Appendix H: Visual impact assessment

ACCENT ENVIRONMENTAL

ESCO Pacific

Wyalong Solar Farm: Visual Impact Assessment

November 2018

Wyalong Solar Farm

Visual Impact Assessment

AE1091.0_D3
November 2018

Version 2 *– 14 November 2018*	
Issued to	
Allison Hawke, Head of Development, ESCO Pacific Cédric Bergé, Development Manager , ESCO Pacific	
Prepared by	**Approved by**
Michael Cramer (Accent Environmental)	 Michael Cramer (Director)
Reviewed by	
Fatma Ipek (Senior Environmental Scientist)	
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Contents

Figures

Tables

Photos

Abbreviations

AC	alternating current
AHD	Australian Height Datum
DC	direct current
DCP	DCP Development Control Plan
EIS	Environmental Impact Statement
ESCO Pacific	ESCO Pacific Pty Ltd
Ha	hectares
km	Kilometre
kV	kilovolt
LGA	Local Government Area
m	metres
MW	megawatts
PCU	Power Conversion Unit
RMS	NSW Roads and Maritime Services
SEARs	Standard Secretary's Environmental Assessment Requirements
VIA	Visual Impact Assessment

1 Introduction

1.1 Context

Accent Environmental Pty Ltd (Accent) has been commissioned by ESCO Pacific Pty Ltd (ESCO Pacific) to undertake a Visual Impact Assessment for a proposed 256 ha solar farm in the Riverina region of southwestern New South Wales (NSW).

The Secretary's Environmental Assessment Requirements (SEARs) for the project, provided by the NSW Department of Planning and Environment, stipulates that the following specific Environmental Impact Statement (EIS) requirements related to visual assessment be met:

> *'Visual - 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.'*

As part of the broader EIS for the project, a visual assessment of the proposed development must therefore be carried out to determine any likely visual impacts.

This visual impact assessment delivers an objective statement of the probable impacts on the visual environment resulting from the construction of the proposed development. The report outlines the results from site assessment, describing the present landscape character. It documents the assessment of visual impact resulting from the proposal and provides an indication for suitable management measures.

1.2 Study area

The proposed Wyalong Solar Farm project is a utility-scale renewable energy project located at Wyalong in New South Wales (NSW). The proposed 256 ha solar farm is located within the Bland Local Government Area (LGA) (Figure 1.1). Bland Shire is located in the Riverina region of southwestern New South Wales and is crossed by the Newell and Midwestern Highways and Goldfields Way. The nearest townships are located at West Wyalong, 7.5 km northeast of the site

The region's main land use is rural and consists predominantly of irrigated land, with primary income derived from agriculture. The nearest major road is the Newell Highway, located immediately north of the site. Rural blocks bound the east, west and south of the site. Four residences are located within 1 km of the development site.

The site is located within the property of a single landholder who is engaged in agricultural and grazing activities. The land comprises gently sloping open paddocks. Due to a long history of agriculture and grazing, the development site is highly modified.

The location of the solar farm was chosen because of the high solar irradiance in the region and the capacity of the Essential Energy electricity networks to transmit the power generated by the solar farm.

