high. The colour of the exterior would be off-white, similar to that shown in the figure below.



Figure 3.6 Air-cooled condenser at Jemalong pilot plant

3.4 Turbine and generators

The steam turbine, electricity generator and auxiliary equipment would be housed in a light noise containment structure approximately 30m wide x 30m long x 13m high clad with powder-coated or painted corrugated steel sheet (in Colorbond Woodland Grey or other colour minimising visual impact).

3.5 Transformer station and switchgear

The proposed 66kV transformer station and switchgear area would be approximately 50m wide x 20m long x 10m high and contain a small number of typical switchyard components.



**Figure 3.7 Typical fenced transformer station showing transformer and switchgear
(photo: Vast Solar)**

3.6 Control and amenities kiosk

Control and communications equipment would be located in a kiosk constructed of brick or metal cladding on a steel frame, with a metal clad roof, approximately 15m wide x 15m long. The kiosk would be painted Colorbond Woodland Grey or other colour sympathetic to the surrounding environment to minimise visual impacts.

3.7 Perimeter security fencing

The perimeter of the site would be fenced with 2.3m high chain link wire topped with barbed wire.



Figure 3.8 Fence at the demonstration facility at Jemalong

3.8 Evaporation ponds

Based on a preliminary site water balance two 2400 square metre evaporation ponds (1.5 m deep) would be located to the east of the solar fields.

3.9 Flood levies

A compacted earthen bund is proposed to be constructed approximately 300mm high around the power island as a precaution against floodwater incursion.

3.10 Transmission line

The design for the 66kV transmission line from the West Jemalong Substation to JSS1 will be subject to approval by Essential Energy. It is highly likely that Essential Energy will undertake the design so that Vast Solar will have little control over the design outcome other than the proposed route.

It is expected that the new transmission line will be similar in design to the 66kV transmission line recently installed by Essential Energy from the West Jemalong substation to Forbes. This has steel poles approximately 22m high and spaced approximately 200m apart. The transmission line would be located in an easement approximately 20m wide and terminate at a connection and metering point within a fenced switchyard enclosure adjacent to the power island.

Another alternative would be to use concrete poles that would be similar in size and less reflective than new steel poles. It is unlikely that this option would offer any longer term visual benefits in comparison to use of steel poles. The option of undergrounding the transmission line is not under consideration because it would cause considerable disruption to the lagoon north of the JSS1 site.



Figure 3.9 66kV transmission line recently installed in the vicinity (in foreground)

3.11 Access tracks and parking

The proposed access tracks to and around the site would remain unsealed but may be re-sheeted with gravel to maintain their condition during the construction phase.

Parking areas for maintenance vehicles are proposed near the generation facilities and administration building within the project site.



Figure 3.10 Typical unsealed access track on Jemalong Station

4 Visual baseline study

4.1 Study area

The study area for this assessment was defined as the area within 16km of the proposed JSS1 site (refer to Appendix B Map 3). This distance is based on the extent of the background zone defined by WAPC (2007) combined with the extent of the proposal view shadow shown on Map 4 (Appendix B) and the observation during fieldwork that vegetation in the foreground and middle ground provided extensive screening of views. Given that the same object viewed from increasingly greater distances will occupy a progressively smaller portion of the observer's field of vision and that the proposed development is relative low in height and not located in an elevated position relative to the surrounding landscape (such as a ridgeline), this distance is considered sufficient to examine the visual impacts of the proposal.

4.2 Existing landscape character

4.2.1 Community values for landscape character

The landscape character of the study area appears to be valued by the community primarily as a productive agricultural landscape that contains some native vegetation. Edge Land Planning (2008) reports after community consultation 'the desire of the community for lifestyle and conservation of vegetation and the natural features and environmental qualities of the area as well as the continuation of agriculture'. Following on from this, the *Forbes Local Environment Plan 2013* (Forbes Shire Council 2013a) does not include any specific landscape character values for the rural zone that applies to the study area. The *Forbes Development Control Plan 2013* Section 9.9 (Forbes Shire Council 2013b), covering scenic and landscape character for rural zones, lists the fairly general objectives to minimise the impact of development on the rural landscape and retain existing native vegetation and then focuses on minimising use of strongly contrasting bricks and finishes.

Although the Forbes Visitor Information Centre was not promoting the study area as a tourist or local recreation destination while fieldwork was in progress, the following attractions are mentioned on Forbes related websites (Forbes Shire Council online 1 and 2) and indicate additional value placed by the community on parts of the study area:

- picnics, bushwalking, fishing and yabbing on the Lachlan River
- visiting the Jemalong Weir
- Bedgerabong Country Music Campout
- Bedgerabong Races
- Bedgerabong Show

Various locations are listed in the Forbes Local Environment Plan 2013 (Forbes LEP 2013) as heritage items including Jemalong and Riversleigh homesteads, and various sites in Bedgerabong and Warroo, again indicating that they are valued by the community.

Community consultation conducted as part of the planning for the project has not indicated any concern about protecting the landscape character or publicly available views in the study area in relation to the project. Concern was expressed by residents during VIA fieldwork visits about the visual effect of locating the proposed transmission line in close proximity to one residence. The design for the transmission line has subsequently been changed to move the route further away from the residence.

4.2.2 General description of landscape character

The study area is primarily a flood plain dedicated to broad scale farming and incised by the meandering and tree-lined Lachlan River. The river has been, and still is, a focus for social and recreational activity. The steep and heavily treed Jemalong Ridge rises abruptly out of the flood plain and provides a backdrop to many views as well as a physical barrier between the town of Forbes and the Jemalong area. The localities of Bedgerabong and Warroo, are clusters of small rural holdings nestled in amongst mature trees.

For the purposes of examining the visual qualities of the study area at a local level, the study area was divided into six landscape character units (LCUs) based on the results of the desktop analysis and fieldwork. Map 5 (Appendix B) shows the location of the LCUs. The area within each LCU has similarities in terms of landform, vegetation patterns, water form, land use patterns and aesthetic qualities.

