



Sandigo Solar Farm: Environmental Impact Statement

February 2018

Sandigo Solar Farm

Environmental Impact Statement

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Issued to	
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Statement of Validity

This Environmental Impact Assessment (EIS) has been prepared in accordance with the relevant provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Environmental Planning and Assessment Regulation 2000.

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Development application	
Applicant name	ESCO Pacific Pty Ltd
Applicant address	Level 4, 13 Cremorne Street, RICHMOND VIC 3121
Proposed development	SSD 8872 – development of a 100 MW Solar Farm at 174 Mitchells Road, Sandigo, New South Wales, 2700
Land to be developed	<ul style="list-style-type: none">• <input type="checkbox"/> Lot 55 on Plan 754550 (168.1 ha)• <input type="checkbox"/> Lot 33 on Plan 754550 (53.4 ha)• <input type="checkbox"/> Lot 35 on Plan 754550 (9.1 ha)
EIS	
An EIS is attached.	
Declaration	
Certification	<p>Pursuant to clause 6(f), Part 3, Schedule 2 of the Environmental Planning and Assessment Regulation 2000, I certify that this Environmental Impact Statement (EIS):</p> <ul style="list-style-type: none">• <input type="checkbox"/> has been prepared in accordance with the EP&A Act, Environmental Planning Assessment Regulation 2000, and the Secretary's Environmental Assessment Requirements, issued 30 November 2017• <input type="checkbox"/> contains all available information relevant to the environmental assessment of the development to which this EIS relates• <input type="checkbox"/> does not contain information that is false or misleading.
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Abbreviations

ABS	Australian Bureau of Statistics
ABRI	Australian Battery Recycling Initiative
AC	alternating current
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHM	Australian Cultural Heritage Management (Victoria) Pty Ltd
ADG	Australian Dangerous Goods
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEP	annual exceedance probability
AER	Australian Energy Regulator
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASL	above sea level
AWA	automatic weather station
BCA	Building Code of Australia
BDAR	Biodiversity Development Assessment Report
BC Act	<i>Biodiversity Conservation Act 2016</i>
BSAL	Biophysical Strategic Agricultural Land
CCTV	closed-circuit television
CEMP	construction environmental management plan
COP21	21 st Conference of the Parties
CFCs	chlorofluorocarbons
CML	concessional mass limits
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cwlth	Commonwealth
DA	Development Application
dB	decibel
DC	direct current
DECCW	Department of Environment, Climate change and water
DMP	decommissioning management plan
DoE	Department of Environment (Cwlth)

DoEE	Department of Environment and Energy
DoP	Department of Planning (NSW) (now DPE)
DPE	Department of Planning and Environment (NSW)
DPI	Department of Primary Industries
EIA	environmental impact assessment
EEC	Endangered Ecological Community
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic fields
EPA	Environment Protection Authority
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EP&A	<i>Environmental Planning and Assessment</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ERP	emergency response plan
ESD	ecologically sustainable development
ESDSC	Ecologically Sustainable Development Steering Committee
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
GHGs	greenhouse gases
GML	general mass limits
GWh	gigawatt hours
ha	hectares
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICNG	Interim Construction Noise Guideline
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
kL	kilolitre
km	kilometre
km ²	square kilometre
kV	kilovolt
LALC	Local Aboriginal Land Council
LAeq	equivalent continuous level
LEP	Local Environmental Plan
LEMC	local emergency management committee
LGA	Local Government Area
LIEMA	Landscape Institute and Institute of Environmental Management & Assessment
LLS Act	<i>Local Land Services Amendment Act 2016</i>

LRET	Large-scale Renewable Energy Target
LSC	land and soil capability
m	metres
MIA	Murrumbidgee Irrigation Area
MIA BFRMP	Murrumbidgee Irrigation Area Bush Fire Risk Management Plan
MPR	Major Projects Register
MNES	Matters of National Environmental Significance (under the EPBC Act)
MW	megawatts
NHVAS	National Heavy Vehicle Accreditation Scheme
NSC	Narrandera Shire Council
NPI	Noise Policy for Industry
NSR	noise sensitive receptors
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
OEMP	operation environmental management plan
PCT	Plant Community Type
PEA	preliminary environmental assessment
PCU	power conversion unit
PHA	preliminary hazard analysis
POEP	<i>Protection of the Environment Operations</i>
PSNL	project specific noise levels
PV	photovoltaic
RAP	Registered Aboriginal Party
RBL	rating background noise level
RET	Renewable Energy Target
RFS	Rural Fire Service
RMRP	Riverina Murray Regional Plan
RMS	Roads and Maritime Service
RNP	Road Noise Policy
RU1	Rural Use Zone 1
SCADA	supervisory control and data acquisition
SDS	safety data sheet (for chemical use)
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development

SRES	small-scale renewable energy scheme
TEC	Threatened Ecological Community (listed under the EPBC Act)
TIA	traffic impact assessment
TMP	traffic management plan
TNSP	Transmission Network Service Provider
UNFCCC	United Nations Framework Convention on Climate Change
VP	viewpoint
WARR	Waste Avoidance and Resource Recovery
WMP	waste management plan
WPMP	weed and pest management plan

Glossary

Applicant	Entity applying for development consent under the EP&A Act, in this case, ESCO Pacific (may also be termed proponent).
alternating current	Alternating current (AC) is an electric current which periodically reverses direction, in contrast to direct current (DC) which flows only in one direction.
direct current	An electric current flowing in one direction only.
development site	The development site (or development footprint), is the area within which the solar panels, substation, office and supporting facilities will be located.
electromagnetic interference	Electromagnetic interference (EMI), also called radio-frequency interference (RFI) when in the radio frequency spectrum, is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction.
Inverters	An apparatus which converts direct current into alternating current
movement (vehicle)	A vehicle movement is a round trip, which includes both the trip to and from the destination.
power conversion unit	Device used to convert power from one form to another e.g. from DC to AC or changing the voltage or frequency.
photovoltaic cell	An electronic device consisting of layers of semiconductor materials fabricated to form a junction (adjacent layers of materials with different electronic characteristics) and electrical contacts and being capable of converting incident light directly into electricity (direct current).
photovoltaic modules	An integrated assembly of interconnected photovoltaic cells designed to deliver a selected level of working voltage and current at its output terminals, packaged for protection against environmental degradation, and suited for incorporation in photovoltaic power systems.
Project boundary	The boundary around lots 33, 35 and 55 within which the development site is located.
risk assessment	Risk assessment is the process of identifying, evaluating and controlling risks associated with hazards for the project, including identifying a clear pathway to one or more receptors, and assessing the potential impacts on the receptors as a result of the hazard.
responsible authority	The relevant consent authority or determining authority. In the case of State significant infrastructure, the Minister.
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
SCADA system	SCADA is an acronym for Supervisory Control and Data Acquisition. SCADA generally refers to an industrial computer system that monitors and controls a process. In the case of the transmission and distribution elements of electrical utilities, SCADA will monitor substations, transformers and other electrical assets.
substation	a set of equipment reducing the high voltage of electrical power transmission to that suitable for supply to consumers.
transformer	Transformers are used to increase or decrease the alternating voltages in electric power applications.

Executive summary

Project overview

This Environmental Impact Statement (EIS) is submitted by ESCO Pacific (the applicant) to support a Development Application (DA) for the construction and operation of a utility-scale solar farm and storage compound at Sandigo, New South Wales (NSW), located approximately 28 km southeast of the Narrandera Township, and 55 km northwest of Wagga Wagga.

The proposed Sandigo Solar Farm (the project) will generate up to 100 MW of alternating current (AC) clean and renewable electricity through the conversion of solar radiation to electricity via photovoltaic modules (solar panels). The electricity output from the project will then be supplied to the TransGrid electricity network via a connection to a 132 kV transmission line, which transects the development site.

The total capital investment value of the solar farm (estimated at approximately \$125 million) classifies it as a State Significant Development (SSD) to be assessed by the NSW Department of Planning and Environment (DPE). As an SSD, the project requires the preparation of an EIS under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The project is a large (231 ha) infrastructure project that is expected to create up to 150 jobs during construction and up to four full-time and eight part time positions when operational. Construction is expected to take approximately eight months and the project is expected to operate for 40 years.

The purpose of the EIS is to identify and assess potential environmental and social impacts associated with the construction, operation and decommissioning of the proposed Sandigo Solar Farm and develop effective mitigation measures.

The EIS has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) and agency comments, issued by DPE on 30 November 2017, and outcomes of community and stakeholder consultation.

Project applicant

The project applicant, ESCO Pacific, is an Australian developer of utility-scale solar farms, founded in 2015 to develop renewable energy assets under the Renewable Energy Target (RET) scheme. ESCO Pacific has a 1.3 Gigawatt pipeline of projects in NSW, Queensland and Victoria.

Environmental setting

The project is located within the Narrandera Local Government Area (LGA) located in the Riverina region of southwestern NSW. The rural region consists predominantly of irrigated land, with the agricultural, forestry and fishing industries being the main employers.

Land within the development site is zoned RU1 - Primary Production under the Narrandera Local Environmental Plan (LEP). The site extends over three lots used for agricultural purposes that are currently owned by the one landholder.

The development site is a mixture of grazed and cropped paddocks and is highly modified due to a long history of agriculture and grazing. The site is comprised largely of pasture grasses and environmental weeds. Apart from scattered paddock trees, native vegetation is largely absent. Despite this, some areas of native vegetation remain around the edges of the site and in adjoining road reserves.

Biodiversity values within the site include fifteen trees containing hollows which are potential habitat, and three threatened fauna species: the Superb Parrot, Grey-crowned Babbler and White-fronted Chat that

may use the remnant vegetation to facilitate movement within the landscape for feeding or juvenile dispersal.

The development site is generally flat to gently undulating. The site is crossed by a number of ephemeral watercourses. However, it does not support aquatic habitat of value. The nearest permanent waterway, Sandy Creek, is located 500 m to the north. The site falls within the catchment of the Murrumbidgee River.

Project description

The Sandigo Solar Farm will comprise up to 310,000 solar photovoltaic (PV) modules, known more commonly as PV modules or solar panels. The panels will be mounted in rows on horizontal tracking or fixed tilt systems.

Key infrastructure items to be established for the project include:

- installation of solar panels in regular arrays
- metal mounting structures
- aboveground and underground DC cabling (low voltage)
- central inverters, step up transformers, and switchgear (PCUs)
- battery storage area
- underground AC cabling that will run from the PCUs to the solar substation (high voltage)
- a main step-up transformer and associated equipment
- perimeter safety fencing and security system
- supervisory control and data acquisition (SCADA) control systems
- site office and staff amenities
- maintenance shed
- permanent staff and contractor car parking area
- permanent all-weather site access (6 m) and access road leading to the office and substation (shared access with TransGrid)
- internal vehicle access tracks (4 m), leading to solar arrays and PCUs
- temporary site compound, lay-down area, and equipment storage areas during construction.