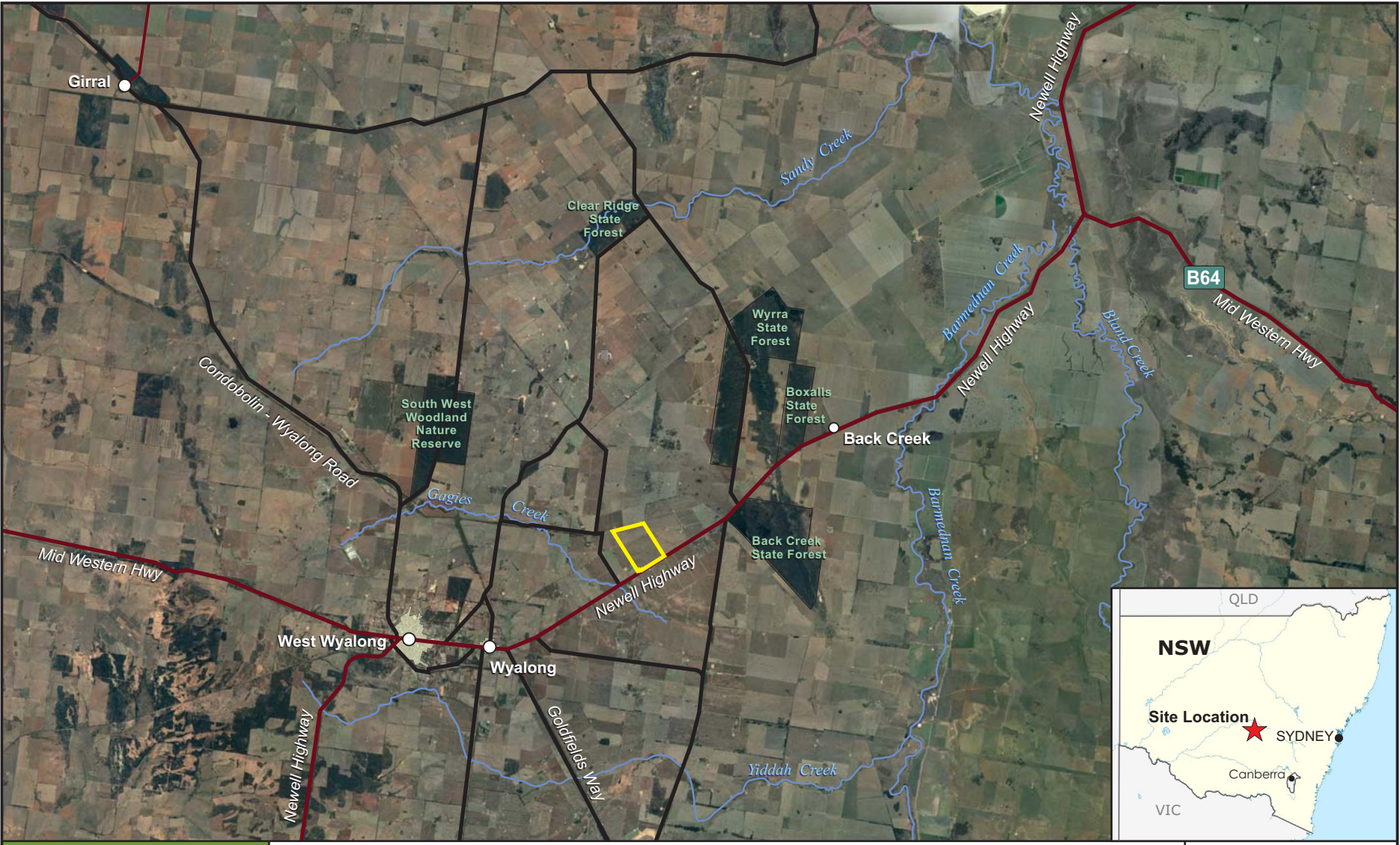

Figure 1.1

Regional Context
Wyalong Solar Farm

Client: Esco Pacific
Project No: AE1091.0

Legend
- Development Site
- Highway
- Main Road
- Watercourse

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1.3 Proposed development

1.3.1 Overview

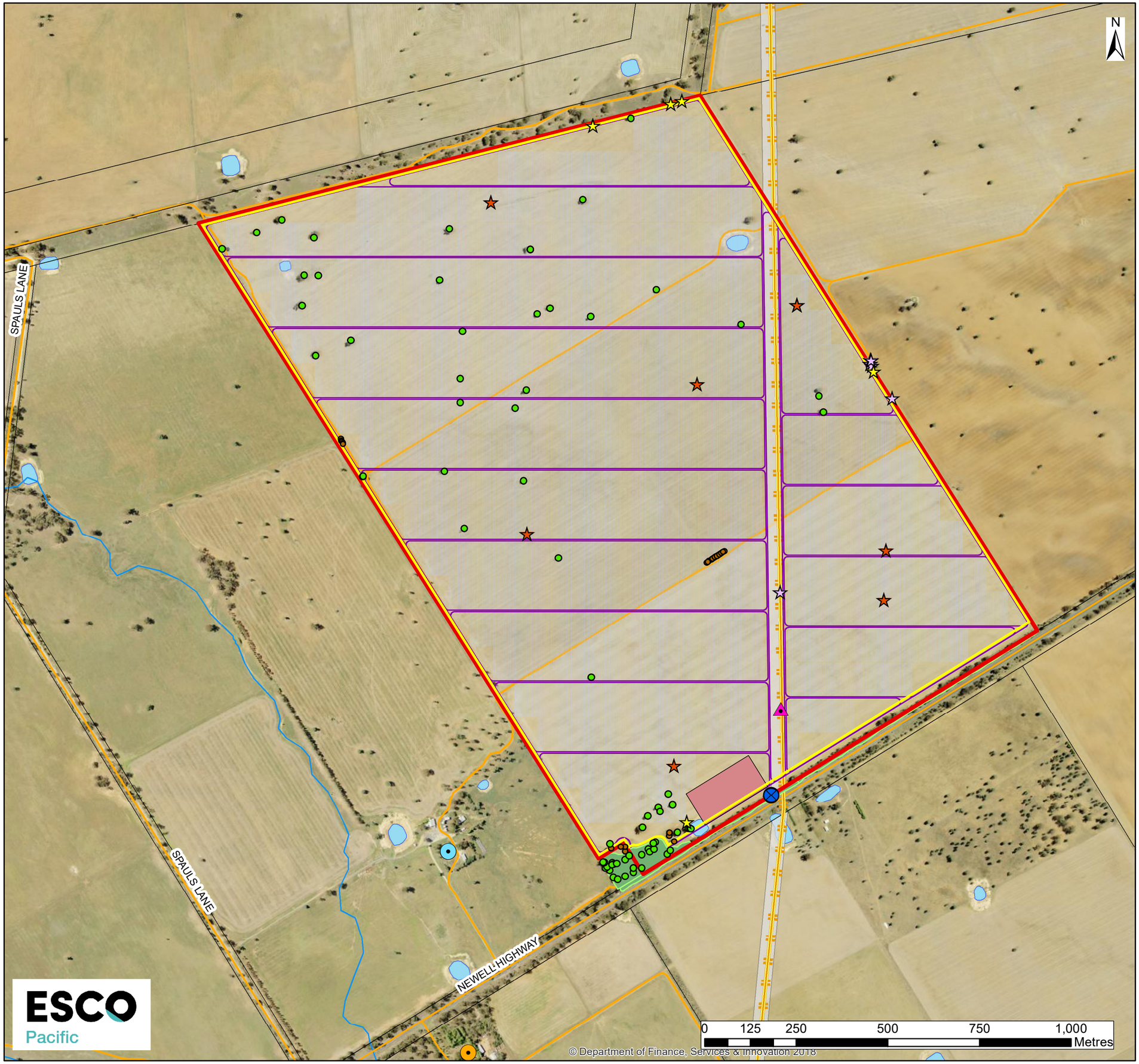
The proposal is a utility scale renewable energy project that would generate up to 130 MW of clean and renewable electricity. The solar farm would comprise up to approximately 350,000 solar photovoltaic modules, known more commonly as 'PV Modules' or 'solar panels'. The solar panels use the same type of technology used in residential solar installations, however are larger in size. General information about the project is provided in Table 1.1 and the project layout is shown in Figure 1.2.

Table 1.1. Project overview summary

Address	1409 Newell Highway, Wyalong, New South Wales, 2671
Applicant	ESCO Pacific Pty Ltd
Council	Bland Shire Council
Titles	Lot 160 on Plan DP750615
Total indicative area	256 ha (development site) 259 ha (Lot 160, including land within the development site)
Land use	Cropping, grazing – high level of ground disturbance
Capacity	Up to 130 MW (DC) or 100 MW (AC)
Connection	Essential Energy 132 / 66 kV Transmission line (Temora – Lake Cowal)

Key relevant visual elements and assumptions in of the proposed development include the following:

- Solar panels would be installed in regular arrays.
- Each solar panel would be fixed to a metal mounting structure, piled or screwed into the ground without the need for any concrete.
- The mounting structure would slowly and silently track (in a single axis) the horizontal movement of the sun.
- The solar panels would not exceed 4 m in height (attained early and late in the day when tilted at maximum angle towards the sun).
- Above-ground DC cabling will connect field combiner boxes approximately 1 m off the ground.
- Central inverters, step up transformers and switchgear would be located in 40 foot containers or container skid pads.
- A substation would be installed, located adjacent to the existing 132 kV transmission line.
- A Synchronous Condenser up to approximately 5 m high, 6 m long and 5 m wide may be installed within the proposed solar farm switchyard.
- Internal vehicle access tracks would be constructed from the entrance point of the site to each Power Conversion Unit (PCU) and to the solar substation to allow for maintenance of the site.
- Perimeter safety fencing would be installed around the site.
- A site office and maintenance building would be installed.
- Temporary infrastructure would be put in place during site construction including site compounds and storage areas.



ESCO Pacific

PROJECT
Wyalong Solar Farm

MAP TITLE
Figure 1.2 Project Layout

Title Info
Lot 160 on Plan 750615

LEGEND

Wyalong Solar Farm

- Lot Boundary (259 hectares)
- Development Site (256 hectares)
- Site Office, Maintenance Shed, Switchyard and Battery Storage
- Proposed Access Point
- Indicative Connection Point (along Transmission line)
- Internal Access Tracks
- PV Solar Array
- Sensitive Receivers associated with the project
- Sensitive Receivers

Ecological Value

- Native Vegetation
- Scattered Trees
- Non Indigenous Trees

Aboriginal Heritage

- Aboriginal Artefacts to be avoided
- Aboriginal Artefacts to be avoided or salvaged
- Aboriginal Artefacts to be salvaged

Hydrology

- Watercourses
- Dams

Others

- Cadastral Boundary
- Transmission Lines
- Essential Energy Easement
- Roads / Tracks

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- Battery storage to be installed on site (in shipping container-like buildings).
- The approximately eight-month construction process would involve the following civil works: limited grading, compaction, stormwater drainage and sediment controls and dust suppression.

Construction activities would be undertaken during standard hours for construction works. Any construction or commissioning activities outside of standard working hours would require approval from relevant authorities.

1.3.2 Solar panels

The solar panels and horizontal tracking systems would be mounted in rows that would be electrically connected into arrays before being inverted from DC to AC electricity via containerised PCUs. The electricity would then be fed, via an on-site, high voltage power reticulation system, into the local electricity network.

The solar farm will be comprised of approximately 350,000 solar panels, arranged in rows or solar arrays as per Photo 1.1. The exact configuration and number of arrays will be identified during the procurement phase. The height of the solar panels will vary as they follow the sun, however they will not exceed 4 m in height. These arrays will be positioned in a north-south alignment and tilt in an east to west movement to follow the path of the sun.

The individual solar panels will be fixed onto a metal mounting structure that will be secured to the ground via piling or fastening to footings.

Photo 1.1. PV Modules and Solar Array (Source: Array Technologies, courtesy of ESCO Pacific)

1.3.3 Power Conversion Units

Within each array block is a Power Conversion Unit (PCU) which contains the central inverters, step-up transformers and switchgear which convert DC electricity collected from the panels into AC electricity for connection and distribution via the Essential Energy 132 kV Transmission Line. The PCU (and associated equipment) is typically designed to be housed within a shipping container for easy transport and installation onsite. A PCU is typically 13 m long, 2.5 m wide, and 3 m high. Figure 1.3 shows a typical PCU

with the relevant power conversion equipment installed. Up to 26 PCUs will be installed on the development site.

Figure 1.3. Power Conversion Unit (PCU) (Source: SMA Solar Technology, courtesy of ESCO Pacific)

1.3.4 Step-up transformer, substation and synchronous condenser

A main step-up transformer and associated equipment in a solar substation would convert the on-site AC reticulated 33 kV electricity to 132 kV electricity. The 132 kV supply would then be connected via high voltage cable to the TransGrid 132 kV Transmission line where it would enter the local electricity network.

In the event that Essential Energy transmission network system strength remediation is required, a Synchronous Condenser may be installed within the Development Footprint (Figure 1.4). The Synchronous Condenser would be up to approximately 5 m high, 6 m long and 5 m wide (to be confirmed when grid studies are completed) and would be located within the proposed solar farm switchyard.

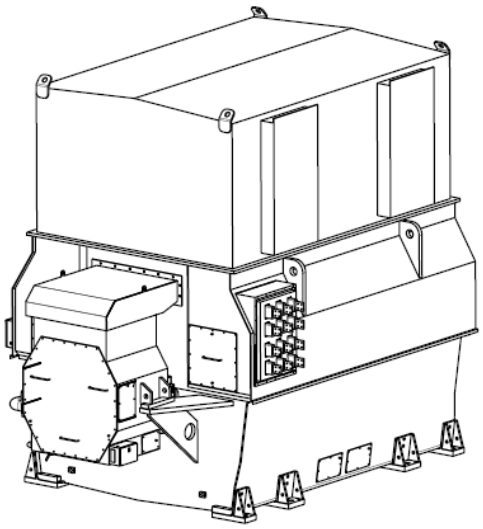

Figure 1.4. Indicative drawing of a Synchronous Condenser

1.3.5 Internal roads

Internal vehicle access tracks would be constructed to each PCU and to the solar substation to allow for site maintenance. Onsite tracks would be constructed of compacted gravel and, where required, geotextile fabric would be laid between the soil and the gravel. Internal access tracks would be up to 5 m wide to allow for the safe delivery, unloading and installation of key components such as the PCUs, PV panels, and switch equipment. The exact position of access tracks would be determined during the detailed design phase when the solar array design in finalised.

1.3.6 Site office

A site office and staff amenities building would be constructed or installed at the site. Its dimensions would be approximately 16 m long, 10 m wide, and 6 m high.

1.3.7 Maintenance building

A maintenance building would be established adjacent to the site office. The maintenance shed will be approximately 16 m long, 10 m wide, and 6 m high.