4.2.3 LCU1: Farmland

Landform: Broad floodplain

Vegetation: Large expanses of pasture grasses and annual crops including wheat and lucerne divided by shelter belts of native trees, occasionally exotic trees planted around farmhouses

Water: Straight irrigation channels have been excavated in the plain and are filled with water

Colour: Seasonal changes in colours of crops and pastures

Scarcity: Seen across a wide area

Human land use: Used extensively for grazing and agriculture

Built characteristics: Scattered farm houses and sheds, many with weathered galvanised or grey powder coated steel sheeting walls and roofs; straight fences, sealed and unsealed roads and irrigation channels divide the landscape into geometric shapes such as squares and rectangles

Agricultural characteristics: Intensively managed farmland with many agricultural enterprises including grazing cattle and sheep, crops including wheat, lucerne and other fodder crops, oranges

Key landscape character elements: Broad, open landscape combining a variety of rural uses into a vast rural patchwork with Jemalong Ridge and the tree-lined river as backdrops to views

Visual amenity and quality: Considered attractive as a working rural landscape with wide, open spaces covered with pasture or crops and areas of native trees; contains some buildings of heritage interest; views from individual houses likely to be highly valued by occupants



4.2.4 LCU2: Lachlan Valley Way corridor

Landform: Broad floodplain

Vegetation: Open grassy woodland along roadsides with mature eucalypts

Water: Adjacent to the Lachlan River corridor

Colour: Dominated by dark grey road surface, drab greens and browns of vegetation and often blue sky

Scarcity: Seen over a long distance and typical of roadsides in the area

Human land use: Transport route between Forbes and Condoblin with moderate traffic flows and relatively unused land either side of the road surface

Built characteristics: Asphalt road is dominant structure, corridor is generally delineated by farm fencing

Key landscape character elements: Flat linear road corridor with gentle bends and curves enclosed by large trees on both sides. Views out to adjacent farmland and the Lachlan River are filtered by tree trunks and screened by dense vegetation along the river.

Visual amenity and quality: Moderately attractive travel route through a typical rural working landscape



4.2.5 LCU3: Lachlan River corridor

Landform: River corridor is slightly sunken in the flood plain with the river banks sloping down to the water

Vegetation: Mature native trees line both sides of the river, creating a heavily shaded and enclosed linear space along the water body with a grassy understorey.

Water: Meandering, shallow river with turgid, slow flowing water and some lagoons

Natural areas: Understorey with minimal shrub cover appears modified by grazing practices and human use

Colour: Dark brown trunks and drab, dark greens

Scarcity: Scarce in the wider region and attractive as a water body in a dry place

Human land use: Used as water source for irrigation and used by locals and visitors for recreation such as picnics, fishing and camping

Built characteristics: Few built structures other than bridges and the Jemalong Weir

Key landscape character elements: The meandering river is an attractive feature with expanses of water and sloping banks in contrast to the surrounding areas. The shady tree canopy provides a sense of enclosure and tranquillity.

Visual amenity and quality: Highly valued locally as a relatively natural area used for recreation; mentioned in tourism literature and is a landmark and backdrop for surrounding areas; likely to have significance for traditional owners



4.2.6 LCU4: Bedgerabong settlement

Landform: Flat flood plain beside meandering river

Vegetation: Mature native trees dominate the landscape which is also planted with exotic trees around houses and cleared for pasture grasses and annual crops

Water: Lachlan River is nearby

Colour: Seasonal variation from crops and deciduous trees with patches of drab greens and bright expanses of sky

Human land use: The settlement is divided into small rural lots located mainly along one road without a clearly defined centre; many lots have a house and farm buildings surrounded by small paddocks.

Built characteristics: Small houses and farming infrastructure such as sheds, fences, machinery, tracks and fences; community resources including a primary school, church, racecourse, hall and bushfire brigade

Agricultural characteristics: Relatively small flat paddocks adjacent to houses used for a range of small farm purposes

Key landscape character elements: An eclectic mix of rural style houses and farm buildings interspersed with mature trees and cleared patches along roadside with potential to develop into rural village

Visual amenity and quality: Likely to be valued locally as familiar rural-style landscape without distinctive scenic features; contains places of heritage interest; views from individual houses likely to be highly valued by occupants



4.2.7 LCU5: Jemalong Ridge

Landform: The steep ridge line rises abruptly out of surrounding flat plain and runs approximately north-south over a large distance; Jemalong Ridge is a dominant form in the landscape and provides a backdrop for many views

Vegetation: Heavily vegetated with mature native trees

Natural areas: Jemalong Ridge is relatively inaccessible due to the slopes and lack of road access; appears to contain relatively undisturbed native vegetation.

Colour: Drab grey greens

Scarcity: Relatively scarce in the region

Human land use: Appears unsettled with no visible built form apart from roads and transmission lines passing through gaps in the ridge

Key landscape character elements: Stark contrast between the steep, heavily vegetated ridgeline and the surrounding rural floodplain. This ridgeline would provide expansive views across the landscape if it was accessible. The break in the ridgeline at the Lachlan River creates a gateway to the Jemalong area.

Visual amenity and quality: Valued locally as dramatic landform and relatively natural area; identified in Edge Land Planning (2009) as a key landscape feature of the Forbes area.



4.2.8 LCU6: Wilbertroy State Forest

Landform: Slightly raised area in flat plain

Vegetation: Reported to have high ecological value, remnant woodland of Red River Gum, Grey Box and Belah

Water: not known

Natural areas: Managed as state forest, part of this area was included in the National Park Estate in 2012 but no information about the site is listed on the NSW National Parks and Wildlife Service website

Human land use: Previously used for logging then managed by grazing by adjacent landowners; there appears to be no public road access

Key landscape character elements: This area was not able to be visited

Visual amenity and quality: Little seen but valued at state level for ecological values



Image © Google Earth

5 Visual impact assessment

5.1 Introduction

This section of the report identifies locations in the study area from where the development may be visible, identifies and describes the visual effects of the proposal from representative viewpoints, assesses the significance of the effects and proposes measures to avoid, prevent, reduce or offset significant effects.

5.2 Opportunities to view the proposed solar plant and transmission line

5.2.1 View shadow areas

View shadow areas are the parts of the study area where it is predicted using computer modelling that the proposed development will not be visible because there are hills or ridges between the viewer and the proposed development that block the view. This does not take into account the screening of views by existing vegetation.

For this visual impact assessment, separate view shadow areas were calculated for the proposed solar plant and the proposed transmission line because the two structures are distinctly different in height and location. The results of the two mappings were fairly similar so the worst case scenario mapping the view shadow area for the 30m high receiving towers is shown in Map 4 (Appendix B).

In the field it was observed that the vegetation lining most roadsides and edges of paddocks throughout the rural areas restricts viewing opportunities to a much greater extent than the screening by topography shown in the view shadow mapping.

5.2.2 Viewing opportunities

Map 3 (Appendix B) shows the location of roads, waterways and places of interest within the study area. This information was compiled from maps, fieldwork and Geographical Information System (GIS) data primarily from NSW Land and Property Information and ESRI Online. Tourism publicity material, Google Maps and Internet searches were also used to identify sites of tourism and community activity. These are all publicly accessible places from where people view the landscape.