Each solar panel will be fixed to a metal mounting structure that will be piled or screwed into the ground without the need for any excavation work or use of concrete. This technique is used to minimise ground disturbance.

The project will also include the potential for battery storage to be installed on site. The batteries would be made of lithium ion and housed in containerised packs.

Alternatives considered

ESCO Pacific has undertaken a constraints and opportunities analysis to identify potential project sites in NSW and other States. Sandigo was chosen as the location of the solar farm due to the high solar irradiance in the region and the capacity of the TransGrid electricity network to transmit the power generated by the farm.

In selecting the development site from a range of options within the Sandigo area, ESCO Pacific has followed a process of avoiding, minimising and offsetting impacts to environmental and social values. Once the current site was chosen, this same process was followed to optimise project design, configuration and footprint. The result has been the selection of a site that can be developed with minimal adverse effects on the environment or local landholders.

Project benefits

The Sandigo Solar Farm will contribute Australia's greenhouse gas (GHG) commitments by reducing emissions associated with energy use and contributing to the achievement of the Renewable Energy Target (RET). The project will also be part of the transition away from fossil fuel reliance to cleaner electricity generation, and the transition to increased energy security through a more diverse energy mix.

At a regional level, the project represents investment in an important rural area of the State and will contribute to a more diversified and sustainable income base. At a local level, project benefits will include employment and training opportunities and local economic stimulation.

Project permissibility

The proposed project has been assessed as a permissible development for which consent can be granted as an SSD under the Section 89E of the EP&A Act. The project as proposed in this EIS is also compatible with surrounding land use, and generally consistent with the requirements of the Narrandera LEP and relevant State Environmental Planning Policies (SEPPs).

A reconfiguration of the existing three lots will be required that conflicts with the requirements of the LEP. However, the Narrandera Shire Council has expressed support for the project and has provided in-principle agreement for the reconfiguration to proceed.

Community and stakeholder engagement

ESCO Pacific has prepared a Stakeholder and Community Consultation Plan to guide communication activities relating to the project and assist in the preparation of the EIS. Consultation has been undertaken with numerous government agencies and council to clarify requirements, discuss methodologies, and seek feedback. Agencies, council and the community appear to be supportive of the project.

ESCO Pacific has also been actively engaging with the local Aboriginal community in the region and the Local Aboriginal Land Councils (LALCs).

Risk assessment and screening

A qualitative environmental risk assessment of the project has been undertaken as part of this EIS. The assessment concluded that the level of risk associated with the construction, operation and rehabilitation of the project, taking into account the implementation of the proposed risk controls, mitigation strategies and management plans, is acceptably low.

Impact assessment

Biodiversity

A biodiversity assessment was undertaken by Ecolink and EnviroKey to identify ecological constraints for the project and prepare a Biodiversity Development Assessment Report (BDAR).

The vegetation within the site is identified as Plant Community Type (PCT) 76, belonging to the endangered Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt Bioregions community. However, the vegetation does not qualify as the nationally significant Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia community.

Up to 1.63 ha of PCT 76 will require removal from within the development site. The vegetation to be cleared comprises 54 paddock trees, including 15 hollow-bearing trees. Two ecosystem credit class offsets are required for this vegetation.

Following targeted threatened species surveys for 'candidate threatened species' identified by the Biodiversity Assessment Methodology (BAM) calculator, up to four threatened fauna species may be impacted by the project:

- Superb Parrot
- Sloane's Froglet (presumed present to expedite the approvals process, despite lack of habitat)
- Grey-crowned Babbler
- White-fronted Chat.

Four species credits, in total, will be required for impacts to the Superb Parrot and Sloane's Froglet.

The assessments identified that the proposed development is unlikely to significantly impact on any Matters of National Environmental Significance (MNES).

The avoidance of habitat during project siting, in combination with appropriate environmental safeguards during construction of the project is expected to ensure the development meets the requirements to avoid and minimise impacts on biodiversity values.

Aboriginal cultural heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) by Aboriginal Cultural Heritage Management (ACHM) has been prepared to identify aboriginal cultural heritage values within the development site and surrounding area.

One Registered Aboriginal Party (RAP) from the Wiradjuri people was identified as part of the consultation process required under Part 6 of the *National Parks and Wildlife Act 1974*. The RAP accompanied the survey team during the archaeological survey of the development site.

The archaeological survey identified a total of three Aboriginal cultural heritage sites within the development site and 22 artefacts were recorded. The cultural material found within the development site is ubiquitous to most of the country and is of low scientific significance. The artefacts within the site are to be relocated in consultation with the RAP.

A written report was provided by the RAP on the cultural significance of the development site, identifying natural values such as flora and fauna, and proposing measures for their protection.

Although the project has been designed to avoid harm wherever practicable and the archaeological significance of the sites within the development site is generally low, the project's impacts will contribute to the cumulative loss of Aboriginal cultural values and archaeological sites within the local area, and the region more widely.

Historic heritage

An historic heritage assessment was undertaken by ACHM to identify historic heritage values of the land within the development site. No known places of historic heritage value or significance were identified within or intersecting the development site.

Hydrology and water resources

An assessment was undertaken of potential project impacts on hydrology and water resources. The assessment included an investigation of flood risk undertaken by Alluvium Consulting Australia which involved the development of a 2D flood model and the use of the Direct Rainfall Approach for flood simulation.

The flood risk assessment concluded that the potential of the development to be an obstruction to riverine flood flow is negligible. Based on a literature review, the assessment also concluded that additional runoff as a result of the project is unlikely to occur provided site vegetation conditions are maintained and impervious areas are not increased substantially.

An investigation of flooding hazard showed that the majority of the development site is of low risk. The indicative location of the substation and office buildings is outside the potential flooding zone.

The project is not expected to result in any significant impacts on surface water or groundwater hydrology or quality, during construction or operation, provided the management and mitigation measures proposed in the EIS are implemented. In addition, the project is not expected to impact on the availability of existing surface water or groundwater resources.

Soils and land use

Potential impacts on soils and land use were assessed, including impacts on agricultural land and compatibility with existing land uses.

Database searches were undertaken that showed: no record of existing contamination on the development site; no overlapping minerals, petroleum, or coal exploration titles or applications; a low probability of acid sulphate soils being present; and no areas of Biophysical Strategic Agricultural Land being present. The site is not located within a flood planning area as designated under the Narrandera LEP.

The project will alter the current land use from agriculture to electricity generation, reducing the availability of land for agriculture. However, once the project is decommissioned, the site could be returned to its pre-existing agricultural state.

Soil surveys identified moderately dispersive soil on site that is prone to erosion. However, adverse impacts on soil and land capability during construction and operation are expected to be readily manageable, provided that the management and mitigation measures proposed in the EIS are implemented.

Traffic and transport

A traffic impact assessment was undertaken by IMPACT Traffic Engineering. The assessment identified the existing road network conditions and assessed the impacts of the project by considering the proposed vehicle access routes, site access, vehicular movements and sighting requirements.

Roads along the proposed site access route were identified as being approved for General Mass Limits and Concessional Mass Limits heavy vehicles, with the exception of Mitchells Road, which runs along the site's western boundary. Apart from needing approval to use Mitchells Road for heavy vehicles, the site access route was assessed as being suitable for accommodating construction and other project related traffic.

Peak project related traffic volumes during construction are expected to increase Sturt Highway traffic by approximately five per cent, which is expected to be absorbed with no significant detrimental impacts to operation or safety. The use of local access roads by construction traffic will result in a significant increase to existing traffic volumes. However, the roads are expected to be able to cater for the increase in use.

ESCO Pacific will undertake pre-construction condition audits of local roads along the site access route and return them to their pre-construction condition once construction is complete.

Noise

A noise assessment was undertaken by Accent Environmental (Accent) that included conservative calculations of noise levels during project construction and operation.

The nearest sensitive receivers to the development site are two dwellings; 'D2' located 1.4 km to the northeast and 'D3' located 1.7 km to the southeast. The noise assessment predicted that compliance with applicable guidelines will be achieved at both dwellings during construction and operation. However, the proposed use of a mulcher during construction will need to be managed effectively to mitigate noise impacts.

Dwelling 'D3' is located within 130 m of the site access route and is expected to be subject to intermittent nuisance traffic noise levels during daytime hours for the eight-month construction period.

Visual amenity

A visual impact assessment for the project was prepared by A.M. Environmental Consulting and Accent. The surrounding rural landscape is generally characterised by extensive agricultural land and vast flat open spaces.

Users of roads, including the Sturt Highway in the vicinity of the development site are the main visual receivers of the project. However, due to the nature of road use in the area, they are not considered to be highly sensitive receivers and as such the associated visual impact has been assessed as negligible.

The nearest dwellings to the development site are also potential visual receivers. However, there is only one dwelling within 2 km of the site from which the project is expected to be visible. This dwelling has been categorised as a sensitive receiver. However due to the distance of the dwelling from site and the screening effect of an intermittent tree line, the associated visual impact has been assessed as negligible.

No landscaping or visual screening of the development site has therefore been recommended.

Other potential visual aspects of the project, such as glare and reflectivity, are not expected to pose significant issues.

Air quality

The project has the potential to create air quality impacts through dust from soil disturbance and emissions from vehicles and machinery. However, these impacts will be temporary and primarily restricted to the construction phase. Impacts are expected to be readily manageable through the application of standard management practices during construction.

Bushfire and electrical fire

Bushfires and electrical fires can present a significant risk to human health, life, biodiversity, and infrastructure. The site is not located on land mapped as Bushfire Prone Land, and the surrounding area has been largely cleared of vegetation. ESCO Pacific has committed to preparing a Bush Fire Management Plan and an Emergency Response Plan to manage fire risk in accordance with the requirements of the Rural Fire Services and Fire and Rescue NSW.

Electromagnetic interference

The risk posed by project-generated electromagnetic fields (EMFs) has been considered with reference to International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines. Exposure of both staff and the general public to EMFs as a result of the project is expected to be well below ICNIRP reference levels and therefore unlikely to present a health risk.

Socio-economic

Socio-economic impacts on local communities, both positive and negative, have the potential to occur as a result of large-scale developments. As described above, the project is expected to have minimal adverse impacts on the local community, whilst resulting in significant benefits locally and regionally in terms of jobs and skills, economic stimulus and attainment of GHG and energy diversity/security targets.

Waste management and resource use

Resource consumption and waste generation will be minimised where practical. Wastes generated during project construction and operation will be managed appropriately through the adoption of standard waste management measures. Materials will be recycled or re-used where possible.