1.3.8 Site access and parking

Access to the site during construction and operation will be from a single access point located on the Newell Highway. Vehicles are expected to approach the site predominantly from the southwest, turning left from the highway into the site, but some may access the site from the northeast and turn right into the site.

During operations, operational and maintenance staff vehicles will be accommodated on-site within a vehicle parking area located adjacent to the site office. During construction, vehicles will be parked either at designated laydown areas, storage locations, or where construction activities are occurring

1.3.9 Site fencing

To ensure public safety, the solar farm would be fenced around the perimeter of the developable area. The security fence would be a height of 2.4 m and would feature CCTV security cameras mounted at regular intervals. The fence would typically be constructed of cyclone fencing material with a strand of barbed wire at the top to deter intruders.

1.3.10 External lighting

Lighting would be provided for security reasons and for staff and contractors utilising the site facilities during operations. External lighting at the project would be restricted to the area where the maintenance shed, permanent site office and switch yard would be located. All external lighting around buildings would be faced downwards.

1.3.11 Operation

The project is anticipated to operate for up to 40 years. Operational activities involve minimal number of personnel monitoring equipment on a daily basis, the full servicing of inverters and substation equipment on a quarterly basis, and cleaning of the solar panels at regular intervals.

At the end of its operational life, the solar farm would be decommissioned, and the site rehabilitated, with the aim of returning it to its pre-existing condition. All infrastructure would be removed, allowing the pre-existing agricultural land use activities to resume, or new land uses in the area to be established.

1.3.12 Planning context

The *Bland Shire Development Control Plan 2012* (DCP) (BSC 2012) informs development so that it ties in with that of the broader Bland Shire Council LGA. Development should take into consideration the objectives and controls within the DCP, in addition to more specific design parameters such as those relating to industrial development. Chapter 7 of the DCP 'Industrial development', outlines performance criteria and acceptable solutions for such development, including those listed in Table 1.2 which are relevant to visual amenity and landscaping.

Table 1.2. Bland Shire Development Control Plan – performance criteria and acceptable solutions

Performance criteria	Acceptable solutions	ESCO Pacific response
Building design		
Building design Buildings are designed to integrate with the streetscape and be compatible with their surroundings.	• Facades adopt a contemporary appearance relating to the function of the building.	• Building design will be consistent with acceptable solution.
Building height Building height is maintained at a scale appropriate to the location of the development.	• Building height generally does not exceed two storeys. • Building height does not adversely impact on the visual amenity of the locality.	• Building design will be consistent with acceptable solutions.
Building materials The form, colours, textures and materials of buildings should enhance the quality and character of the industrial precinct.	• External walls and roofing materials are to be of a non-reflective material, such as brick, concrete block, rendered concrete or masonry, metal or fibre cement cladding systems or pre-coloured metal sheeting. • All external building materials shall be of a neutral colour appropriate to the site. High contrast, white, bright and reflective surfaces are not acceptable.	• Building design will be consistent with acceptable solutions.
Landscaping		
Site planning Landscaping is considered as a component of the site planning process and reflects the scale of the development	• Landscaping plan is to be provided with Development Application.	• If landscaping was to be proposed, plan would be provided prior to construction, not at EIS stage.
Existing trees and shrubs Development is designed to maximise the number of trees retained onsite.	• Where there are existing trees onsite, the building design provides for their protection, where possible.	• ESCO Pacific has modified the development footprint to avoid trees in the southwestern corner.

Performance criteria	Acceptable solutions	ESCO Pacific response
	• During site work and construction, protective measures will be required around trees to be retained.	• Trees lining the northern and southern boundaries will not be disturbed other than for the construction of site access. • Retained trees will be protected during construction.
Visual amenity Landscaping is used to soften the impact of buildings, as a screen to visual intrusions, parking areas and for recreation space	• Landscaping is provided in the front setback areas to soften the appearance of buildings and improve the streetscape.	• Landscaping within development footprint not considered necessary to reduce visual amenity (see Section 3.4.2).
Water efficiency Landscaping should use indigenous species of a low water demand.	• Landscaping design should incorporate species indigenous to the area and those which will not cause damage to adjacent buildings or driveways. • Adequate fixed underground watering equipment is to be installed in all landscaped areas.	• If landscaping was to be undertaken: – any planted species would be indigenous – adequate watering of planted species would be undertaken.
Vehicular access, parking and hardstand areas		
Car parking Car parking does not adversely impact upon the visual amenity of the site and the locality.	• Where car parking is proposed to be located forward of the building it has been demonstrated that it is essential and it is provided in accordance with the following: – Car parking is not located within 1.5 m of the property boundary.	• Car park location will be greater than 1.5 m from the property boundary.
Fencing		
Fencing and screen walls Fencing and screen walls do not adversely impact upon the visual amenity of the area.	• Fencing does not exceed a maximum height of 2.4 m.	• Fencing height will not exceed 2.4 m.

1.3.13 Activities that may have a visual impact at the site

Activities associated with the phases of the proposed solar farm development have the potential to have a visual impact on the sensitive receivers at and in the vicinity of the site. These are discussed below.

Construction

A number of activities that are likely to occur in the construction (or pre-construction) phase of the proposed development may be visible from areas surrounding the development envelop, including:

- ongoing detailed site assessment including technical investigations
- various minor civil works at the site access point
- construction facilities, including portable structures and laydown areas
- various construction and directional signage
- vegetation clearing, excavations and earthworks
- construction-related vehicles and equipment gaining access to site from widened shoulders and left- and right-hand turning treatments on the Newell Highway
- various construction activities including erection of solar panels with associated electrical infrastructure works, including power conversion blocks
- the use of lighting at night to assist with construction activities and/or site security.

The majority of pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact due to their duration and temporary nature.

Operation

As the number and type activities undertaken during the operational phase of the project are much less, the impacts likely to be less and limited to the impacts of:

- the constructed solar arrays and their daily tracking of the sun
- site buildings
- fencing
- minor site signage
- vehicles and equipment gaining access to site for operations and maintenance activities from widened shoulders and left- and right-hand turning treatments on the Newell Highway.

As the operation phase of the proposed solar farm is expected to be 40 years, visual impacts during operations need to be carefully assessed.

Decommissioning

Decommissioning activities are anticipated to be similar to those during construction.

1.4 Methodology

This visual impact assessment is based on a combination of professional qualitative judgement and commonly accepted industry criteria and guidelines, as outlined below:

- Landscape Institute and Institute of Environmental Management & Assessment '*Guidelines for Landscape and Visual Impact Assessment*' (LIIEMA 2013).
- Roads and Maritime Services '*Environmental Impact Assessment Guidance Note. Guidelines for landscape character and visual impact assessment*' (RMS 2009)
- Roads and Maritime Services '*Beyond the Pavement: Urban Design Policy Procedures and Design Principles*' (RMS 2014).

The assessment was undertaken to:

- Assess the existing visual character within the proposed solar farm site as well as the surrounding landscape.
- Determine the extent and nature of the potential visual impact of the proposed solar farm on the surrounding areas.
- Identify measures to mitigate and minimise any potential visual impacts.

The assessment involved the following general methodology:

- A desktop review of aerial photography to identify landscape character and potential visual receptors.

- Ground-truthing of desktop research by Accent representatives on 19-20 September 2018. Viewpoints of the development site were selected and photographed and surrounding visual receptor views were considered and documented.
- Description and evaluation of the existing landscape character and visual environment based on ground truthing and desktop research.
- Assessment of visual impacts of project night lighting on surrounding residences, scenic/significant vistas, air traffic and road corridors.
- Assessment of the degree of occurrence of potential reflective visual nuisance (glare and glint) based on the design and the mechanical behaviour of the solar panels and the existing environment.
- Preparation of photomontages showing the completed development site from the key viewpoints.
- Visual impact assessment using a grading matrix, taking into consideration the sensitivity of the landscape and receptors and magnitude of any likely development site impact.
- Preparation of design, construction and operational mitigation and management measures, including consideration of the necessity for a site landscaping and visual screening plan.
- Consideration of community consultation outcomes (undertaken as part of the wider EIS process) throughout the assessment.

2 Existing landscape character

2.1 Purpose

This chapter outlines the existing local landscape character in order to gain a general understanding of the visual environment on which the influence of the proposal will be assessed.

2.2 Landscape description

2.2.1 Dominant character

The dominant character of the surrounding area is a rural landscape characterised by a patchwork of extensive agricultural land and vast open spaces, predominantly focussed on cropping and livestock grazing.

The surrounding properties are generally partitioned and have varying types of rural infrastructure, such as unsealed roads, tree plantings and fencing. At various locations in the vicinity of the development site, farm sheds and other structures are present. Most vegetation within the area is located along road reserves, including the Newell Highway which is located adjacent to the site.

Photographs of the landscape surrounding the development site were taken by Accent Environmental in September 2018. The selection of characteristic images provided in Photos 2.1 to 2.6 illustrates the scenery typical of the local area and wider region.

2.2.2 Topography

There is a minimal degree of topographic relief across the local and regional area, resulting in a largely flat landscape aesthetic. Across the 1.9 km x 1.3 km site, elevations vary by just 4 m from 232 m Australian Height Datum (AHD) to 236 m AHD.