Residential areas and farm properties (refer to Appendix B Map 4) were identified using GIS data and aerial photography. These are generally not publicly accessible but are locations where residents and workers view the landscape.

Table 5.1 summarises the types of places in the study area from where the proposed development might be seen, without regard to screening by vegetation or other structures but excluding areas in the view shadow.

Table 5.1 Opportunities for viewing proposed development if screening is not present

Location and types of viewers	Nature of views to proposal
Newell Highway – many travellers on transport route	Fleeting views looking NNW from short section of highway approximately 16km from JSS1 and transmission line
Lachlan Valley Way – moderate number of travellers on transport route	Short duration views looking south (perpendicular to direction of travel), closest points are approximately 3.1km from JSS1 and 150m from transmission line
Lachlan River – moderate number of tourists and local people	Long duration views for campers, fishers and other people engaged in social and recreational activities looking south, closest points are approximately 3.3km from JSS1 and 3.3km from transmission line
Bedgerabong – small number of residents in and around houses and visitors travelling through locality, moderate numbers attending events	Views looking south to JSS1 (closest residence 4.9km) and transmission line (closest residence 2.1km). Long duration views from private houses and small farms, medium duration views from community facilities, short duration views from North Condobolin Road
Warroo – small number of residents in and around houses, small number of visitors to heritage sites	Medium to long duration views looking south east from several private houses, small farms and heritage buildings to JSS1 and transmission line (approximately 8.8km)
Jemalong Weir Picnic Area – moderate number of people engaged in recreation activities	Medium duration views looking west from public recreation area approximately 10.7km from transmission line and 12.2km from JSS1
Jemalong Polo Club – small number of people engaged in sport and recreation	Short to medium duration views from private facility (on involved property) looking west to transmission line (approximately 900m) and south west to JSS1 (approximately 3.7km)
Jemalong Ridge – few if any people walking or working	Elevated views of unknown duration looking west to JSS1 and transmission line (approximately 10km). No public access or residences were identified in this study.
Wilbertroy State Forest – few if any people	Views of short duration looking north. Closest point of JSS1 is approximately 3.5km
Local roads – small number of residents and workers on transport routes	Views of short duration. Local roads closest to JSS1/transmission line are Whispering Pines Lane, Driftway Road, Constables Road, Willawang Road, Murphys Road, Hodges Road, Waree Lane, Dowra Lane and North Condobolin Road
Rural residences – small number of residents	Medium to long duration views by residents in and around houses. Closest houses are in Whispering Pines Lane.
Paddocks – small number of workers	Short duration views from paddocks and other farm facilities

5.3 Reflectivity

A report titled 'Ocular Hazards from Glint and Glare' has been prepared by senior engineer Nick Bartos from Vast Solar and covers glint and glare hazards for the proposed development. This topic is also covered in the Environmental Impact Assessment for the proposed development where a copy of the report is included. In summary:

- The report examines ocular hazard from glint and glare and not whether glint and glare will be of nuisance value to viewers.
- Ocular hazard from glint and glare is considered to occur where there is potential for after-image or permanent eye damage.
- Eye hazard from a single heliostat would be a risk for viewers to the north of JSS1 who are less than 900m from the heliostat in cases where there is no vegetation or other structures to screen the glare.
- There could be eye hazard from glint and glare from multiple heliostats for viewers to the north of the site but these views are well shielded by vegetation around the lagoon, there is only a small chance that multiple heliostats will direct glare to a particular viewpoint at the one time and the effects can be mitigated using operational measures.
- Single or multiple receivers on the receiving towers do not pose eye hazard at any distance.
- Aircraft pilots would probably only see glare from one heliostat at a time which would not be a hazard since they would be more than 900m away. If they were to experience combined glare from a number of heliostats there would be a significant hazard. If this proves to be a problem, there are operational measures that could be explored to minimise the potential for glare from clusters of heliostats by adjusting the alignment of individual heliostats.

Based on advice from Vast Solar, the visual impact assessment assumes that the zone where non-hazardous glare from the receiving towers could be experienced by viewers is up to 45 degrees from due south of the receivers (that is, from SE around in a clockwise sweep to SW). This zone does not include any of the viewpoints considered in this visual impact assessment or any other publicly available viewing locations close to JSS1. Consequently, the visual impact of glare from the receiving towers is considered to be not significant.

The visual impacts of glare from the heliostats are considered below for individual viewpoints where relevant.

5.4 General visual effects

Many elements of the proposed development will not be seen except by visitors to the site and workers in paddocks near JSS1. Because of their relatively low height and the screening vegetation near the JSS1 site, the following elements are considered to have a minimal visual effect:

- security fence
- internal and external access tracks, carpark and materials laydown area
- evaporation ponds and flood levies
- field piping network
- control kiosks and temporary site construction offices
- heliostats (tracking mirrors)
- 66kV onsite transformer station and switchgear
- thermal storage tanks with associated pumps, valves and piping
- air cooled condenser
- steam generator and heat exchanger
- noise hood.

The visual effects of the receiving towers, heliostat glare and the transmission line are examined in detail below.

5.5 Visual impact from specific locations

Viewpoints in the study area were selected based on the list of viewing opportunities in Table 5.1. The viewpoint locations are identified on Map 6 in Appendix B. Details of the view, the visual effects of the proposed development, the significance of the effects and specific mitigation proposals are described below for each viewpoint.

V1 Lachlan Valley Way 1

Location	Lachlan Valley Way, approximately 12.3km north west of the Jemalong substation, looking south east
Reason for selection	Represents views for travellers from this major road in the background zone to the west of the proposal
Distance to proposal	14.8km
Visual effects of proposal	Given the long distance to the proposal and the presence of multiple bands of trees in the foreground and middle ground providing screening, the scale of the effect is expected to be insignificant with only a tiny proportion of the view (if any) occupied by the development.
Susceptibility of viewers to change	Travellers on this road are expected to be moderately susceptible to change in the view because probably only part of their attention will be focussed on this view that is part of a rapidly changing sequence. The view takes in the Farmland LCU, which is valued by the community as a productive landscape.
Visual impact significance	Not significant (minimal visual effects due to distance to proposal)
Mitigation opportunities	Not required



V2 Murphys Road

Location	Intersection of Murphys Road and Warroo Road looking east
Reason for selection	Represents views from Murphys Road for travellers, residents and farm workers
Distance to proposal	7.0km
Visual effects of proposal	The proposed development is unlikely to be visible because of the screening effects of the vegetation and the distance to the proposed development.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents with longer duration views are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen from this viewpoint)
Mitigation opportunities	Not required