Cumulative impacts

The main potential for cumulative impacts is the development of the proposed Avonlie Solar Farm, to be located within 10 km of the development site. If construction of the Sandigo and Avonlie solar farms was to

coincide, then cumulative impacts may include community impacts such as demand for local resources (e.g. business and accommodation) straining capacity. However, construction of the two projects may also be sequential, depending on timing, which could provide an extended and sustainable period of income and business for the local region. If both projects shared existing transmission infrastructure, this will reduce or remove existing excess capacity in the local network.

Management and mitigation

Based on the findings of this environmental impact assessment, ESCO Pacific has committed to a suite of project-specific mitigation measures to manage the environmental risks associated with the project. It is intended to manage all commitments and environmental mitigation measures by preparing and implementing a Project Environmental Management Plan.

Conclusion

Based on the findings of this risk assessment and environmental impact assessment (including technical investigations conducted by specialists in key areas of potential concern) and the outcomes of community and stakeholder consultation, the project is considered likely to provide significant local and regional benefit while resulting in generally minor, short term and largely reversible environmental impacts. However, this conclusion relies on the effective implementation of the environmental management and mitigation measures outlined in this EIS.

1 Introduction

1.1 Purpose and scope of this document

This Environmental Impact Statement (EIS) has been prepared by Accent Environmental (Accent) on behalf of ESCO Pacific (the applicant) to support a Development Application (DA) to construct and operate a utility-scale solar farm and storage compound at Sandigo, New South Wales (NSW), located approximately 28 km southeast of the Narrandera Township and 55 km northwest of Wagga Wagga (Figure 1.1). The proposed Sandigo Solar Farm (the project) will¹ have a capacity of up to 100 megawatts (MW).

The total capital value (exceeding \$30 million) of the solar farm classifies it as a State Significant Development (SSD) to be assessed by the NSW Department of Planning and Environment (DPE). As an SSD, the project requires the preparation of an Environmental Impact Statement (EIS) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the EIS is to identify and assess potential environmental and social impacts associated with the construction, operation and decommissioning of the project and to develop effective mitigation measures where necessary.

This EIS has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) and agency comments, issued by DPE on 30 November 2017 (see Section 1.5), and outcomes of community and stakeholder consultation.

1.2 Project overview

The project is a utility-scale renewable energy development that will generate clean and renewable electricity from the power of the sun. Up to 100 MW of alternating current (AC) will be generated through the conversion of solar radiation to electricity via photovoltaic modules (solar panels). The solar panels will generate direct current (DC) electricity that will be inverted to AC electricity via the use of power conversion units (PCUs). The electricity output from the project will then be supplied to the TransGrid electricity network via high voltage cables connecting to the 132 kV transmission line which transects the development site.

Sandigo was chosen as the location of the solar farm due to the high solar irradiance in the region and the capacity of the TransGrid electricity network to transmit the power generated by the farm.

The project is a large infrastructure project that is expected to create up to 150 jobs during construction and up to four full-time and eight part-time positions when operational.

General information about the project is provided in Table 1.1.

¹ The use of 'will' rather than 'would' in this EIS is for stylistic purposes and is not intended to imply that the outcomes of either the project approvals process or the detailed design process is known.

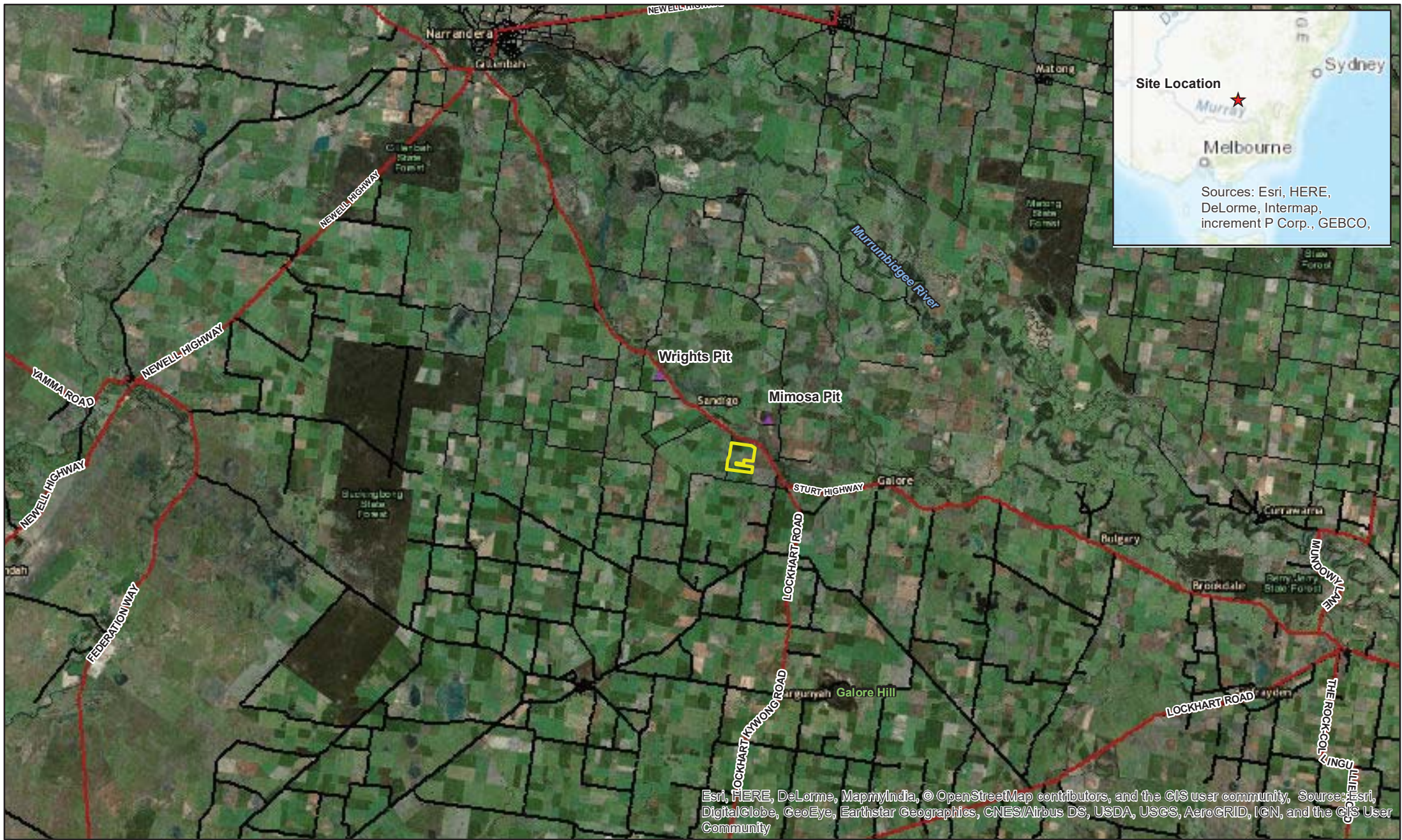


Figure 1.1

Regional Context

Sandigo Solar Farm

Client: Esco Pacific
 Project: Sandigo Solar Farm
 Project No: AE1078
 Mapping by GeoEccentric 16/02/2018

Legend

- Development Site
- Highway
- Main Road

N

0 2,000 4,000 8,000

Metres

1:300,000 when printed @ A4

ACCENT
ENVIRONMENTAL

1.2.1 Development site

The project is located within the Narrandera Local Government Area (LGA). The LGA is located in the Riverina region of southwestern NSW and is crossed by the Sturt and Newell Highways. The main land use of the region is rural and consists predominantly of irrigated land, with agricultural, forestry and fishing industries being the main employers.

The proposed development site in relation to the wider landscape is shown in Figure 1.2. The site extends over three lots used for agricultural purposes that are currently owned by one landholder residing 1 km northwest of the development site. A 40-year land lease will be negotiated with the existing landholder.

The 231 ha development site is highly modified due to its history of agriculture and grazing, and is comprised largely of pasture grasses and environmental weeds. The wider landscape consists largely of land historically cleared for agriculture.

The site is generally flat to gently undulating, at an elevation of between 156 and 172 m above sea level (ASL) and is crossed by a number of ephemeral watercourses.

An existing 132 kV transmission line (Yanco to Wagga 330) transects the northern end of the development site, running northwest to southeast, and will be utilised by the project. A 66 kV transmission line (Essential Energy) is located immediately northeast of the site, and another 132 kV transmission line is located approximately 600 m to the south.

Table 1.1 Sandigo Solar Farm project overview

Address	174 Mitchells Road, Sandigo, New South Wales, 2700
Applicant	ESCO Pacific Pty Ltd
Council	Narrandera Shire Council
Titles	<ul style="list-style-type: none"> • Lot 55 on Plan 754550 (168.1 ha located within development site) • Lot 33 on Plan 754550 (53.4 ha located within development site) • Lot 35 on Plan 754550 (9.1 ha located within development site)
Total indicative area	231 ha (development site) 420 ha (lots 33, 35 and 55, including land within the development site)
Land use	Cropping, grazing – high level of ground disturbance
Capacity	Up to 100 MW (AC)
Connection	TransGrid 132 kV Transmission line #994

1.3 Project applicant

The project applicant, ESCO Pacific, is an Australian developer of utility-scale solar farms, founded in 2015 to develop renewable energy assets under the Renewable Energy Target (RET) scheme.

ESCO Pacific has a 1.3 Gigawatt pipeline of projects in NSW, Queensland and Victoria that in February 2018 included:

- the 140 MW Mulwala Solar Farm in NSW for which EIS preparation and consultation has commenced
- the 148 MW Ross River Solar Farm, near Townsville, Queensland, currently under construction
- six additional approved projects in Queensland, totalling 500 MW
- the 170 MW Finley Solar farm in NSW, which obtained development consent in January 2018
- three projects in Victoria totalling 500 MW (approvals due early 2018).