However, some gentle relief is present, as follows:

- an ephemeral tributary of Barmedman Creek that drains the northern part of the site
- an ephemeral tributary of Gagies Creek that drains the southern part of the site
- an ephemeral tributary of Gagies Creek, approximately 550 m to the west of the site
- a low, forested ridgeline (the Booberoi Hills) which is located approximately 5.6 km east of site (see Photo 2.3).

This generally vast and open regional landscape character results in a locale with a broad visual catchment. The predominantly flat nature of the terrain also contributes to high visual exposure.

2.2.3 Adjacent roads

Two roads located within 500 m of the development site are considered to be sensitive receivers and selected viewpoints along them have been chosen to assess the visual impacts to those receivers (Figure 2.1). The two roads are:

- Newell Highway (VP1) located adjacent to the site along its southern boundary
- Spauls Lane (VP4) located to the west of the site (480 m from the northwest corner of the site at its closest point).

Photo 2.1. **View across site from northeastern corner looking southeast**	
Photo 2.2. **View across site from proposed access road entry, looking north**	

Photo 2.3. **View across paddock towards site from landowner driveway, looking east**	
Photo 2.4. **View west away from northeastern corner of site towards low-lying ridgeline**	

Photo 2.5. **View northeast along Newell Highway from southeastern corner of site (site is on the left of picture)**	
Photo 2.6. **B-double truck using Newell Highway adjacent to southern boundary of site**	

Figure 2.1

Viewpoint Locations
Wyalong Solar Farm

Client: Esco Pacific
Project No: AE1091.0

Legend

- Development Site
- Lot Boundary
- 1 km Offset Buffer
- 2 km Offset Buffer
- Watercourse
- Highway
- Main Road
- Local Road
- Host Landholder
- Sensitive Receivers
- Viewpoint Locations

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A farm access road also runs along the northern boundary of the site. The view of the site from this road will be similar to that from the Newell Highway in terms of the visual aspects of the project. However, as this road is used only to access properties in the area and is not used by the public in general transit, it has not been considered further as a sensitive receiver.

2.2.4 Surrounding residences

Five scattered residences (R1-R5) are located on rural properties within 2 km of the site. These residences are located between 0.3 km and 1.4 km from the site, as listed on Table 2.1 below and shown in Figure 2.1.

Table 2.1. Location summary of residences near the development site

Residence no.	Description/location	Distance and direction from site
R1	Site landholder residence across paddock to east of site	1.4 km east
R2	Residence owned by the landholder close to western boundary of site	300 m southwest
R3	Residence close to Newell Highway on opposite side of highway from site	600 m southwest
R4	Residence approximately 470 m from Newell Highway on opposite side of highway from site	800 m southeast
R5	Residence off Worners Lane	1.0 km northwest

2.2.5 Recreational features

The main recreational features of the region are as follows:

- Back Creek State Forest, located 3.2 km to the east of the development site (up to approximately 80 m higher elevation than the site)
- Wyrra State Forest, located 4 km to the northeast of the development site (up to approximately 30 m higher elevation than the site)
- Boxalls State Forest, located 6.4 km to northeast of the development site
- Southwest Woodland Nature Reserve – Hiawatha Precinct, located 7.3 km southwest of the development site.

Boxalls State Forest is on the northeastern side of a ridgeline and beyond the viewshed of the project. The Southwest Woodland Nature Reserve – Hiawatha Precinct is gently undulating, but due to its forested nature, relatively low elevation above the site (approximately 25 m) and distance to the project (7.3 km) it is not considered further.

2.2.6 Existing vegetation

The local and regional area is highly modified and has been largely cleared of vegetation. However, remaining vegetation includes (see Figure 1.2):

- scattered native trees within the development site, particularly the northern and southwestern area
- scattered native trees lining Newell Highway (in the road reserve) and the northern boundary of the site, which offer some breakup of the view of the site
- native vegetation in the southern area of the development site and the adjoining road reserves.

The screening potential of the vegetation described is reduced by a lack of understory.

3 Visual impact assessment

3.1 Grading matrix

There are two primary measurements used to determine impacts to the landscape character:

- sensitivity of the landscape character
- magnitude of the proposal.

The visual impact of the proposal is determined using the flowchart in Figure 3.1 and risk matrix in Figure 3.2.

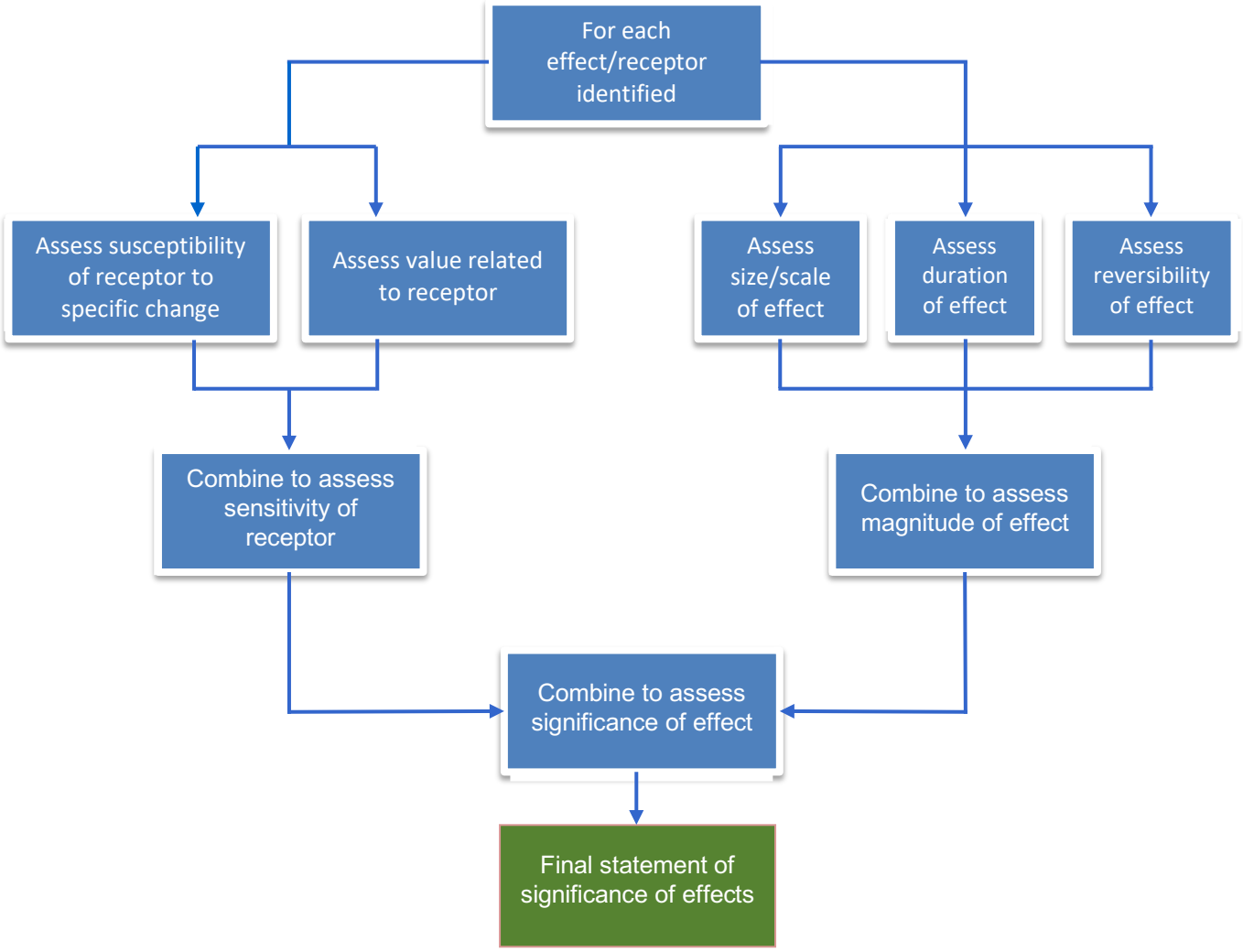

Figure 3.1. Flowchart for assessing visual impact of a proposal (LIIEMA 2013)

Sensitivity					
	High	High Impact	High - Moderate	Moderate	Negligible
	Moderate	High - Moderate	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low Impact	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible
		High	Moderate	Low	Negligible

Magnitude

Figure 3.2. Risk matrix for rating visual impacts (RMS 2009)

3.1.1 Receivers

According to the Landscape Institute and Institute of Environmental Management and Assessment (LIIEMA), visual receivers (or receptors) are individuals and/or defined groups of people who have the potential to be affected by a proposal. Furthermore, LIIEMA states that (LIIEMA 2013):

> "*The zone of theoretical visibility identifies land that, theoretically, is visually connected with the proposal and this is refined by site survey to confirm the extent of visibility. But in parts of this area there will be relatively few people to experience the effects of the proposal on views. The baseline studies must therefore identify the people within the area who will be affected by the changes in views and visual amenity [these people are] usually referred to as "visual receptors". They may include people living in the area, people who work there, people passing through road, rail or other forms of transport, people visiting promoted landscapes or attractions, and people engaged in recreation of different types."*

LIIEMA also says that:

> "*The visual receptors most susceptible to change are generally likely to include:*
>
> - *residents at home*
> - *people, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focused on the landscape and on particular views;*
> - *visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;*
> - *communities where views contribute to the landscape setting enjoyed by residents in the area.*
>
> *Travellers on road, rail or other transport routes tend to fall into an intermediate category of moderate susceptibility to change. Where travel involves recognised scenic routes awareness of views is likely to be particularly high.*"

When considering sensitivity, LIIEMA comments, saying that:

> "*it is important to remember at the outset that visual receptors are all people. Each visual receptor, meaning the particular person or group of people likely to be affected*

at a specific viewpoint, should be assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views."