V3 Warroo Rd

Location	Warroo Road, approximately 4km south of Murphys Road looking north east
Reason for selection	Represents views from Warroo Road for travellers, residents and farm workers
Distance to proposal	7.5km
Visual effects of proposal	The proposed development is unlikely to be visible because of the screening effects of the vegetation and the distance to the proposed development.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V4 Willawang Road 1

Location	Willawang Road, approximately 1.9km south of intersection with Driftway looking south east
Reason for selection	Represents views from the northern end of Willawang Road for travellers and for residents from the nearby house
Distance to proposal	3.8km
Visual effects of proposal	The top few metres of the backs of the thermal receivers (on top of the receiving towers) may be visible above the tops of the trees around the lagoon. These will appear light grey and the galvanised steel elements may reflect sunlight occasionally until the galvanised surface dulls (typically approximately one year). Scattered paddock trees will screen views to the towers in some parts of the view. The contrast introduced will be relatively small because the colour of the towers will blend with the colour of the trees and the proportion of the view occupied by the development is small relative to the area of sky and paddocks because of the distance to the development. The house near this viewpoint faces north and south so the main views from the residence are unlikely to include the proposed development. This viewpoint is on the edge of the area from where glare from heliostats might be seen occasionally but the sightlines to the proposed heliostats appear well screened by vegetation.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects are relatively small, generally not seen by highly susceptible viewers, heliostat glare is unlikely and mitigation opportunities exist if required).
Mitigation opportunities	Adjust the focal direction of heliostats in standby mode if heliostat glare is identified through complaints. Install screen planting or shade material on security fence in targeted locations around JSS1 if heliostat glare cannot be mitigated by adjusting focal direction of heliostats.



V5 Willawang Road 2

Location	Willawang Road, approximately 4.5km south of intersection with Driftway looking east
Reason for selection	Represents views from Willawang Road for travellers, workers and residents in the nearby house
Distance to proposal	3.5km
Visual effects of proposal	Views to the proposed development will be screened by the existing mature trees located between 750m and 1.2km from the viewpoint. JSS1 is not expected to be visible from this viewpoint. In addition, the house appears to be oriented with the main views facing north and south, which is away from the proposed development. The large sheds to the east of the house will also screen views from outside the house looking towards the proposed development.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V6 Willawang Rd 3

Location	Willawang Road, approximately 5.5km south of intersection with Driftway, at entrance to Willawang Station
Reason for selection	This is the closest publicly accessible viewpoint to the south west of the proposed development. There are also several houses nearby.
Distance to proposal	3.7km
Visual effects of proposal	There are scattered trees and bands of trees that will screen parts of the view to the proposed development. The top few metres of the thermal receivers may be visible above the tops of the trees seen across the horizon. These will appear light grey and the galvanised steel elements may reflect sunlight occasionally until the galvanised surface dulls (typically approximately one year). Scattered paddock trees will screen views to the towers in some parts of the view. The contrast introduced will be relatively small because the colour of the towers will blend with the colour of the trees and the proportion of the view occupied by the development is small relative to the area of sky and paddocks because of the distance to the development.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects will be relatively small in scale and generally not seen by highly susceptible viewers)
Mitigation opportunities	Not required



V7 Driftway 1

Location	Driftway, approximately 2.2km west of intersection with Lachlan Valley Way looking south east
Reason for selection	Local public road relatively close to the proposed development
Distance to proposal	3.5km
Visual effects of proposal	The proposed development is expected to be almost entirely hidden by vegetation. There may be occasional glimpses of the backs of the receiving towers above the trees along the lagoon (in the background of the photo). Any visible parts of the tower will be appear small in scale because of the distance to the proposal and their colour will blend with the vegetation.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen or will be relatively small in scale and viewed for short durations)
Mitigation opportunities	Not required



V8 House - Driftway

Location	House off Driftway, approximately 0.9km west of intersection with Lachlan Valley Way looking south
Reason for selection	Residence that is relatively close to north side of JSS1
Distance to proposal	3.1km
Visual effects of proposal	The house is set in a mature garden that screens most views to the surrounding areas. The house is oriented with the main views looking away from JSS1. The vegetation around the house, along the nearby creek and along the lagoon is expected to screen views to JSS to a large extent and any glimpses of the tops of the receiving towers will be small in scale.
Susceptibility of viewers to change	Residents are likely to be highly susceptible to changes but views in the direction of the proposal are likely to be short in duration. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V9 Lachlan Valley Way 2

Location	Lachlan Valley Way, approximately 2.1 km north west of substation looking south
Reason for selection	View from main road north of proposal and adjacent to woodland that appears to be an extension of the Lachlan River vegetation type
Distance to proposal	3.7km
Visual effects of proposal	JSS1 is expected to be barely visible from this viewpoint because of the distance to the proposal and the screening effects of mature trees along the nearby creek and the lagoon. The top third of the receiving towers may be visible above the tree tops along the lagoon where there are gaps in the closer vegetation. The view is perpendicular to the direction of travel and will be seen fleetingly. The woodland to the north is likely to have a distracting effect since it is relatively unusual in the sequence of views along Lachlan Valley Way.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V10 Hodges Rd

Location	Hodges Road, approximately 0.3km north east of intersection with Lachlan Valley Way, on northern side of Lachlan River looking south
Reason for selection	Represents closest views from north of the Lachlan River
Distance to proposal	3.4km
Visual effects of proposal	The river is lined with mature eucalypts on along both banks that screen views to south from the flat plain north of the river. JSS1 is unlikely to be visible because of screening of views to the south by vegetation.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Lachlan River landscape has high local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V11 House - Lachlan Valley Way

Location	Beside house on south side of Lachlan Valley Way, approximately 0.8km north west of substation, looking south
Reason for selection	Near several houses that are relatively close to the northern side of JSS1
Distance to proposal	3.0km
Visual effects of proposal	Residences are surrounded by mature vegetation that filters views to the wider area so the proposal is unlikely to be seen from the houses. The mature vegetation along the lagoon will screen the bottom two thirds of the receiving towers. The top third of the towers is likely to be visible above the trees on the skyline across part of longer views. The scale of the effect will be relatively small because of the distance to the proposal and the blending of the colour of the towers with the colour of the vegetation. The fleeting view is perpendicular to the direction of travel on Lachlan Valley Way.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be highly susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen to be seen from the houses and are small in magnitude for travellers)
Mitigation opportunities	Not required