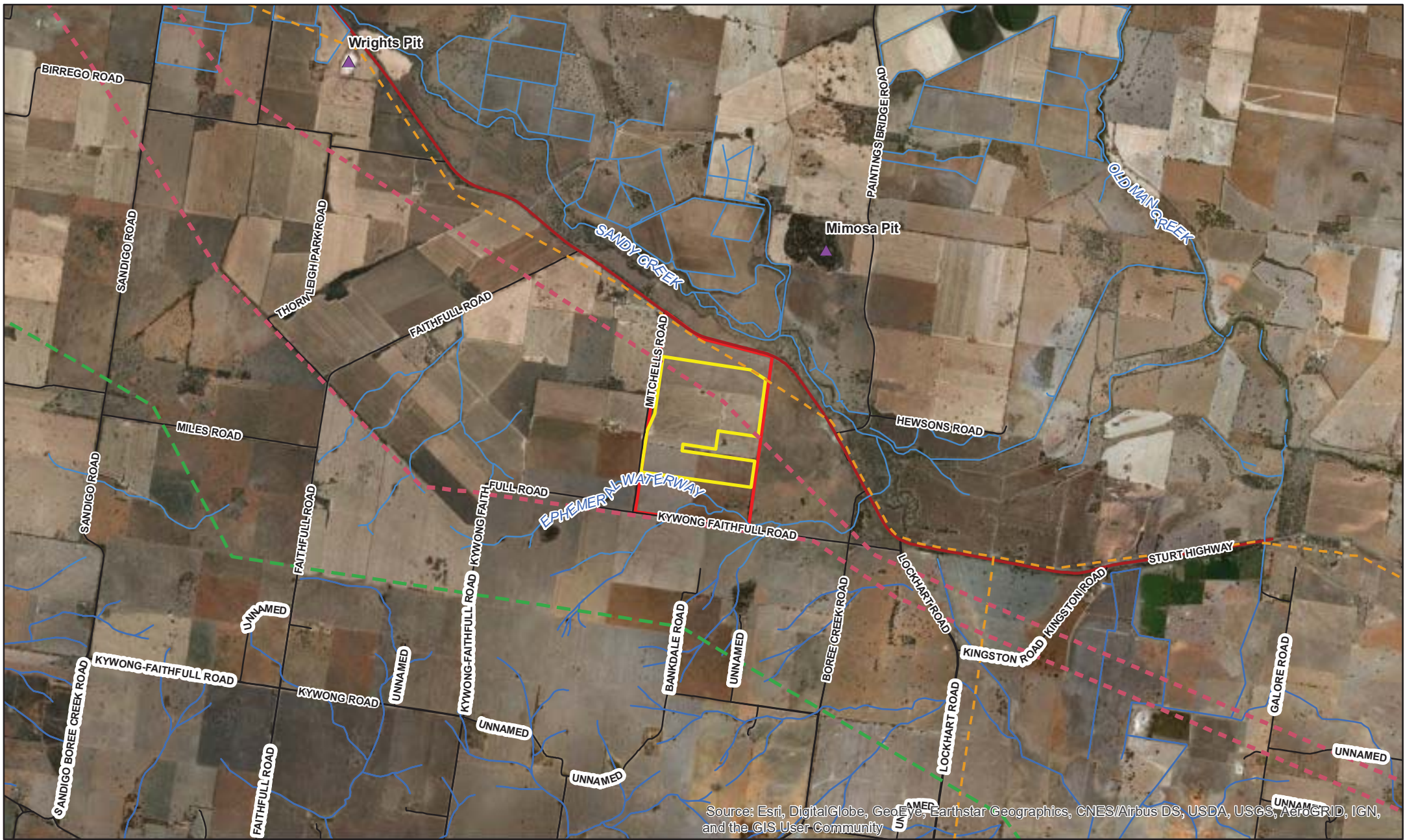
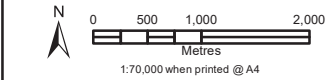


Figure 1.2

Local Context Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 16/02/2018

- Legend**
- Development Site
 - Subdivision Lot
 - 66kV Line
 - 132kV Line
 - 330kV Line
 - Watercourse
 - Highway
 - Main Road
 - Local Road



ESCO Pacific is headquartered in Melbourne and has a team of professionals with specific experience in developing and delivering to market, utility-scale renewable energy projects in Australia and internationally.

1.4 Capital investment value

The project will have a capital investment value of approximately \$125 million.

1.5 Secretary's Environmental Assessment Requirements

To initiate the environmental approvals process for the project, a Preliminary Environmental Assessment (PEA) Scoping Report (Accent 2017) was prepared to support a request to DPE for issue of the SEARs for the project. The PEA Scoping Report was provided for two proposed solar farm locations, including the current development site, with the capacity to generate up to a combined 300 MW (AC). ESCO Pacific is no longer proceeding with development of the second site.

The SEARs are intended to provide guidance on the process for environmental assessment and the structure and general content of the EIS.

In accordance with Clause 3, Schedule 2 of the EP&A Regulations, a written application accompanied with the PEA Scoping Report was made to the Secretary on 1 November 2017 requesting SEARs for the project (Application number: SSD 8872). The SEARs were issued by DPE on 30 November 2017 and were accompanied with statutory agency comments. ESCO Pacific undertook additional consultation with Narrandera Shire Council and the NSW Office of Environment and Heritage (OEH) to seek clarification and advice regarding the SEARs.

A copy of the SEARs and agency comments, as well as relevant correspondence with statutory agencies, are provided in Appendix A and summarised in Table 1.2 and Table 1.3. Each requirement listed in Table 1.2 and each issue listed in Table 1.3 is cross-referenced with the section of the EIS in which it is addressed.

Table 1.2 Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements	Section in EIS
General requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	1.5
In particular, the EIS must include:	
<ul style="list-style-type: none"> a stand-alone executive summary; A full description of the development, including: <ul style="list-style-type: none"> details of construction, operation and decommissioning; a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development. a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential; 	3.0 3.2 4.0

Secretary's Environmental Assessment Requirements	Section in EIS
<ul style="list-style-type: none"> an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: <ul style="list-style-type: none"> a description of the existing environment likely to be affected by the development an assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the two sites and existing or proposed developments, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and a description of the measures that would be implemented to monitor and report on the environmental performance of the development; a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and the reasons why the development should be approved having regard to: <ul style="list-style-type: none"> relevant matters for consideration under the <i>Environmental Planning and Assessment Act 1979</i>, including objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. <p>In addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by:</p> <ul style="list-style-type: none"> a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000), including details of all the assumptions and components from which the capital investment value calculation is derived; and the consent in writing of the owner of the land (as required in clause 49(1)(b) of the Environmental Planning and Assessment Regulation 2000). 	<p>8.0</p> <p>9.0</p> <p>4.0 and 5.2.1</p> <p>To be provided separately</p> <p>To be provided separately</p>
Specific issues	
The EIS must address the following specific issues:	
Biodiversity - including an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the <i>Biodiversity Conservation Act 2016</i> (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the <i>Biodiversity Conservation Act 2016</i> (NSW).	8.1 and Appendix B
Heritage - including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.	8.2, 8.3 and Appendix D
Land - including an assessment of the impact of the development on agricultural land (including possible cumulative impacts on agricultural enterprises and landholders) and flood prone land, an assessment of any impacts to Crown lands, a	5.2.9, 5.3, 8.1, 8.4, 8.5, 8.9 and Appendix B

Secretary's Environmental Assessment Requirements	Section in EIS
soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries including but not limited to Wrights Pit, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivision.	
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 (particularly the Sturt Highway), including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	8.8 and Appendix H
Noise - including an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Noise Policy for Industry 2017</i> and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	8.7 and Appendix G
Transport - including an assessment of the site access routes (including Sturt Highway, Mitchells Road, Kywong Boree Creek Road and Malwa Road), site access points, transport between the two sites, any potential rail safety issues and likely transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);	8.6 and Appendix F
Water - including: <ul style="list-style-type: none"> an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Sandy Creek, Old Man Creek, drainage channels, wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; details of water requirements and supply arrangements for construction and operation; and a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom 2004); 	8.4 and Appendix E
Hazards and Risks - including: <ul style="list-style-type: none"> a preliminary risk screening in accordance with <i>State Environmental Planning Policy No. 33 – Hazardous and Offensive Development</i> and <i>Applying SEPP 33</i> (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with <i>Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis</i> (DoP, 2011) and <i>Multi-Level Risk Assessment</i> (DoP, 2011); and an assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure (including the proposed transmission line and 	7.0 8.11

Secretary's Environmental Assessment Requirements	Section in EIS
substation) against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) <i>Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields</i> .	
Socio-Economic – including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	8.12
Consultation	
<ul style="list-style-type: none"> During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Narrandera Shire Council. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS. 	6.0 and Appendix C
Further consultation after 2 years	
If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS.	-

Table 1.3 Key issues raised by statutory agencies

Agency	Key issue raised	Section in EIS
Narrandera Shire Council	Traffic movements of heavy vehicles and impact upon road safety, local traffic movement and the condition of the local roads should be considered.	8.6 and Appendix F
	Accommodation for workers during the construction phase should be considered.	8.12
	Visual screening of the proposed development should be considered.	8.8 and Appendix H
Department of Industry	An assessment of impact of construction and operation of the development on agricultural land (including possible cumulative effects to agricultural enterprises and landholders) and flood prone land.	8.5, 8.14, and 8.12
	A soil survey to consider the potential for erosion to occur.	8.5
	Compatibility of the development with existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land, and measures proposed to appropriately avoid, reduce or mitigate these impacts (including potential land use sharing arrangements with agriculture).	8.5
	Description of current and potential important agricultural land in accordance with <i>A guideline to identifying important agricultural lands in NSW</i> (2012).	8.5

Agency	Key issue raised	Section in EIS
	Description of proposed rehabilitation objectives and strategies (including the design criteria of the final land use and landform) for returning the land back to agricultural production, and proposed monitoring to be adopted to inform rehabilitation.	8.5
	An assessment of any impacts to Crown lands or roads, and any actions required to secure permission for these impacts.	5.2.24
Department of Planning and Environment – Resources and Geoscience	Identify the project’s compatibility of the development with existing land uses on the site and adjacent land (such as operating mines, extractive industries, mineral or petroleum resources and exploration activities), during operation and after decommissioning.	8.5
	Consult with the operators and/or titleholders of the above to establish if the proposal is likely to have a significant impact on current or future extraction of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and any way the proposed development may be compatible with any existing or approved uses, or current or future extraction or recovery under the land use compatibility requirements of Part 3 (13) of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.	8.5
	The EIS must include a mineral, coal and petroleum titles search through the Division’s MinView application, with the results shown on a map(s).	8.5
	Identify the Wrights Pit in text and on a map(s) in relation to the project and address land use compatibility considerations.	8.5
	Should biodiversity offsets be considered for this project, consult with the Division to ensure there are no potential sterilisation impacts to resources.	8.1 and 8.5
NSW Environment Protection Authority	Narrandera Shire Council will be the appropriate regulatory authority for pollution control and environmental management issues.	-
Fire and Rescue NSW	<p>A comprehensive Emergency Response Plan (ERP) be developed for the site, detailing:</p> <ul style="list-style-type: none"> • foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity or potential hazmat incidents) • risk control measures that would need to be implemented to safely mitigate potential risks to health and safety of firefighters and other first responders (including electrical hazards) • other risk control measures that may need to be implemented in a fire emergency due to any unique hazard specific to the site. <p>Store two copies of the ERP in a prominent ‘Emergency Information Cabinet’ directly adjacent to the site’s main entry point/s.</p>	8.10