For the Wyalong Solar Farm, visual receivers fall into two main categories:

- people living at residences near the development site (e.g. those listed in Table 2.1)
- people passing through by road (such as road users on the Newell Highway and Spauls Lane).

3.1.2 Sensitivity

Visual sensitivity refers to the character of a setting, the quality of the view and how sensitive it is to the proposed change. Combined with magnitude, sensitivity provides a measure of impact. Visual sensitivity relates to the direction and the composition of the view. Views from habitable room windows, outdoor areas of the home yard residence are treated as sensitive receivers. Views from residual land beyond the home yard area (such as cropping/grazing land, recreational land etc.) are treated as less sensitive receivers. The greater the distance between the visual receiver and the proposal, the lesser the visual sensitivity of that visual receiver.

The definitions in Table 3.1 are adapted from the LIIEMA (2013) and *Environmental Impact Assessment Guidance Note Guidelines for landscape character and visual impact assessment* (RMS 2009). These are generally accepted within the industry to identify visual receiver sensitivity.

Table 3.1. Sensitivity definitions

Sensitivity	Definition
High	Private residents at home with prolonged viewing opportunities, heritage properties and landscapes.
Moderate	Commercial properties, travellers on road/rail/other transport routes with an interest in their environment.
Low	Transient type spaces and people at their place of work, whose attention is on their work.
Negligible	Only a small part is discernible or at such a distance and is scarcely appreciated.

The higher the visual quality of the landscape, the greater the significance of introducing a new development, and therefore the higher the sensitivity. A place with a more consistent character would also be more visually sensitive to new development than a place with less consistency.

3.1.3 Magnitude

The magnitude of a visual effect is the degree of change that the visual landscape undergoes as a result of the proposed development. It is the measurement of the overall scale, form and character of a development proposal when compared to the existing condition. Four categories are used in ranking the magnitude of a proposal (negligible, low, moderate, high).

Magnitude takes into consideration the distance between the viewer and the proposal. Judging the magnitude of visual effects takes account of the:

- scale of the change within the view with respect to the addition (or loss) of elements in the view and change to its composition (including the proportion of the view that is taken up by the proposed development)
- degree of change and/or integration of any new features or changes in the landscape in terms of form, scale and mass, line height, colour and texture
- nature of the view of the proposed development and whether the views are permanent, full, partial or glimpses (LIIEMA 2013).

The categories of magnitude and sensitivity of visibility are defined in Table 3.2.

Table 3.2. Magnitude definitions

Magnitude	Definition
High	Substantial to total loss of key elements/features/characteristics of the baseline visual character and/or introduction of elements considered to be totally uncharacteristic of the existing landscape character
Moderate	Partial loss of/or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic of the existing landscape character
Low	Minor loss of/or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that are consistent with the existing landscape character
Negligible	Very minor loss or alteration to one of more key elements/features/characteristics of the baseline visual character and/or introduction of elements that are consistent with the visual character to the existing landscape character (i.e. approximating the 'no change' situation)

3.2 Selected receivers and viewpoints

3.2.1 Receivers

As noted in Section 3.1, visual receivers are individuals and/or defined groups of people who have the potential to be affected by a proposal. Whether they are sensitive depends on their susceptibility to change in views and visual amenity and also the value attached to particular views.

Based on the guidance offered by LIIEMA regarding visual receivers that may be impacted by the development, Accent has identified, two roads, five residences and two recreational features that may be visually impacted, as previously described in Sections 2.2.3, 2.2.4 and 2.2.5, respectively.

Sensitive receivers

Based on the LIIEMA guidance, people living at residences are considered more susceptible to change than road users. The use of roads in the vicinity of the development site is assumed to be largely for functional purposes (e.g. movement between towns via a major highway, or access to farmland via local roads). The roads in question are not thought to be used typically by people, 'engaged in outdoor recreation' or 'visitors to heritage assets, or to other attractions' – at least, not attractions in the immediate vicinity of the development site which may cause their awareness of views to be particularly high.

People using the two recreational features (Back Creek State Forest and Wyrra State Forest) are considered to be sensitive receivers as both forest reserves contain elevated areas that provide potential vantage points towards the site.

Of the residences identified, R1 and R2 are owned by the landholder who is part of the commercial venture of the solar farm. These two residences are therefore not considered sensitive receivers for the purposes of this report, although viewpoints from the residences are provided for completeness (see Section 3.2.2). The other three residences (R3, R4 and R5) are identified as sensitive receivers as the project will be, at least to some extent, visible from the households or immediate surrounds.

3.2.2 Viewpoints

Viewpoints (VPs) are positions looking towards the proposal that consider views from receivers. Accent has selected nine locations for viewpoint analysis. These are listed in Table 3.3 and shown in Figure 2.1. As two of the five residences (R1 and R2) are owned by the landholder, only residences R3-R5 are considered receivers for statutory assessment purposes.

Table 3.3. Selected viewpoints from which the development site is currently visible

Viewpoint	Location	Distance and direction from site	Receiver for statutory assessment purposes (yes/no)
VP1	Newell Highway, directly adjacent to site, northeast of site access point	30 m southeast of site	Yes
VP2	In driveway of residence **R2** (owned by the landholder)	200 m southwest of site	No
VP3	Newell Highway, at entrance to driveway of residence **R4**	340 m east of site	Yes
VP4	Spauls Lane at closest point to site	480 m northwest of site	Yes
VP5	Newell Highway, between site and residence **R3**	580 m southwest of site	Yes
VP6	In front of residence **R5**	1.0 km northeast of site	Yes
VP7	From driveway of site landholder residence **R1**	1.4 km east of site	No
VP8	View from ridgeline in Back Creek State Forest	5.7 km east of site	Yes
VP9	View from a hill in Wyrra State Forest	5.4 km northeast of site	Yes

3.3 Viewpoint impact assessment

The potential for visual impacts at each of the viewpoints in Table 3.3 during operations is assessed below by considering the:

- nature of potential impacts
- sensitivity of the landscape character at the viewpoint
- magnitude of the proposal as seen from the viewpoint
- impact rating (using the matrix in Figure 3.2).

Photomontages have been prepared to simulate the visual impacts of the proposed development (see Figures 3.3 to 3.10 below). The photomontages assume that the photovoltaic modules and solar array will be comparable to the type supplied by Array Technologies and shown in Photo 1.1.

3.3.1 Viewpoint 1 - Newell Highway, directly adjacent to site

Impacts

- The solar arrays and associated infrastructure would be visible to users of the Newell Highway and would result in a change in the rural character of the view.
- The attention of passing motorists may be drawn to the solar farm.
- Traffic accessing the site, particularly during construction, will also be visible to users of the Newell Highway.

Sensitivity

- Open and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- Highway with significant but transient traffic.
- Receivers are road users with an interest in their environment (note, however, a general lack of scenic attractions are present in vicinity of site).
- The sensitivity is therefore assessed as **Low**.

Figure 3.3 Viewpoint 1 photomontage - Newell Highway, directly adjacent to site

Magnitude

- The solar arrays would be up to 4 m in height and would be located within 55 m of the viewpoint.
- The region is flat, leading to high visibility, however there is moderate existing shielding by roadside vegetation (a combination of mature trees of greater than 4 m height interspersed with shrubs and smaller, immature trees that provide more complete car-level screening).
- Traffic accessing the site will pull into side lanes to decelerate and turn. Construction traffic will be frequent and include oversize vehicles. Operations traffic will be minimal.
- Viewing opportunities would be brief (e.g. 43 seconds to drive past the site at 110 kmh).
- The development represents a departure from the existing rural environment, and the solar arrays are in close proximity to the highway. However, the arrays are low, have moderate vegetative screening and the construction period will last for nine months. The magnitude is therefore assessed as **Moderate**.

Impact rating

Moderate-low

3.3.2 Viewpoint 2 - driveway of residence R2

Impacts

- The solar arrays and associated infrastructure would be visible from the residence R2 driveway, as well as from the residence and immediate surrounds.
- The arrays would provide some disruption of the view to the distant ridgeline.

Sensitivity

- Open and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- Main receivers are people living in residence R2 (approximately 60 m further away from the site than VP2) and relaxing in house surrounds.
- The sensitivity is therefore assessed as **Moderate**.