V12 House 1 - Whispering Pines Lane

Location	House off Whispering Pines Lane, approximately 1.7km south of substation looking south to JSS1 and east to transmission line
Reason for selection	Closest non-involved house to JSS1
Distance to proposal	1.7km to JSS1, 1km to transmission line
Visual effects of proposal	Views looking east from outside the south side of the house are filtered by mature trees (refer to Figure C.5 in Appendix C). The proposed transmission line would run across the view behind the trees with taller poles than the existing transmission line. The photomontage in Figure C.6 (Appendix C) shows the visual effect of the proposed transmission line, which occupies a relatively small proportion of the view. Views looking south from the house towards JSS1 are screened by the landowner's shed. The tops of the receiving towers would be visible above the tops of the trees along the lagoon in views from the driveway. Figures C.7 and C.8 show the magnitude of the visual effect, which is broad but relatively low in height. The colour of the receiving towers is expected to blend with the vegetation although initially there may be some glint until the surfaces dull. There could also be occasional glare from heliostats seen from parts of the property closer to JSS1 through gaps in the trees.
Susceptibility of viewers to change	During consultation the resident expressed little concern about the proposed changes. Landscape has moderate local value to community.
Visual impact significance	Significant (visual effects of JSS1 extend across the breadth of the view but are relatively small in height, viable mitigation opportunities are available and landowner is unconcerned)
Mitigation opportunities	Offer option of screen planting south of house area. Adjust the focal direction of heliostats in standby mode if heliostat glare is identified through complaints. Install screen planting or shade material on security fence in targeted locations around JSS1 if heliostat glare cannot be mitigated by adjusting the focal direction of the heliostats.



View looking east to transmission line location View looking south to JSS1 location
Refer also to photomontages in Appendix C.

V13 House 2 - Whispering Pines Lane

Location	House off Whispering Pines Lane, approximately 0.9km south of substation looking east to transmission line and south west to JSS1
Reason for selection	Non-involved house close to JSS1 and transmission line
Distance to proposal	2.1km to JSS1 and 200m to transmission line
Visual effects of proposal	Views looking east are partly screened by mature trees in the foreground (Figure C.1 in Appendix C). An existing transmission line is clearly visible in front of the trees. The proposed transmission line would run behind the trees and have taller poles. The expected visual effect is shown in the photomontage in Figure C.2 with the transmission wires and poles introducing contrasting elements. The extent of visual impact of the poles from this viewpoint will depend primarily on the location of the poles. Views looking south west to JSS1 from the house area are partly screened by an immature shelterbelt (Figure C.3). There are also many other trees between the viewer and the JSS1 site. The tops of the receiving towers are expected to be visible above the tops of the trees along the lagoon in some places but the magnitude of the effect is relatively small (refer to photomontage in Figure C.4).
Susceptibility of viewers to change	Residents are highly susceptible to changes in the view. Consultation with the residents has resulted in the transmission line route being moved further east (away from the house) to reduce the visual impact. Landscape has moderate local value to community.
Visual impact significance	Significant (visual effects of the transmission line will contrast with existing elements and be viewed for extended lengths of time from the house and garden, visual effects of JSS1 will be not significant because of the small proportion of view occupied by the development)
Mitigation opportunities	It is recommended that the placement of transmission line poles be carefully considered to minimise the visual effect of the transmission line. Poles placed either side of the view or hidden behind tall trees would have less visual impact.



View looking north east
Refer also to photomontages in Appendix C.



View looking south west to JSS1 location

V14 North Condobolin Road West

Location	Intersection of North Condobolin Road with Hodges Road looking south west
Reason for selection	Relatively busy local road north of Lachlan River
Distance to proposal	5.0km
Visual effects of proposal	View towards proposal is heavily screened by vegetation along the river and Lachlan Valley Way. Proposal is unlikely to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V15 Substation

Location	At West Jemalong Substation beside Lachlan Valley Way, approximately 26km west of intersection with Newell Highway
Reason for selection	Location on Lachlan Valley Way closest to proposed transmission line
Distance to proposal	3.0km to JSS1, 80m to transmission line
Visual effects of proposal	The existing substation is clearly visible from Lachlan Valley Way and Whispering Pines Lane. Its visual character contrasts unfavourably with the surrounding landscape. As well as the substation equipment, many transmission lines of various types are already present. It is likely that at this viewpoint an additional transmission line connecting to the south side of the substation will go relatively unnoticed since it is similar in visual character to existing transmission lines. The tops of the JSS1 receiving towers may be visible above the tops of the trees along the lagoon but at this distance the effect will occupy a small proportion of the view and be observed only fleetingly.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view. Views from substation area are likely to have low value to community since the substation is an industrial type structure strongly contrasting with the surrounding farmland and not generally admired.
Visual impact significance	Not significant (visual effects unlikely to be noticed)
Mitigation opportunities	Not required



V16 Jemalong Polo Club

Location	Jemalong Station, Lachlan Valley Way, approximately 0.6km east of substation looking west to transmission line and south west to JSS1
Reason for selection	Recreation facility privately owned by involved landowner but also visited by many people for polo games
Distance to proposal	800m to transmission line, 3.7km to JSS1
Visual effects of proposal	The facility has mature tree planting around the perimeter providing an effective screen for longer views. The tops of the receiving towers are unlikely to be noticed from the clubhouse because the effect is relatively small in scale and views are partly screened by the perimeter planting. The proposed transmission line is also unlikely to be noticed because of screening by trees. Other transmission lines are already present so the proposed transmission line introduces visual effects that match effects already seen in the vicinity.
Susceptibility of viewers to change	Visitors to the facility are likely to be highly susceptible to changes in the view since they are engaged in outdoor recreation and social activities related to the landscape setting. Most viewers will be family, workers or guests of the involved landowner.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V17 Bedgerabong West

Location	North Condoblin Road, approximately 1.2km east of intersection with Hodges Road looking south west
Reason for selection	More heavily populated area north of the river
Distance to proposal	5.2km
Visual effects of proposal	Residences surrounded by mature vegetation are scattered throughout this locality. The backdrop of the mature trees along the river screens views to the proposal.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate to high local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V18 Noakes Road

Location	Noakes Road, approximately 4.4km north of intersection with North Condobolin Road looking south west
Reason for selection	Representative of views further north in study area
Distance to proposal	10.8km
Visual effects of proposal	Mature trees along the roadsides, shelterbelts in paddocks and the trees along the Lachlan River screen views to the proposal which is not expected to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V19 Bedgerabong East