Agency	Key issue raised	Section in EIS
	The operator of the facility to contact the relevant local emergency management committee (LEMC) post construction and prior to operation. LEMC contact details can be obtained from the relevant local council.	8.10
Office of Environment and Heritage	The EIS to appropriately address the following: <ul style="list-style-type: none"> Biodiversity and offsetting Aboriginal cultural heritage Flooding Cumulative impact 	8.0
	Biodiversity <ul style="list-style-type: none"> Biodiversity impacts are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR), unless the Planning Agency Head and the Environment Agency Head determine the project is not likely to have a significant impact on biodiversity values. The BDAR must be prepared in accordance with the <i>Biodiversity Conservation Act 2016</i>, Biodiversity Conservation Regulation 2017, and Biodiversity Assessment Method. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method. The BDAR must include details of the measures proposed to address the offset obligations as follows: <ul style="list-style-type: none"> total number and classes of biodiversity credits required to be retired for the development/project number and classes of like-for-like biodiversity credits proposed to be retired number and classes of biodiversity credits proposed to be retired in accordance with the variation rules any proposal to fund a biodiversity conservation action any proposal to make a payment to the Biodiversity Conservation Fund. If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits. The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the <i>Biodiversity Conservation Act 2016</i>. 	8.1 and Appendix B
Office of Environment and Heritage	Aboriginal cultural heritage <ul style="list-style-type: none"> An Aboriginal Cultural Heritage Assessment Report (ACHAR) must be prepared. The EIS must identify and describe the Aboriginal cultural heritage values existing across the whole area that will be affected by the development, with identification conducted in accordance with the relevant codes of practice and guidelines. Where Aboriginal cultural heritage values are identified, 	8.2 and Appendix D

Agency	Key issue raised	Section in EIS
	<p>consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW) and the significance of these values documented in the EIS.</p> <ul style="list-style-type: none"> Potential impacts on Aboriginal cultural heritage values should be assessed and documented in the EIS, and demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH. 	
	<p>Historic heritage</p> <ul style="list-style-type: none"> The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, and trees. Where impacts to State or locally significant heritage items are identified the assessment shall address the requirements outlined for historic heritage in Attachment A. 	8.3 and Appendix D
	<p>Flooding</p> <ul style="list-style-type: none"> The EIS must map features relevant to flooding as described in the Floodplain Development Manual 2005. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event. The EIS must model the effect of the proposed development (including fill) on the flood behavior under the following scenario: <ul style="list-style-type: none"> Current flood behavior for a range of design events as identified above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change. Modelling in the EIS must assess and document impacts on existing flood behavior in accordance with requirements outlined in Attachment A and relevant provisions of the NSW Floodplain Development Manual 2005. 	8.4 and Appendix E
Roads and Maritime Services	<p>Consideration of:</p> <ul style="list-style-type: none"> Construction and decommissioning phase – the transport of materials and equipment / components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility. Operational phase – the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project. 	8.6 and Appendix F

Agency	Key issue raised	Section in EIS
	The implications of the State Environmental Planning Policy (infrastructure), particularly clause 101 needs to be addressed.	5.24, 8.6 and Appendix F
	Development of a Traffic Impact Assessment (TIA), addressing impacts of traffic generated by the development upon the nearby road network, to be submitted with the Development Application. The TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site.	8.6 and Appendix F
	A Traffic Management Plan to manage traffic generated during the construction and operation period, detailing potential impacts of the project and measures to maintain standard and safety of the road network, and procedures to monitor and ensure compliance.	8.6 and Appendix F
	Address potential distraction of passing motorists as a result of the project, including potential glint/glare impacts.	8.8 and Appendix H
	Consideration of the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road, particularly Sturt Highway.	8.8 and Appendix H

1.6 Project team

A number of specialist consultants were engaged by Accent to undertake the technical assessments required to support the preparation of this EIS. Table 1.4 lists the project team members and their relevant areas of assessment.

Table 1.4 Project team

Name	Organisation	Area of assessment
Michael Cramer	Accent Environmental	Project Director and technical review
Fatma Ipek	Accent Environmental	Project Manager and EIS preparation
Ian Finley, Neil Wines and Ashwini Ramakrishna	Accent Environmental	EIS preparation
Amanda Feetham	Accent Environmental	GIS and graphics
Rebecca Mase	A.M. Environmental Consulting	Visual assessment
Stuart Cooney and Simon Scott	Ecolink	Biodiversity
Steven Sass	EnviroKey	Biodiversity
Shaun Canning	ACHM	Aboriginal Cultural Heritage
Christopher Power and Steve Skull	Alluvium Consulting	Flood risk
Paul Ollett	Hydralinc	Flood risk
James Rennie	Australian UAV	Topographic surveys
Cédric Bergé and Allison Hawke	ESCO Pacific	Community and stakeholder engagement Aboriginal consultation

2 Site description

This section provides a brief description of the site setting. More detailed information is provided in subsequent chapters.

2.1 Land ownership

The development site comprises parts of the following lots, which are owned by the same landholder (the area of each lot located within the development site is shown in brackets):

- Lot 55 on Plan 754550 (168.1 ha)
- Lot 33 on Plan 754550 (53.4 ha)
- Lot 35 on Plan 754550 (9.1 ha).

The total size of the three lots (including the development site) is 420 ha. The landholder's consent has been obtained for the lodgement of the DA and the supporting EIS.

2.2 Approvals

There have been no DAs for the development site or immediate vicinity, other than those provided for the establishment of residential dwellings and associated farm infrastructure.

2.3 Zoning

Under the Narrandera LEP, the proposed development site is located on land that is zoned RU1 - Primary Production (NSC 2013). The land zoning for the site is shown on Figure 2.1.

The RU1 zoning classification provides planning objectives and activities which are permitted and prohibited, which are discussed in relation to permissibility of the project in Chapter 5.

2.4 Land use

2.4.1 Site land use

The three lots on which the development site is located are a mixture of grazed and cropped paddocks. The crops are grown in rotation, interspersed with years in which the paddocks are sowed with Rye-grass and Lucerne. In those years, sheep graze the paddocks, keeping the biomass low.

Due to the long history of grazing and cropping activities in the area, there has been significant disturbance to the natural environment, and native vegetation is largely absent. Photo 2.1 and Photo 2.2 show the development site in late November 2017 when it was being grazed by sheep.

Two dams are present on the development site. However, no building structures or distinct tracks are present.

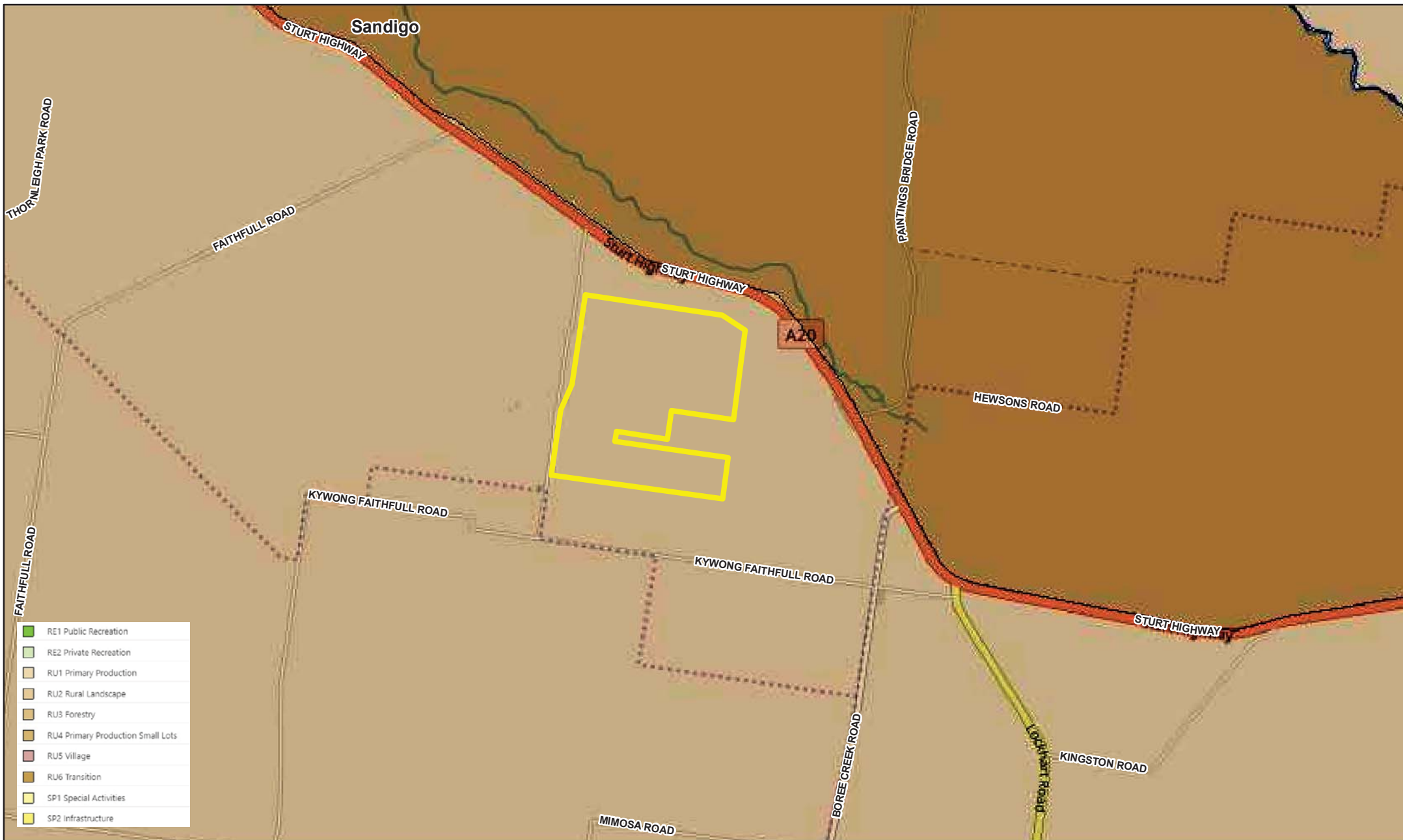


Figure 2.1

Local Zoning Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 16/02/2018

Legend

Development Site

Map generated from SEED web map 11/01/2018



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Metres

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Photo 2.1 Development site – looking west



Photo 2.2 Example of a scattered tree on the development site – looking north

2.4.2 Surrounding land use

The development site is located in the Riverina region of southwestern NSW, which consists predominantly of irrigated land, with agriculture, forestry and fishing being the main industries. The land use immediately surrounding the development site is similar to that of the site (i.e. mainly cropping paddocks).