Figure 3.4 Viewpoint 2 photomontage - driveway of residence R2

Magnitude

- The solar arrays would be up to 4 m in height and would be located approximately 190 m of the viewpoint and approximately 250 m from R2.
- The region is flat, leading to high visibility, however there is some existing screening by trees planted between VP2/R2 and the site.
- The distant ridgeline provides some relief to the flat nature of the landscape. The solar arrays partially obscure the view of the ridgeline, although are generally lower than the top of the ridge.
- As the development is low and has some existing tree screening , but is located relatively close to VP2 and R2 and represents a departure from the existing rural environment, the magnitude is assessed as **Moderate**.

Impact rating

Moderate (note, however, that R2 is owned by the landowner and is not considered a sensitive receiver for statutory assessment purposes)

3.3.3 Viewpoint 3 - Newell Highway, entrance of residence R4 driveway

Impacts

- The solar arrays would be visible from the R4 driveway entrance.
- The arrays would also be visible from residence R4, but less intrusive, as the house is an additional 500 m away from VP3.

Sensitivity

- Open and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- VP3 is assumed to be used mainly in transit to and from residence R4.
- Main receivers are people potentially living in residence R4 500 m away and relaxing in house surrounds.
- The sensitivity is therefore assessed as **Moderate**.

Figure 3.5 Viewpoint 3 photomontage - Newell Highway, entrance of residence R4 driveway

Magnitude

- The solar arrays would be up to 4 m in height and would be located within 340 m of VP3 and 900 m from R4.
- The region is flat, leading to high visibility, however there is moderate existing shielding by roadside vegetation at VP3 and additional shielding at R4 due to vegetation in vicinity of residence.
- The solar arrays towards northern end of development site blend into the existing tree line on the horizon
- As the development is low, a moderate distance from VP3, and large distance from R4, has intermittent screening and blends into the treeline, the magnitude is assessed as **Low**.

Impact rating

Moderate-low

3.3.4 Viewpoint 4 - Spauls Lane at closest point to site

Impacts

- The solar arrays would be visible from Spauls Lane.
- The arrays would provide some disruption of the view to the distant ridgeline.

Sensitivity

- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- Spauls Lane is expected to have infrequent traffic, generally comprising local landowners in transit to and from their properties.
- Receivers are road users with an interest in their environment (note, however, a general lack of scenic attractions are present in vicinity of site).
- The sensitivity is therefore assessed as **Low**.

Figure 3.6 Viewpoint 4 photomontage - Spauls Lane at closest point to site

Magnitude

- The solar arrays would be up to 4 m in height and would be located within 480 m of VP4 (the closest point of Spauls Lane to site).
- Along most of its length, Spauls Lane is approximately 1 km or more from the site, with much more substantial tree screening than from VP4.
- The region is flat, leading to high visibility.
- The distant ridgeline provides some relief to the flat nature of the landscape. The solar arrays obscure the base of the ridgeline, but do not affect its profile and will generally blend into the ridgeline, reducing their visual impact.
- As the development is low, located almost 480 m from VP3 (and approximately 1 km or more from most vantage points along the lane), road use low, viewing opportunities brief (in transit) and the arrays blend into the distant ridgeline, the magnitude is assessed as **Low**.

Impact rating

Negligible

3.3.5 Viewpoint 5 - Newell Highway, between site and residence R3

Impacts

- The solar arrays would be visible from the Newell Highway in front of residence R3.
- The arrays would also potentially be visible from residence R3 itself, although the trees planted between the house and the highway restrict visibility.

Sensitivity

- Open and visible landscape character from VP5, but closed and vegetated within surrounds of residence R3.
- VP5 would not typically be a common viewpoint, other than for road users, but is used as a worse-case representation of views from R3.
- Main receivers are people living in residence R3 and relaxing in house surrounds.
- The sensitivity is therefore assessed as **Moderate**.

Figure 3.7 Viewpoint 5 photomontage - Newell Highway, between site and residence R3

Magnitude

- The solar arrays would be up to 4 m in height and would be located within 580 m of VP5 and 640 m from R3.
- The region is flat, however there is existing shielding by roadside and other vegetation and a farm dam at VP5, and additional shielding at R3 due to vegetation in vicinity of residence.
- Only the arrays towards the southern end of the site are visible from VP5 and are only minimally intrusive due to the distance to them and the presence of vegetation.
- As the development is low, distant, largely shielded from VP3 and shielded even more completely from VP5, the magnitude is assessed as **Low**.

Impact rating

Moderate-low

3.3.6 Viewpoint 6 - in front of residence R5

Impacts

- The solar arrays and supporting infrastructure would be visible from the front of residence R5.
- The residence is oriented in the direction of the solar farm, with the front door, front lawn, verandah and front lawn providing vantage points towards the solar arrays.

Sensitivity

- Open, flat and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, unsealed roads and dams.
- Receivers are people living in residence R5 and relaxing in house surrounds.
- The sensitivity is therefore assessed as **High**.

Figure 3.8 Viewpoint 6 photomontage - in front of residence R5

Magnitude

- The solar arrays would be up to 4 m in height and located approximately 1 km from R5.
- The region is flat and views to the western half of the solar farm are largely unimpeded by vegetation, although intermittent trees along the fenceline provide some screening and break up the profile of the arrays. The eastern half of the solar farm is largely obscured by fenceline trees.
- There is only limited visual distraction (several trees) in the foreground of the view, but the distance to the arrays limits their overall visual intrusiveness.
- As the development is low, distant, and partly shielded by trees, the magnitude is assessed as **Low**.

Impact rating

Moderate

3.3.7 Viewpoint 7 - driveway of site landholder residence R1

Impacts

- The solar arrays infrastructure would be visible from VP7
- The arrays would also be visible from residence R1, but will be partially obscured due to a number of trees and farm buildings located between the residence and the solar farm.

Sensitivity

- Open, flat and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- Receivers are people living in residence R1 and relaxing in house surrounds.
- The sensitivity is therefore assessed as **Moderate**.

Figure 3.9 Viewpoint 7 photomontage - driveway of site landholder residence R1

Magnitude

- The solar arrays would be up to 4 m in height and located approximately 1.4 km from VP7 and R1.
- VP7 is in the driveway and represents the view in transit to and from the residence, but the dimensions of the solar array from the driveway are the same as they would appear from the residence itself.
- Due to the flat nature of the landscape and distance to the solar farm, the arrays are not visually intrusive and comprise only a minor component in the field of view.
- There is only limited screening of the solar arrays from VP7 by trees, although greater screening from R1 due to trees and farm buildings. However, the arrays blend in to the tree lines behind them reducing their intrusiveness.
- As the development is low, distant, and blends into distant treelines, the magnitude is assessed as **Low**.

Impact rating

Moderate-low (note, however, that R1 is owned by the landowner and is not considered a sensitive receiver for statutory assessment purposes)

3.3.8 Viewpoints 8 and 9 - Back Creek and Wyrra state forests

Impacts

- The solar arrays would be visible from the ridgeline that runs through the Back Creek State Forests and potentially from elevated locations within the Wyrra State Forest.
- The arrays provide a contrast to the otherwise typical rural landscape of flat open farmland.

Sensitivity

- Open, flat and visible landscape character.
- Rural landscape – farmland with scattered trees, treelines, infrequent residences, farm buildings, roads and dams.
- Receivers are people undertaking recreational activities in the two state forests which involve gaining access to a vantage point on the ridgeline from which the solar farm can be seen.
- The sensitivity is therefore assessed as **Moderate**.

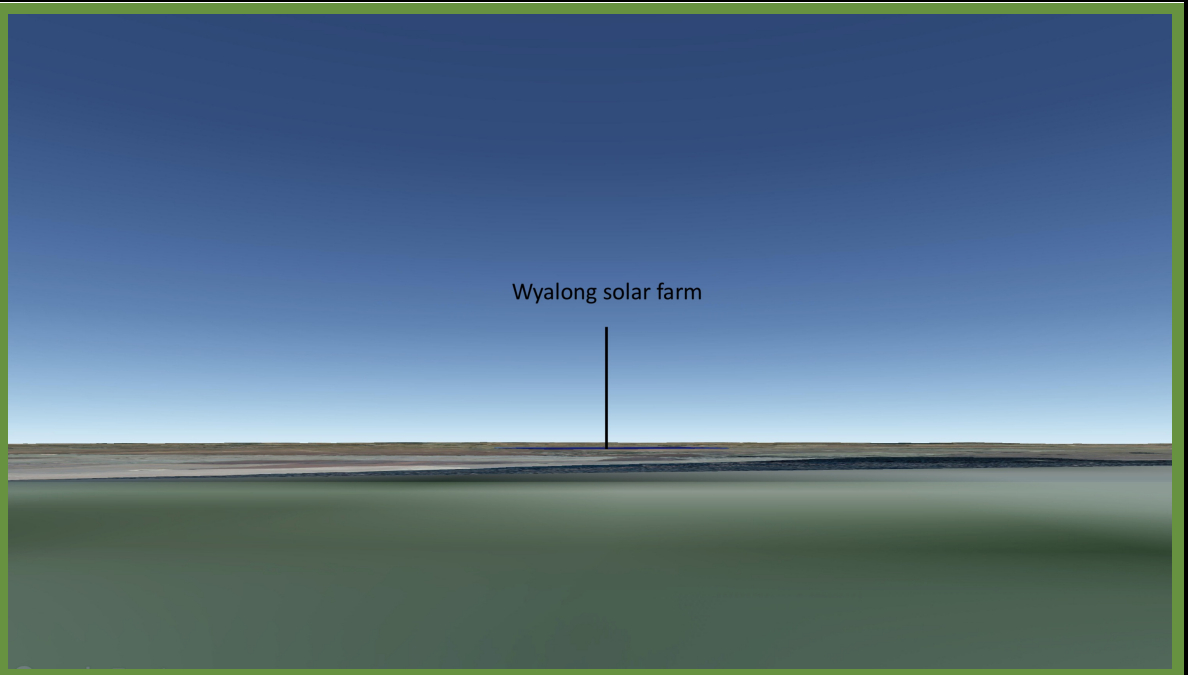

Figure 3.10 Simulation of view to site from state forest (VP8)