Location	Intersection of North Condobolin Road and Noakes Road looking south west
Reason for selection	Representative view for Bedgerabong
Distance to proposal	7.2km
Visual effects of proposal	Views towards JSS1 are well screened by mature trees along roads, around houses and along the Lachlan River so the proposal is not expected to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V20 Waree Lane

Location	Waree Lane, approximately 0.2km north of intersection with Lachlan Valley Way looking west
Reason for selection	Representative viewpoint for Lachlan Valley Way and residences east of JSS1
Distance to proposal	6.9km
Visual effects of proposal	Trees along the roadsides and shelterbelts in paddocks screen views to JSS1. At this distance and with the presence of screening vegetation, JSS1 is not expected to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V21 Dowra Lane North

Location	Dowra lane, approximately 2.2km south of intersection with Lachlan Valley Way looking west
Reason for selection	Representative of views from residences and closest public road to the east of JSS1
Distance to proposal	6.1km
Visual effects of proposal	Houses in this vicinity are well screened by mature vegetation and a series of shelterbelts running north-south. JSS1 is not expected to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V22 Dowra Lane South

Location	Dowra Lane, approximately 3.0km south of intersection with Lachlan Valley Way looking north west
Reason for selection	Representative of views from houses and road further south on Dowra Lane
Distance to proposal	6.2km
Visual effects of proposal	The views to JSS1 in this area are well screened by roadside vegetation and tree lines in paddocks. JSS1 is not expected to be seen at this distance.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V23 Specks Lane

Location	Intersection of Specks Lane and Lachlan Valley Way looking west
Reason for selection	Representative of views from houses along Specks Lane
Distance to proposal	9.2km
Visual effects of proposal	Extensive blocks of mature trees, roadside vegetation and tree lines in paddocks screen views towards JSS1 so the proposed development is not expected to be visible.
Susceptibility of viewers to change	Travellers on the road and farm workers are likely to be moderately susceptible to changes in the view; residents are likely to be more susceptible to changes. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V24 North Condobolin Road East

Location	North Condobolin Road, approximately 8.4km east of intersection with Noakes Road looking south west
Reason for selection	Recreational and tourist spot on Lachlan River used for informal camping
Distance to proposal	11.5km
Visual effects of proposal	Area is relatively low lying and set under a canopy of mature trees that enclose the views. JSS1 is unlikely to be visible due to distance and the screening effect of the trees along the river and Lachlan Valley Way.
Susceptibility of viewers to change	Travellers on the road are likely to be moderately susceptible to changes in the view; people camping are likely to be more susceptible to changes to views. Landscape along the river has high local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not needed



V25 Jemalong Weir

Location	Lachlan Valley Way, approximately 1.9km east of Waree Lane looking west
Reason for selection	Recreation area with formal picnic facilities
Distance to proposal	11.0km
Visual effects of proposal	The picnic area is set relatively low in landscape and is enclosed by trees around the perimeter. Additional screening of views to JSS1 is provided by trees along the river, roadsides and in paddocks. At this distance and with the vegetation screening, JSS1 is not expected to be visible.
Susceptibility of viewers to change	Visitors engaged in outdoor recreation in the picnic area are likely to be highly susceptible to visual change. Lachlan River landscape has high local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



V26 Newell Highway

Location	Newell Highway, approximately 28km south west of intersection with Lachlan Valley Way looking north west
Reason for selection	Representative of views from Newell Highway
Distance to proposal	14.8km
Visual effects of proposal	Mature trees approximately 2km from the viewpoint provide screening of long views across the farmlands. Most views to Jemalong from the highway are hidden by Jemalong Ridge. At this distance and with the screening effects of the trees, JSS1 is not expected to be seen from the highway.
Susceptibility of viewers to change	Travellers on the road are likely to be moderately susceptible to changes in the view. Landscape has moderate local value to community.
Visual impact significance	Not significant (visual effects unlikely to be seen)
Mitigation opportunities	Not required



5.6 Cumulative impacts

Cumulative visual impacts are assessed by reviewing the visual integrity and form of other built structures within the visual catchment of the proposed solar plant and transmission lines. Structures with similar scale and dominance are identified as having a level of visual impact that together with the proposed infrastructure will have a cumulative visual effect.

For this project the transmission line has the greatest potential for cumulative impact since there are other transmission lines in the vicinity including one running along a similar route. The proposed transmission line is relatively short in length and follows a route where it is unlikely to be noticed by the public. The cumulative effects are minor and not significant.

JSS1 is an unusual structure in the landscape, has novelty value and is relatively discrete thanks to screening by existing vegetation throughout the landscape. Cumulative impacts at this stage do not appear to be relevant.

5.7 Summary of significant visual impacts

The visual impact on several viewpoints is significant. Table 5.2 summarises the specific findings for these viewpoints.

Table 5.2 Summary of significant visual impacts

Viewpoint	Description of visual impact
V4 Willawang Road 1	Possible glare from individual heliostats on occasions
V12 House 1 – Whispering Pines Lane	Possible glare from individual heliostats when viewed from southern parts of property through any gaps in the vegetation Tops of receiving towers will be visible above the treetops across the breadth of views to the south
V13 House 2 - Whispering Pines Lane	Location of transmission line pole in centre of view looking east would increase size of negative effect for susceptible residents

6 Visual impact mitigation

The following measures are proposed to reduce and manage the impacts on visual amenity by the proposed solar farm.

Table 6.1 Effectiveness of mitigation and management measures

Measure	Feasible	Effective	Reliability
Stagger the focal direction of heliostats in standby mode (not to target) to minimise potential for glare from a cluster of heliostats if such glare is identified through complaints	Yes	Effective in installations overseas	Good
Consult with neighbouring properties to west, north and east of JSS1 in relation to potential glare from heliostats when not on target and adjust the focal direction of heliostats in standby mode if such glare is identified through complaints	Yes	Within 1-2 years	Good
Additional screen planting in targeted boundary areas of JSS1 if heliostat glare experienced on neighbouring properties cannot be mitigated by adjusting focal direction of heliostats	Yes	Within 3-5 years	Good
Install shade material on security fence in targeted locations if heliostat glare experienced on neighbouring properties that cannot be mitigated by adjusting focal direction of heliostats	Yes	Immediately	Excellent
Screen planting south of house area at V12 House 1 – Whispering Pines Lane to screen views to receiving towers	Yes	Within 3-5 years	Good
Locate new transmission line poles to minimise impacts of views from House 2 in Whispering Pines Lane	Yes	Immediately	Excellent
Select colours for above ground structures, including the construction site offices, sympathetic to the landscape character of the site	Yes	Immediately	Excellent

7 Conclusion

Overall the visual impact of the proposed development is of low significance. This is a consequence of the relatively low height of the proposed design, the presence of screening vegetation throughout the study area, the relatively low population density and the distance of publicly available views from the JSS1 site.