Other land uses in the vicinity of the site include extractive industry use, with five quarries intermittently operating within 12 km of the site. The two closest are Mimosa Pit, 1.7 km north of the site and Wrights Pit, approximately 6 km northwest of the site.

Areas used for recreation in the surrounding region include:

- Sandy Creek, located 500 m to the north of the development site (see Figure 1.2 and Photo 2.3).
- Buckingbong State Forest (or Buckingbong Reserve), located 16 km east of the development site (see Figure 1.1).
- Galore Hill, a forested area and scenic lookout located 13.4 km southeast of the development site (see Figure 1.1 and Photo 2.4).

More detailed information on the surrounding land use is provided in Section 8.5.



Photo 2.3 Sandy Creek, at Paintings Bridge Road



Photo 2.4 Galore Hill, viewed from Lockhart Kywong Road

2.5 Sensitive receivers

As a result of the historical agricultural use of the area, the sensitive receivers potentially impacted by the project comprise rural residential dwellings and Sandy Creek. These sensitive receivers are shown on Figure 2.2 (note that the 1 km and 2 km buffer zones on Figure 2.2 are measured from the subdivision lot boundary, not the actual development site).

Eight dwellings are located within 4 km of the development site, as listed below. Those within 2 km of the development site are considered to be sensitive receivers.

D1: Site landholder dwelling, 980 m northwest

D2: Dwelling 1.4 km northeast

D3: Dwelling 1.7 km southeast

D4: Dwelling 2.5 km north

D5: Dwelling 3.4 km south

D6: Dwelling 3.1 km northwest

D7: Dwelling 3.2 km west

D8: Dwelling 3.9 km south

2.6 Climate

The nearest Bureau of Meteorology Automatic Weather Station (AWS) is located at Narrandera Airport (BoM Site: 074148), at an elevation of 145 m, approximately 34.5 km northwest of the development site. Climate data for the Narrandera Airport AWS is as follows (BoM 2017):

- The average annual minimum temperature is 9.8°C (with a range between 17.5°C in January and 3.2°C in July).
- The average annual maximum temperature is 23.8°C (with a range between 33.3°C in January and 14.3°C in July), with the warmest months generally between November and March.
- Annual mean rainfall is 437.3 mm.
- Highest rainfall is experienced from May to October (i.e. generally over winter). However, monthly rainfall ranges from 30.1 mm in March to 40.4 mm in October, indicating that rainfall is relatively consistent across all months and seasons.
- Wind speeds average between 7.2 and 16.3 km per hour at 9 am, with strongest winds during the summer months.
- During January through to April, winds from the east and northeast are most prevalent. During May to August, winds are generally from the east or northwest. From September to December, the prevailing wind direction is from the southwest.
- Mean monthly daily solar exposure (measured in mega-Joules/square metre (MJ/m²)) ranges from 8.1 MJ/m² in June to 27.9 MJ/m² in January, with mean monthly exposure being 18.2 MJ/m². This indicates that solar exposure is, as expected, higher during the summer months.

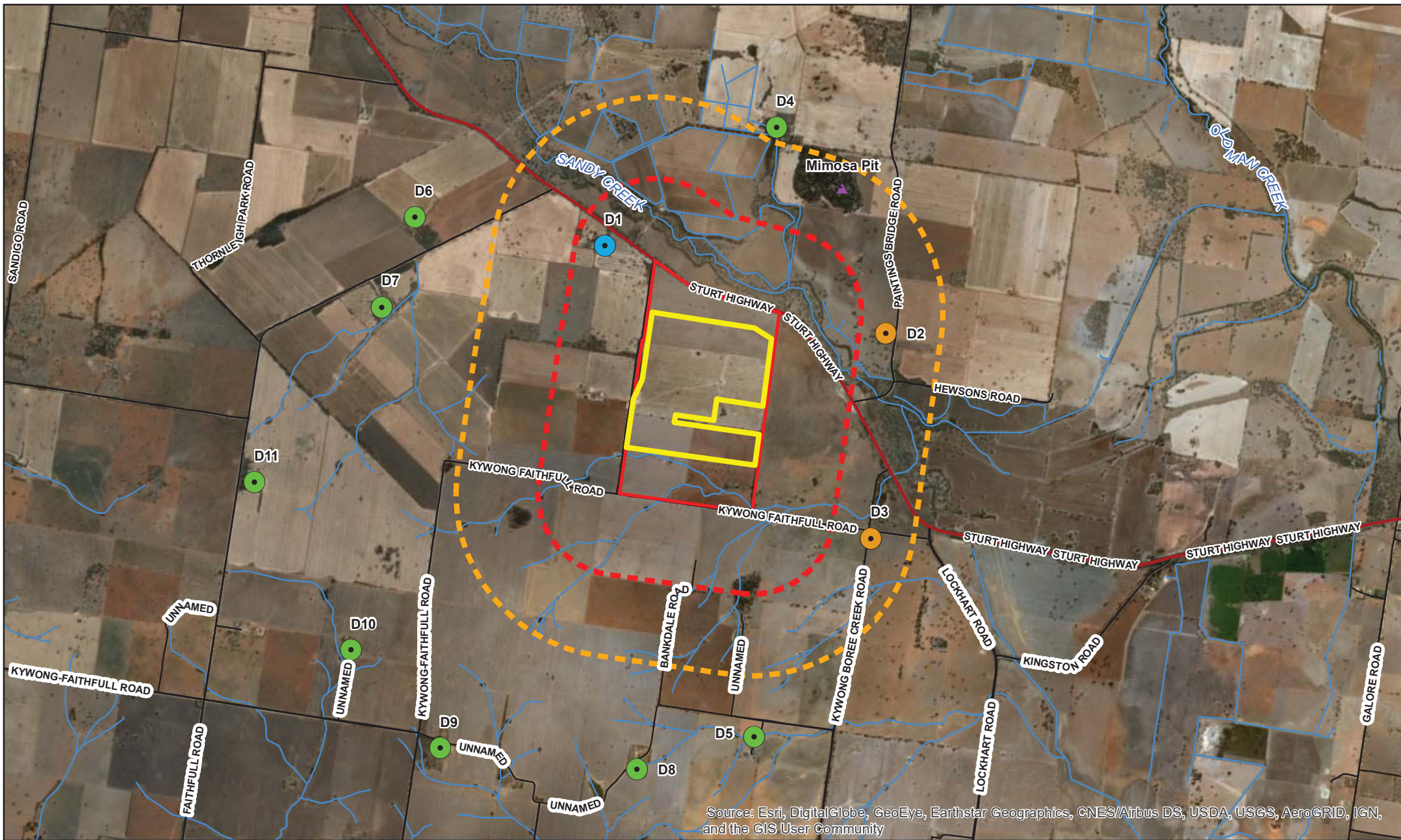


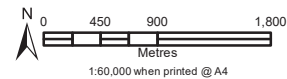
Figure 2.2

Sensitive Receivers Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 27/02/2018

Legend

- | | | |
|--------------------|-------------|---------------------|
| Development Site | Watercourse | Host Landholder |
| Subdivision Lot | Highway | Sensitive Receivers |
| 1 km Offset Buffer | Main Road | Other Dwellings |
| 2 km Offset Buffer | Local Road | |



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2.7 Geology and soils

The Narrandera 1:250 000 Geological Sheet (Pogson, 1974) indicates the geology of the area consists of Late Ordovician sedimentary rocks (largely obscured by residual and colluvial deposits) and minor Quaternary deposits of black and red clayey silt, sand and gravel of the Shepparton Formation.

The two main soil types in the area (OEH 2018), defined as kandosols and chromosols under the Australian Soil Classification (CSIRO 2018a and 2018b).

Further detail on geology and soils is provided in Section 8.5.

2.8 Topography and hydrology

2.8.1 Topography

The development site is relatively flat to gently undulating with elevations ranging from approximately 156 m above the Australian Height Datum (mAHD) in the north (near Sandy Creek) to approximately 172 mAHD in the south.

A low, west to east trending ridgeline extends most of the way across the southern section of the development site. As a result, the top two-thirds of the development site slopes gently in a generally northeastern direction and the southern third slopes gently in a generally southeastern direction.

2.8.2 Hydrology

The development site is located within the Murray-Darling Basin, approximately 12.8 km southwest of the Murrumbidgee River. The site is within the Sandy Creek subcatchment of the Murrumbidgee catchment (NSC 2015). The site is drained by a number of smaller unnamed and ephemeral tributaries of Sandy Creek. The northern part of the site drains to the northeast directly to Sandy Creek and the southern third drains to the south to an easterly flowing ephemeral tributary. The northern section of the site contains three constructed farm dams located along the ephemeral drainage lines.

The development site is not located within a flood planning area as designated under the Narrandera LEP.

Site hydrology and flood risk is discussed further in Section 8.4.

2.9 Biodiversity

The development site is located within the Lower Slopes Subregion of the South Western Slopes Bioregion, which lies in the foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range, extending into western Victoria.

A biodiversity site assessment, undertaken by Ecolink in late 2017 (Appendix B), identified that native vegetation is largely absent from the development site, with scattered paddock trees the most obvious remnants of the historic vegetation communities that once covered the area. Despite this, some areas of native vegetation remain around the edges of the development site and in the road reserves that adjoin the development site. Fifteen trees contain hollows which are potential habitat to a number of fauna species.

The three dams within the development site generally appeared to have been lined with clay and this, in combination with regular grazing by sheep, has resulted in the absence of fringing or aquatic native vegetation. There are no creeks or drains within the development site and no natural wetlands or swamps were observed during the biodiversity assessment.

Three threatened fauna species were identified within the vicinity of the development site: Superb Parrot *Polytelis swainsonii*; Grey-crowned Babbler *Pomatostomus temporalis temporalis* and White-fronted Chat *Epthianura albifrons*. Each of these three species may use the remnant vegetation to facilitate movement within the landscape for feeding or juvenile dispersal.

Weeds identified on the development site include Common Sowthistle *Sonchus oleraceus*, Prickly Lettuce *Lactuca serriola* and the high-threat weed African Lovegrass *Eragrostis curvula*.

Further information on the biodiversity of the development site and vicinity can be found in Section 8.1.

3 Project description

3.1 Overview

The Sandigo Solar Farm will comprise up to 310,000 solar photovoltaic (PV) modules, known more commonly as PV modules or solar panels. The solar panels use the same type of technology as commonly used in residential scale solar installations throughout Australia but are larger in size. The panels will be mounted in rows on horizontal tracking or fixed tilt systems.

The solar panels will generate DC electricity that will be inverted to AC electricity via the use of PCUs. AC power is the standard form of electricity used throughout Australia.