Magnitude

- The solar arrays would be up to 4 m in height, approximately 2 km in width (as seen from the two VPs), and located approximately 5.7 km and 5.4 km from VP8 and VP9, respectively. VP8 and VP9 are elevated only approximately 80 m and 30 m, respectively, above the site.
- The arrays would appear as a distant thin feature towards the horizon (as seen by the thin blue line in the image above, which simulates the view from VP8).
- Due to the flat nature of the landscape and distance to the solar farm, the arrays are not visually intrusive and comprise only a very minor component in the field of view.
- From most locations along the ridgeline within the state forests, the view of the arrays would be obscured by trees and vegetation.
- As the development is low, distant, and recedes into the horizon, the magnitude is assessed as **Negligible**.

Impact rating

Negligible

The following considerations are common to all the assessed receivers:

- The duration of construction impacts will be temporary in nature, lasting for a relatively short nine months (approximately). Operational impacts, however, will last for 40 years.
- Night-lighting impacts during both construction and operation are expected to be readily manageable and minor (see Section 3.5).
- Traffic impacts will be much greater during construction when a daily peak of 22 light vehicles and 24 heavy / over-dimension vehicle movements) will access the site from the Newell Highway. During operations the site will have up to two daily vehicle movements (Impact 2018).

3.4 Visual impact assessment summary

In assessing the visual impacts proposed development, the following have been considered:

- the potential sensitive receivers in the vicinity of the site
- the type of sensitive receiver
- distance of sensitive receiver from site
- visibility of site from sensitive receiver
- profile of proposed infrastructure
- the type of materials proposed to be used in construction
- the nature, location and frequency of project-related traffic accessing the site
- lighting required during construction and operation.

In summary, nine viewpoints in the vicinity of the proposed Wyalong Solar Farm have been considered (see Figure 2.1). Two of these (VP2 and VP7), correspond to residences owned by the landowner (R1 and R2), which are part of the commercial development of the project and are not considered sensitive receivers for statutory assessment purposes. VP2 and VP7 have been included for completeness and to assist with ESCO Pacific's consultation process but are not discussed further in this report.

A summary of the visual impact assessment for each receptor is provided in Table 3.4. Three of these viewpoints coincide with residence receptors, two coincide with road viewing receptors and two coincide with potential vantage points from recreational areas (state forests), as listed in Table 3.5.

As described in Table 3.5, the assessments are conservative in some cases. In particular, the viewpoints most closely representing residences R3 and R4 are conservative as the view from the actual residence is subject to additional screening and/all distance compared to the viewpoint.

Table 3.4. Viewpoint visual impact assessment summary

Viewpoint	Location viewed from	Sensitivity	Magnitude	Resultant impact
VP1	Newell Highway, directly adjacent to site, northeast of site access point	Low	Moderate	Moderate-low
VP3	Newell Highway, at entrance to driveway of residence **R4**	Moderate	Low	Moderate-low
VP4	Spauls Lane at closest point to site	Low	Low	Low
VP5	Newell Highway, between site and residence **R3**	Moderate	Low	Moderate-low
VP6	In front of residence **R5**	High	Low	Moderate
VP8	View from ridgeline in Back Creek State Forest	Moderate	Negligible	Negligible
VP9	View from a hill in Wyrra State Forest	Moderate	Negligible	Negligible

Table 3.5. Receiver visual impact assessment summary

Receiver	Location	Sensitivity	Magnitude	Resultant impact	Comment
Residences					
R3 (60 m south of **VP5**)	Residence close to Newell Highway on opposite side of highway from site	Moderate	Low	Moderate-low	Conservative assessment – impact at R3 expected to be even lower than at VP5 due to presence of additional trees between residence and site
R4 (500 m southeast of **VP3**)	Residence approximately 470 m from Newell Highway on opposite side of highway from site	Moderate	Low	Moderate-low	Conservative assessment – impact at R4 expected to be substantially lower than at VP3 due to additional distance between residence and site and presence of some additional trees
R5 (same as **VP6**)	Residence off Worners Lane	High	Low	Moderate	R5 is same location as VP6
Roads					
Newell Highway (**VP1**)	Newell Highway, directly adjacent to site, northeast of site access point	Low	Moderate	Moderate-low	VP1 considered to represent maximum visual intrusion for road users passing site
Spauls Lane (**VP4**)	Spauls Lane at closest point to site	Low	Low	Low	VP4 considered to represent maximum visual intrusion for road users along Spauls Lane
Recreational features					
Back Creek State Forest (**VP8**)	View from ridgeline in forest	Moderate	Negligible	Negligible	VP8 and VP9 assessments are conservative as they assume open view of site with no screening by forest vegetation
Wyrra State Forest (**VP9**)	View from ridgeline in forest	Moderate	Negligible	Negligible	

3.4.1 Receivers with the highest visual impact ratings

VP6 corresponds to residence R5 located to the north of the solar farm off Worners Lane and has the highest visual impact rating of moderate. The moderate rating is due primarily to the sensitivity of the location, with the front of the property facing directly towards the solar farm (although the distance to the solar farm is 1 km and the eastern half of the solar farm is largely screened by trees).

Three receivers (VP1, VP3 and VP5) are considered to have impact ratings of moderate to low.

VP1 is the Newell Highway immediately adjacent to the site. Moderate existing shielding is provided by roadside vegetation. In the stretch of highway immediately adjacent to site, this vegetation comprises a combination of mature trees of greater than 4 m height interspersed with shrubs and smaller, immature trees that provide more complete car-level screening. The main gap in the vegetation is an approximately 50 m wide gap located where the proposed site access point is to be constructed.

As a result of the vegetation, the site would be clearly, but intermittently visible to vehicles passing by on the highway. However, viewing opportunities would be brief (43 seconds to drive past the site boundary at 110 kmh) and the general lack of scenic attractions in the vicinity of the site means that the attention of road users (in the absence of the solar farm) would not likely be specifically focussed on the scenery at that point. In addition, road users are receivers but in the case of this project are not considered to be sensitive receivers.

VP3 and VP5 correspond to residences R3 and R4, located across the Newell Highway from the solar farm. However, in both cases, the viewpoint where the rating was undertaken was closer to site than the corresponding residence. At the two residences, impacts are expected to be substantially lower due to factors such as the additional distance between residence and site and presence of additional trees. The assessments for VP3 and VP5 are therefore considered conservative representations of the impacts at R3 and R4.

None of the remaining viewpoints (VP4, VP8 and VP9) have a visual impact rating greater than low.

3.4.2 Reducing the visual impact

Although VP6 had a moderate rating, it is not considered necessary to take measures within the development site to mitigate the project's impact due to the relatively large (1 km) distance to the solar farm and the blending in of the solar farm with distant treelines. However, it is understood that ESCO Pacific is in discussion with the resident concerning possible other means of impact mitigation.

Each of the remaining six receivers that were considered for statutory assessment purposes have a visual impact rating of either moderate-low, low or negligible. It is not considered necessary to take measures to mitigate the project's visual impact on these viewpoints. Regardless, for the three locations with moderate-low impact ratings, a series of general mitigation measures is proposed to reduce the visual impacts on those receivers. These measures are discussed in Section 4. Additionally, ongoing engagement with the local community may ameliorate the impact on the sensitive receivers. This is discussed in Section 3.4.3, below.

3.4.3 Community and stakeholder consultation

ESCO Pacific has prepared a Community and Stakeholder Consultation Plan that sets out the objectives and requirements for consultation with identified project stakeholders, including the residences located nearest to the development site. The process of community consultation implemented by ESCO Pacific will provide a forum for project issues, including visual impacts, to be discussed. ESCO is in active discussion with the nearest residences concerning visual impacts and their management.

3.4.4 Decommissioning phase

It is envisaged that decommissioning would involve the removal of all infrastructure associated with the project and rehabilitation of the site. It is anticipated that activities occurring during decommissioning and associated impacts would be similar to that during the construction phase. As the decommissioning phase of the project is likely to be of limited duration, it is not considered likely to result in an unacceptable level of visual impact. At the completion of rehabilitation, the development site would have been returned to its existing rural landscape character.