There are some locations close to the site where there could be significant impacts for residents. These are listed in Table 5.2. All have options for measures that would reduce the severity of the visual impact. These are listed in Table 6.1. These measures have been used successfully for many projects. In some cases there are multiple measures suggested to reduce the same impacts and not all measures will be required. There are not expected to be any significant residual visual impacts if these measures are implemented.

8 References

- Edge Land Planning (2008) *Forbes Shire Growth Management Strategy Draft Rural Lands Supplement*. Online http://www.forbes.nsw.gov.au/f.ashx/docs/3247-Forbes_Growth_Mangt_Strategy_Rural_Lands_Supplement_November_2008_Exhibition_Document.pdf
- Edge Land Planning (2009) *Forbes Shire Growth Management Strategy*. Available online www.forbes.nsw.gov.au/f.ashx/docs/Previous/011-forbes-growth-mangt-strategy-final-february-2009.pdf
- Forbes Shire Council (2013a) *Forbes Local Environment Plan 2013*. Online <http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+428+2013+cd+0+N>
- Forbes Shire Council (2013b) *Forbes Development Control Plan 2013*. Version 2. Online <http://www.forbes.nsw.gov.au/f.ashx/docs/Management-Plans/Development-Control-Plan-2013V2.pdf>
- Forbes Shire Council (online 1) *40 Things To Do In Forbes* <http://www.forbes.nsw.gov.au/visitors/things-to-do.aspx>
- Forbes Shire Council (online 2) *Find it in Forbes* http://www.forbes.nsw.gov.au/f.ashx/docs/Find_it_in_Forbes_update_2013.pdf
- LI & IEMA (2013) *The Landscape Institute with the Institute of Environmental Management and Assessment, Guidelines for Landscape and Visual Impact Assessment*. 3rd edition. Spon Press, London.
- Tudor, C. (2014) *An approach the Landscape Character Assessment*. Available online www.gov.uk/natural-england.
- WPAC (2007) *Visual Landscape Planning in Western Australia: a Manual for Evaluation, Assessment, Siting and Design*. Environment and Sustainability Directorate, Department for Planning and Infrastructure and Western Australian Planning Commission, Perth WA.

Appendix A: Visual landscape quality indicators

The following frames of reference for visual quality are derived from the WAPC visual landscape character preference indicators (WAPC 2007 Appendix 7).