Electricity from the solar farm will then be connected to the TransGrid supply network by an on-site high voltage power reticulation system. The reticulation system will include an underground or above ground high voltage cable to the TransGrid 132 kV transmission line. Details of the site layout, environmental constraints, access roads, easements, and closest receivers are shown in Figure 3.1.

3.2 Infrastructure design and development site layout

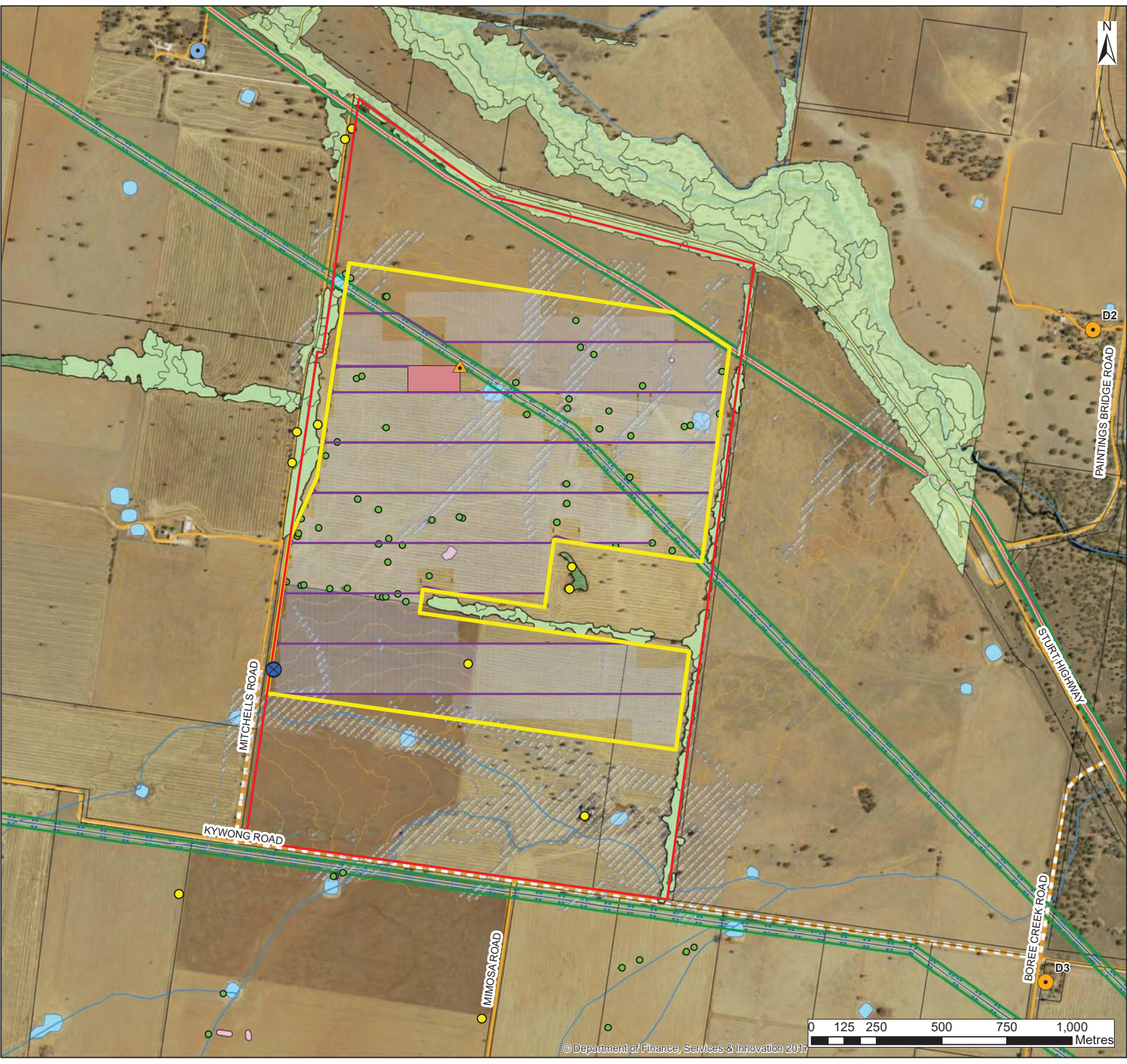
The infrastructure design and site layout aspects of the Sandigo Solar Project are discussed below.

3.2.1 Key project components

Key infrastructure items to be established for the project include:

- installation of solar panels in regular arrays
- metal mounting structures
- aboveground and underground DC cabling (low voltage)
- central inverters, step up transformers, and switchgear (PCUs) (up to 30 PCUs, 3 m in height)
- battery storage area
- underground AC cabling that will run from the PCUs to the solar substation (high voltage)
- a main step-up transformer and associated equipment
- perimeter safety fencing and security system
- supervisory control and data acquisition (SCADA) control systems
- site office and staff amenities
- maintenance shed
- permanent staff and contractor car parking area
- permanent all-weather site access (6 m) and access road leading to office and substation (shared access with TransGrid)
- internal vehicle access tracks (4 m) leading to solar arrays and PCUs
- temporary site compound, lay-down area, and equipment storage areas during construction.

The above components are discussed in further detail in the following sections. The design within the development site is currently conceptual. The switchyard/transformer could move to a different location along the transmission line (within the site); however, any relocation would take into account the need to avoid areas of flood hazard (see Section 8.4.3) and other environmental constraints.



PROJECT

Sandigo Solar Farm

MAP TITLE

Figure 3.1. Project Layout

Title Info

Lots 33, 35, 55 on Plan 754550

LEGEND

Sandigo Solar Farm

Project Boundary (Combined Lot Boundary) (420 hectares)

Development Footprint (231 hectares)

Site Office, Maintenance Shed, Switchyard and Battery Storage

PV Solar Array

Proposed Access Point

Indicative Connection Point

Internal Access Tracks

Landholder associated with the project

Sensitive Receivers

Project Access Route (off Sturt Hwy)

Ecological Value

Native Vegetation

Scattered Trees (within project boundaries)

Threatened Species

Other Habitats

Aboriginal Heritage

Artefact Scatter

Hydrology

Watercourses

Flood Hazard (1 in 100 years)

Dam

Others

Cadastral Boundaries

Existing Easement

Essential Energy 66kV Transmission Line

TransGrid 132kV Transmission Line

Roads / Tracks

Contours (1m)

ESCO

Pacific

DISCLAIMER:

This plan was prepared for the purpose and exclusive use of ESCO Pacific Pty Ltd and its subsidiaries and is not to be used for any other purpose. This map is not guaranteed to be free from error or omission. The location of features should not be relied on as exact field locations.
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Projection: GDA94 MGA55

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3.2.2 Solar arrays and ground mounts

The solar arrays will comprise up to 310,000 individual solar panels which will either be multicrystalline, monocrystalline, or thin film technology. Each solar panel will be fixed to a metal mounting structure that will be piled or screwed into the ground without the need for any excavation work or use of concrete. This technique is used to minimise ground disturbance. The PV mounting structures will slowly track (in a single axis) the horizontal movement of the sun through the use of an automated tracker unit. Alternatively, fixed tilt mounting structures may also be used. Under both scenarios the height of the fixing systems and modules will not exceed 4 m. Photo 3.1 below shows typical PV panels at a solar farm grouped in solar arrays.



Source: Array Technologies

Photo 3.1 Typical PV modules and solar array

3.2.3 DC cabling

DC cabling will be used to connect each PV module in a string to field DC boxes mounted near the solar panels. The DC boxes will be located approximately 1 m off the ground between the PV arrays. DC cabling will be installed underground at a minimum depth of 1 m between the DC boxes and the PCUs. DC cabling will be installed in accordance with Australian Standards and also with the requirements of Primefact 1063: Infrastructure Proposals on Rural Land (DPI 2013a).

3.2.4 Power conversion unit

Within each array block is a PCU, which contains the central inverters, step-up transformers and switchgear that convert the DC electricity collected from the PV panels into 33 kV AC electricity. 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. Photo 3.2 below shows a typical PCU with the relevant power conversion equipment installed.



Source: SMA Solar Technology

Photo 3.2 Typical power conversion unit

3.2.5 AC cabling

From the PCUs within each array block, underground or above ground AC cabling will be installed (to a minimum depth of 1 m if underground) and connected with the step-up transformer in the solar substation. AC cabling will be installed in accordance with Australian Standards and also with the requirements of Primefact 1063: Infrastructure Proposals on Rural Land (DPI 2013).

3.2.6 Step-up transformer and substation

A main step-up transformer and associated equipment located in a solar substation will convert the on-site AC reticulated 33 kV electricity to 132 kV electricity. The 132 kV supply will then be connected via a high voltage cable to the TransGrid 132 kV transmission line where it will enter the local electricity network. High voltage cabling will be installed in accordance with Australian Standards.

3.2.7 Local transmission network

The proposed connection point for the solar farm to the Transmission Network Service Provider (TNSP) is the 132 kV transmission line owned and operated by TransGrid. From the TransGrid transmission line, power is distributed to the national electricity grid.

3.2.8 Battery storage

The project will also include the potential for battery storage to be installed on site.

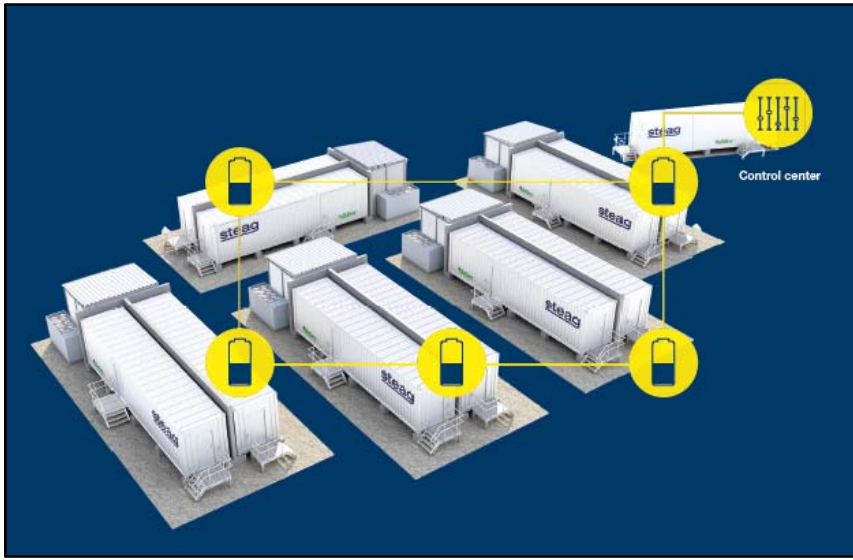
Solar farms are an intermittent source of energy. Battery storage systems can be used either to smooth the fluctuating energy produced by the solar farm or to store the excess energy during low demand periods for subsequent use during higher demand periods or when solar energy is unavailable (e.g. at night).