3.5 Night lighting

During operation, lighting will be provided for security reasons and for staff and contractors utilising the site facilities. External lighting would be restricted to the area where the maintenance shed, permanent site office, and switch yard are located. All external lighting around buildings will be faced downwards and inwards to minimise impacts to neighbouring properties.

Construction activities at the site would occur from 7 am to 6 pm Monday to Friday and from 8 am to 1 pm on Saturdays (i.e. during daylight hours). However, if lighting is required during construction, it will be directed into the construction areas and placed sensitively to minimise the potential increase in light pollution for adjacent receptors.

The likely visual impacts of project night lighting on surrounding residences, scenic or significant vistas, air traffic and road corridors (particularly the Sturt Highway) in the public domain are summarised below.

3.5.1 Residences

A minor/negligible amount of light spill from the development may be visible from residences R3, R4 and R5, along with the two landholder residences (R1 and R2). Given the relatively minor amount of construction and operational lighting required for the project and the proposed management measures outlined above, night lighting is unlikely to pose a significantly adverse impact to any residences.

3.5.2 Scenic/significant vistas

Development site light spill visibility from vantage points within the Back Creek and Wyrra state forests (VP8 and VP9) is likely to be very minor and is unlikely to pose a significantly adverse impact given the relatively minor amount of lighting required for the project and that:

- VP8 and VP9 are located 5.7 km and 5.4 km from site, respectively
- proposed lighting management measures are to be implemented, as outlined above
- a reduced number of receivers would be present in the forest reserves at night.

3.5.3 Air traffic

No certified aerodromes are located close to the solar farm site. Five registered aerodromes are located within 100 km of the site; West Wyalong (13.1 km southwest), Temora (63 km south), Forbes (87 km to the northeast), Condoblin (90 km to the north) and Young (95 km to the southeast).

Considering the nature and relatively minor amount of construction and operational lighting required for the project, and given the proposed management measures, it is unlikely that air traffic would be affected by night lighting at the site.

3.5.4 Road corridors

Light spill from the development is unlikely to significantly adversely impact surrounding roads users, including those of the Newell Highway and Spauls Lane (VP1 and VP4) given the proposed light management measures and relatively minor amount of construction and operational lighting required for the project.

3.6 Glare and reflectivity

There are a number of factors which contribute to the occurrence of reflective visual nuisance, such as the frequency of the reflection, the type of reflection (specular versus diffuse), localised environmental impacts and the location of visual receivers. This assessment considers the following two qualities to ascertain the proposal's degree of reflective nuisance:

- the design and the mechanical behaviour of the solar panels
- the existing environment.

Glare-based visual nuisance associated with the proposal will be largely influenced by the location and position of the solar panels relative to sensitive visual receivers. Receivers within a closer proximity to the proposal will be exposed to more direct specular reflection.

3.6.1 Solar panel design

The solar panels are designed to follow the sun along a single axis to maximise energy absorption. The solar panels would remain at a stationary and constant 45-degree angle from sunrise (first light), until approximately 9:00 am when the solar panels will begin to move and follow the path of the sun. Likewise, from approximately 4:30 pm until sunset (last light), the solar panels will remain at a constant -45-degree angle.

Considering that the solar panels will remain at a static 45-degree angle in the early mornings and late afternoons, the resulting specular glare is likely to have a negligible influence on sensitive receivers, and any glare would reflect away from ground-based receivers.

Photovoltaic solar panels are designed to absorb the highest amount of solar energy possible to generate the maximum amount of electricity. The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited. Refer to Table 3.6 for a comparison of solar panels against other materials/surfaces.

Photovoltaic solar panels reflect approximately 3-20% of the light received, depending on the angle of incidence. They generally do not create noticeable/nuisance glare compared with other commonly existing surfaces such as roofs and are less reflective than other naturally occurring elements (refer to Table 3.6).

Within the pastoral context of the proposal, grazing landscapes, crops and water share a similar or higher reflective value than photovoltaic solar panels, therefore the proposal would not represent a significant departure from the existing visual environment in terms of glare.

Additional solar farm infrastructure that may cause glare or reflections depending on the sun's angle, including the following (note that this infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to motorists or aircraft):

- steel array mounting structures - array mounting would be steel or aluminium
- temporary site offices, sheds, containerised inverter stations
- on-site substation
- perimeter fencing
- permanent staff amenities.

The topography of the site and local area is largely flat and there are not many nearby opportunities to view the site from a higher position, apart from the low, distant ridgeline to the east. The nearest airfield is located in West Wyalong, 13.1 km southwest of the site. No other certified or registered airfields are located within 50 km of the site. When viewed from above, from aircraft or tall buildings, photovoltaic solar panels appear dark grey and do not cause a glare or reflectivity hazard. It is therefore unlikely that air traffic would be affected by solar panel glare.

Table 3.6. Reflectivity of different materials (adapted from Avery & Berlin 1992)

Material	Percentage reflected
Solar panels	**3-20**
Fresh snow	80-95
Thick cloud	70-80

Material	Percentage reflected
Water (sun near horizon)	50-80
Old snow	50-60
Light soil	50-60
Thin cloud	20-30
Dry soil	20-25
Wet soil	15-25
Deciduous forest	15-20
Dark soil	5-15
Asphalt	5-10
Crops	10-25
Grazing / grass	10-20
Coniferous forest	10-15
Water (sun near zenith)	3-5

3.6.2 Impact on visual receivers

In summary, considering the relatively minimal glare reflecting off the photovoltaic solar panels, and their mechanical nature as they follow the sun, the level of visual nuisance or glare resulting from the proposal would have a minimal influence on nearby visual receivers.

4 Visual impact assessment management and mitigation measures

4.1 Objectives and principles

The following general project objectives aim to maintain the existing landscape character where possible, via strategic and practical measures:

- Adopt integrated rural infrastructure/landscape design that permits the landscape to take precedence over the built form.
- Strengthen the vegetated character of the proposal area and express the rural and bushland nature of landscaping.
- Any urban design features should reflect and be sympathetic to the existing historic, cultural and natural character of the area.
- Design lighting so as not to negatively impact on adjacent land uses (e.g. no light spill into adjacent rural properties affecting residences).

The following landscape design principles would be applied to the proposal:

- Maximise the retention of existing visual screening opportunities.
- Revegetate areas disturbed by construction work, where possible.
- When revegetating, consider the potential to reflect similar vegetation types found in the area.
- Use materials and colours that reflect the existing urban design character and palette.

Although the visual impacts of the proposed project have been assessed as low, management measures have been proposed in the following sections to ensure that such impacts are minimised during both construction and operation.

4.2 Design phase measures

As outlined in Section 3.4.2, landscaping and visual screening treatments within the site are not considered to be required. However, the following detailed design measures should be adopted to reduce the visual impact of the project:

- Apply urban design principles and objectives during detailed design phase.
- Investigate colour combinations for infrastructure items to aid visual obscurity.
- Ancillary structures: minimise reflective surfaces with a preferred use of muted colours.

4.3 Construction phase measures

The following measures will be implemented to minimise visual impacts during construction:

- Demarcation and exclusion fencing will be installed around trees and vegetation to be retained.
- Limiting disturbance and rehabilitating disturbed areas.
- Minimising light spill from the development into adjacent visually sensitive properties by directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
- Temporary hoardings, barriers, traffic management and signage should be removed when no longer required.

- The site to be kept tidy and well maintained, including removal of all rubbish at regular intervals. There should be no storage of materials beyond the construction boundaries

4.4 Operation phase measures

The following measures will be taken to minimise visual impacts during the operation phase of the project:

- Restrict external lighting to the area where the maintenance shed, permanent site office, and switch yard are located.
- All external lighting around buildings to be faced downwards and inwards to minimise impacts to neighbouring properties.

4.5 Decommissioning phase measures

The following measures will be taken to minimise visual impacts during the decommissioning phase of the project:

- A Decommissioning Management Plan will be implemented to return the site to its pre-existing condition.

5 Conclusion

This visual impact assessment has qualitatively assessed the visual impact of the development site from major viewpoints and receivers, finding that the impacts range from moderate to negligible. However, the degree to which the change to the landscape will actually be perceived will depend on affected individual receptors' sensitivities, which cannot be finally predicted at this stage, although it is being considered as far as practicable via ongoing community consultation as part of the wider EIS and will be further considered during project planning and development.

The standard design, construction and operational recommendations outlined in this assessment are considered sufficient to assist with maintaining the landscape character of the local area and minimise impacts. No project specific landscaping and visual screening plans within the site boundary have been recommended. However, it is understood that ESCO Pacific is in discussion with the resident at R5 concerning possible mitigation of visual impacts, potentially including the planting of screening vegetation within the R5 property boundary

In terms of reflectivity, considering the relatively minimal glare reflecting off the photovoltaic solar panels, and their mechanical nature as they follow the sun, the degree of visual nuisance resulting from the proposal would have minimal influence on local visual receptors and it is unlikely that air traffic would be affected.

6 References

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