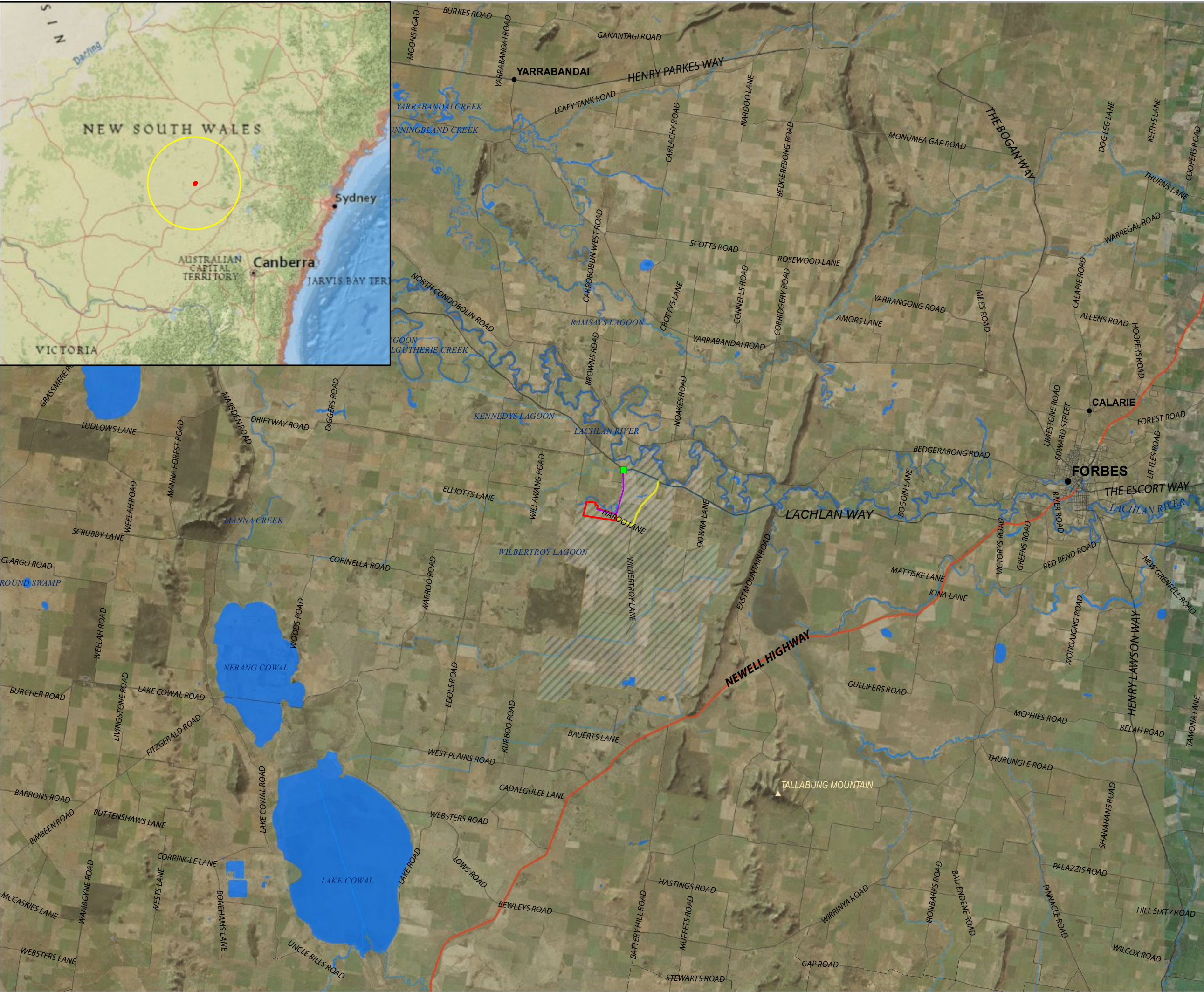
Natural areas

Quality indicator	Most preferred	Least preferred
Perceived naturalness	High degree of perceived naturalness	Disturbed areas with little evidence of naturalness
Topography	Dramatic topography, ruggedness, rock outcropping, outstanding ridgelines and beach forms	Areas of soil erosion (especially human-induced)
Vegetation	Distinctive vegetation patterns, diverse species composition, height, colour, texture, age and density	Areas of diseased, dead or dying vegetation, severe weed infestations
Water bodies	Water bodies present (waterfalls, rivers, estuaries, oceans, lakes, inundated areas)	Water bodies with degraded banks, weed infestations, stagnation, eutrophication, algae or litter
Colour	Distinctive displays of colour in soils, seasonal vegetation, topography, rock formations or water bodies	Evidence of mining (gravel pits, sand mines)
Dramatic landforms	Unusually expansive landforms or vast horizontal scale (desert landscapes, beach and dune fields, rolling hills), distinctive landscape features (reefs, geological formations, ranges, cliff faces, rocky outcrops)	
Distinctive vegetation	Unique plants or plant combinations	
Seascapes	Combinations of ocean, reefs, beach, dunes, coastal rocks and coastal vegetation	
Outstanding combinations	Outstanding combination of landform, vegetation patterns and water features in one place	
Ephemeral features	Areas frequently prone to ephemeral events (fauna, water or wave conditions, climatic events)	

Rural landscapes

Quality indicator	Most preferred	Least preferred
Natural areas	Distinctive remnant vegetation along streams, roads and paddocks (parkland cleared paddocks), gradual transition zones between agricultural land and natural landscape	
Topography	Topographic variety and ruggedness	Areas of soil erosion (especially human-induced) or dryland salinity
Vegetation	Agricultural patterns, colours and textures that complement natural features	Areas of diseased, dead or dying vegetation, severe weed infestations
Water bodies	Water bodies present (dams, lakes, inundated areas) that borrow location, shape, scale and edge configuration from natural elements	Water bodies with degraded banks, weed infestations, stagnation, eutrophication, algae or litter
Structures and land use	Settlement patterns and individual structures that strengthen the local rural character (silos, windmills, water tanks, historic buildings, bridges, hay stacks and dams)	Evidence of mining (gravel pits, sand mines), plantations, utility towers, roads, fencing, tips, dumps and landfill areas, structures in state of disrepair, unmanaged roads and access tracks, jetties that are closed or not maintained
Outstanding combinations	Significant landscape features (trees and tree groups, historic relics, old shearing sheds, some windmills and areas of unusual topographic variation)	
Ephemeral features	Areas frequently prone to ephemeral events (fauna, distinctive crop rotations, water and climatic conditions)	

Appendix B: Maps



1. SITE LOCATION MAP

Jemalong Solar Station 1
Visual Impact Assessment

- Town
- Village
- Substation
- Proposed 66kV overhead transmission line
- Proposal site
- ▲ Topographic features
- Proposed access
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- ▨ Involved property excluded from VIA

- Relevant VIA data may be restricted to (16km) background extent
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 1 2 4 Kilometres
A3 @ 1:250000
Author: SP
Ref: SW010_VIA_20150602



2. SITE LAYOUT INCLUDING
THE PROPOSED
TRANSMISSION LINE

Jemalong Solar Station 1
Visual Impact Assessment

- Power island, evaporation ponds, water treatment plant, control/admin buildings, carpark, hardstandings
- Solar arrays
- △ Places of interest
- Substation
- Proposed 66kV overhead transmission line
- Proposal site
- Proposed access
- ▲ Topographic features
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- Jemalong station (involved properties)

- Relevant VIA data may be restricted to (16km) background extent
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 100 200 400 Metres

A3 @ 1:18000
Author: SP
Ref: SW010_VIA_20150602



3. STUDY AREA AND PLACES OF INTEREST

Jemalong Solar Station 1
Visual Impact Assessment

- △ Places of interest
- Substation
- Proposed 66kV overhead transmission line
- Proposal site
- Study area
- ▲ Topographic features
- Proposed access
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- ▨ Jemalong station (involved properties)
- Wilbertroy State Forest

- Relevant VIA data may be restricted to (16km) background extent
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 1 2 4 Kilometres

A3 @ 1:130000
Author: SP
Ref: SW010_VIA_20150602



4. TYPES AND LOCATIONS OF VIEWS

Jemalong Solar Station 1
Visual Impact Assessment

- Farm building
- △ Places of interest
- Substation
- Proposed 66kV overhead transmission line
- Proposal site
- Mid ground (5.5km)
- Foreground (500m)
- ▲ Topographic features
- Proposed access
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- ▨ Involved property excluded from VIA
- Study area (16km)
- View shadow (poles and receiving towers hidden by topography)

- Relevant VIA data may be restricted to (16km) background extent
- Viewshed based on 25m pixels
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 1 2 4 Kilometres

A3 @ 1:130000
Author: SP
Ref: SW010_VIA_20150602



5. LANDSCAPE CHARACTER UNITS

Jemalong Solar Station 1
Visual Impact Assessment

- △ Places of interest
- Substation
- Proposed 66kV overhead transmission line
- Proposal site
- Study area (16km)
- Mid ground (5.5km)
- Foreground (500m)
- ▲ Topographic features
- Proposed access
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- Wilbertroy State Forest
- Landscape Character Unit (LCU)
- Bedgerabong
- Farmland
- Jemalong Ridge
- Lachlan River corridor
- Lachlan Valley Way corridor
- State Forest

- Relevant VIA data may be restricted to (16km) background extent
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 0.5 1 2 Kilometres

A3 @ 1:130000
Author: SP
Ref: SW010_VIA_20150602



6. VIEWPOINTS

Jemalong Solar Station 1
Visual Impact Assessment

- Viewpoint
- Photomontages
 - Viewpoint 12, looking E and SSW to the site
 - Viewpoint 13, looking E and SW along the proposed transmission line
- △ Places of interest
- Proposed 66kV overhead transmission line
- Proposal site
- Study area (16km)
- Topographic features
- Proposed access
- Highway
- Major road
- Local road
- Major drainage line
- Minor drainage line
- Waterbody
- ▨ Jemalong station (involved properties)

- Relevant VIA data may be restricted to (16km) background extent
- Viewshed based on 25m pixels
- VIA data from Fresh Landscape Design
- Infrastructure provided by Vast Solar and may be subject to change
- Topographic data from NSW LPI current from 25.09.2014
- Base map © Esri and its data suppliers.

The accuracy and integrity of the information displayed in this map are not guaranteed by SW environmental, nor does SW environmental bear responsibility/liability for any errors, omissions or map uses.

0 1 2 4 Kilometres

A3 @1:130000
Author: SP
Ref: SW010_VIA_20150602