The batteries can also compensate for frequency variations in the electricity grid that can be caused by intermittent renewable generators, power plant outages or fluctuations in consumption. Batteries can store electricity from the grid or feed electricity into the grid in a matter of seconds to compensate for such variations.

In addition to the shifting of electricity output, energy storage on the site can contribute to:

- improved reliability of the electricity network and reduced electricity costs associated with grid upgrades to deal with peak energy demand
- sustainable outcomes by combining clean energy generation with clean energy storage.

Lithium ion batteries in containerised packs would be installed, as illustrated Photo 3.3 and Photo 3.4. The chosen battery will be identified in the procurement phase along with modules and inverters. Any battery will have undergone the required hazard assessment to ensure the product meets Australian Standards and legislated safety requirements.



Source: steag

Photo 3.3 Example of containerised packs



Source: Tesla

Photo 3.4 PowerPack system

3.2.9 System monitoring

The entire solar farm will be monitored through a SCADA system that will monitor the performance of all the solar equipment onsite. The SCADA system will also be capable of notifying staff onsite and remotely of system issues and failures.

3.2.10 Internal roads

Internal vehicle access tracks will be constructed to each PCU and to the solar substation to allow for site maintenance. Onsite tracks will be constructed of compacted gravel and, where required, geotextile fabric will be laid between the soil and the gravel. Internal access tracks will be up to 4 m wide to allow for the safe delivery, unloading and installation of key components such as the PCUs, PV panels, and switch equipment. The access road leading to the substation will also be designed in accordance with TransGrid requirements (e.g. 6 m wide) to enable access by their inspection and maintenance vehicles.

The exact position of access tracks will be determined during the detailed design phase when the layout of the solar arrays is finalised. Internal access tracks are private roads designed and constructed only for construction, operation and maintenance purposes. The conceptual locations of internal roads are shown on Figure 3.1.

3.2.11 Site office and staff amenities

A site office and staff amenities building will be constructed or installed at the site. The dimensions of the building are expected to be approximately 16 m long, 10 m wide, and up to 3 m high. All visitors and contractors will be required to report to the site office upon entry to the site. The office building will include staff offices and a control room. Staff amenities will include toilets, showers, a lunch room and a first aid room. The conceptual location of the site office during operation is shown on Figure 3.1.

3.2.12 Maintenance building

A maintenance building will be established adjacent to the site office and will provide storage for spare parts and maintenance equipment, and include a workshop. The maintenance building will be approximately 25 m long, 15 m wide, and 5 m high. The workshop building will be approximately 15 m long and 10 m wide.

3.2.13 Site access and parking

Access to the site during construction and operation will be from the Sturt Highway, located immediately north of the site, via Kywong Boree Creek Road and Kywong Faithfull Road (see Figure 3.1 and Section 8.6).

A vehicle parking area will be located adjacent to the site office, with parking spaces provided for operational and maintenance staff. Parking for construction vehicles will be either at designated laydown areas, storage locations, or where construction activities are concentrated at any given time.

3.3 Site services and utilities

3.3.1 Site power

Diesel generators will be available for power supply through the construction period. Should low voltage power be available in the vicinity, the project may use power from the existing network during construction.

Once operational, it is anticipated that the project will use power generated from the solar farm rather than a grid connected service.

3.3.2 Water and sewerage supply

Temporary toilets will be available throughout the construction period for use by contractors. The toilets will be pumped out by a local, licenced waste contractor.

Once operational, it is anticipated that the development will collect water from building roofs and use onsite water storage tanks (e.g. 2 x 35 kilolitre [kL] tanks). It is anticipated that 500 kL of water will be used

during operation each year for cleaning, maintenance, and staff amenities. Water will be trucked in during periods when the onsite water tanks contain insufficient water.

Sewage generated during operation will be treated by an onsite bio-cycle system, installed to comply with Building Code of Australia (BCA) requirements.

3.3.3 Communications

The development is expected to use both mobile and fixed line networks for communication purposes. Where a connection is made to the fixed line network, cabling will follow existing access tracks and road reserves to minimise ground disturbance.

3.4 Construction

3.4.1 Construction materials

The majority of the construction materials and components are likely to be sourced from overseas due to the specialised nature of the equipment. Materials will be transported by road from port facilities in either Sydney or Melbourne in 12 m shipping containers. Civil materials such as aggregates and concrete will be sourced where available from local suppliers. The main construction materials will include:

- aggregates, road base, and concrete
- steel fencing materials
- steel piles and ground screws
- steel mounts and bolts
- cabling, conduit, and weather proof junction boxes
- PV modules and mounting structures
- shipping containers to house central inverters
- weatherproof DC boxes and steel posts
- steel framing and Colorbond sheeting for maintenance shed and site office
- timber and fixtures for building fit-out.

3.4.2 Site preparation

Site preparation will commence immediately across the development area to allow for the timely installation of roads, drainage, solar equipment, cabling, and infrastructure. Site preparation activities will generally involve the following:

- slashing and/or removal of paddock trees or vegetation approved for removal
- removal of existing fencing and establishment of boundary fencing
- establishing the site access point and internal roads for delivery of machinery and equipment
- undertaking land survey, geotechnical and other preliminary investigations
- establishing ancillary facilities including the site compound, laydown areas and temporary contractor facilities.

3.4.3 Infrastructure installation

The installation of infrastructure will commence directly after site preparation works are finalised. The key infrastructure activities will include:

- backfilling and levelling of dams (where required)
- installing internal roads and access tracks

- installing drainage works and regrading of surface features (where required)
- construction of the permanent site office, maintenance shed, and switchyard
- installing mounting structure foundations by driving steel piles pneumatically into the ground using specialist equipment (dependant on ground conditions ground screws may be used)
- attaching steel mounting structures to the ground piles
- installing solar panels onto the mounting structures, including tracker units
- installing and connecting the solar panels to the DC boxes with aboveground cabling
- installing the PCUs
- provision for installing battery energy storage system behind the meter
- connecting the DC boxes to the PCUs by trenching and underground cabling, and connecting the PCUs to the onsite power reticulation system and step-up transformer
- grid connection through the installation of underground mains from the step-up transformer to the TransGrid transmission line
- commissioning and testing of PV strings, central inverters, switch equipment, step-up transformer, monitoring systems, and electrical protection systems.

3.4.4 Construction equipment

Construction equipment required for the establishment of the solar farm will be limited to the heavy machinery and plant generally used across the wider construction industry. It is envisaged that all of this machinery and plant will be able to be sourced locally. Construction equipment to be used onsite will include:

- 1 x truck and dog for civil works
- 1 x D6 dozer or equivalent for levelling and road development
- 1 x 24 tonne excavator for earthworks
- 1 x grader for road development and levelling activities
- 1 x mulcher for the mulching and re-use of vegetation material onsite
- 1 x 7 tonne vibrating roller for road construction
- 1 x front end loader for the movement and loading of soil and aggregate materials
- 1 x water cart for road construction and dust suppression
- 1 x piling rig for installing PV piles
- 1 x Franna crane for the lifting of loads, erection of steel and movement of heavy plant
- 2 x trenchers for the installation of underground conduits and cabling
- 1 x portable generator for temporary site power
- hand power tools and equipment.

3.4.5 Construction schedule

The construction of the project is expected to take up to eight months to allow for the gradual development and commissioning of the facility (Table 3.1).

Table 3.1 Construction schedule

Activity	Month							
	1	2	3	4	5	6	7	8
Site preparation and establishment								
Civil works (roads and drainage)								
Installation of PV piles, support structures and trackers								
Installation of PV panels								
Cabling of PV Strings								
Installation of central inverters								
Installation of underground cabling from central inverters								
Installation of switch equipment, step-up transformer and site office								
Connection to transmission line								
Commissioning								

3.5 Commissioning and operation

3.5.1 Commissioning activities

Commissioning of the solar farm will be undertaken once equipment is installed to ensure that the PV panels and associated infrastructure are structurally and electrically safe. Commissioning will also ensure that the solar plant is operating within its design and performance parameters.

Commissioning of the solar farm will involve the testing of the following components:

- PV module strings
- central inverters
- transformers
- switching equipment
- lightning protection systems
- earthing protection systems
- electrical protection systems
- grid connection compliance protection and disconnection systems
- battery storage
- SCADA system (including meteorological stations)
- support structures
- security systems.

The above components of the solar farm will be subject to a maintenance and inspection regime for the life of the development.

3.5.2 Operational activities

The Project is anticipated to have an operational life of up to 40 years.

Operational activities involve monitoring of equipment on a daily basis, full servicing of inverters and substation equipment on an annual basis, and cleaning of the solar panels at regular intervals depending on system performance benchmarked to weather conditions.

There will be no storage of hazardous or dangerous goods or materials on site during the operation of the project.

The solar panels are expected to need cleaning up to two times per year. Any water required for cleaning of the panels will be brought to site in water trucks.

Land between the panels and along the boundary of the solar farm will require maintenance to control vegetation growth. Such maintenance will be undertaken either through the use of livestock (i.e. sheep) or by mowing with a slasher.

3.6 Workforce

3.6.1 Construction

The anticipated construction workforce will be approximately 150 staff. It is expected that the majority of the workforce will be sourced from the local area. Non-local workforce or contractors are likely to come from other areas of NSW and are likely to seek accommodation in either Narrandera or Wagga Wagga. It is expected that the majority of the construction staff movements will be made to/from site using mini buses from Narrandera.

3.6.2 Operation

During operation, it is expected that there will be up to four full-time and eight part-time staff based at the solar facility to manage site activities and to support routine plant operation and maintenance. The operational staff are likely to originate from Narrandera or the surrounding region.

3.7 Hours of operation

3.7.1 Construction

Construction activities at the site will occur from 7 am to 6 pm Monday to Friday and from 8 am to 1 pm on Saturdays. No construction activities will occur on Sundays or public holidays.

3.7.2 Operations

As the solar farm only generates power during daylight hours, site staff will only be present during the daytime, except in response to any emergencies. Regular hours will be from 7:30 am to 4:30 pm, Monday to Saturday.

3.8 Traffic generation

3.8.1 Construction

It is anticipated that the average traffic generation during the construction phase will peak at 30 movements (round trips) per day in month five, comprising 14 heavy vehicle and 16 light vehicle movements. At least 10 oversized vehicles will be required during construction stage.

Further detail on construction traffic movements and impacts is provided in Section 8.6.

3.8.2 Operations

It is anticipated that the average traffic generation during operation will peak at 21 movements (round trips) per week in year one and 19 in year two, before averaging 17 movements per week in subsequent years.

Further detail on operational traffic movements and impacts is provided in Section 8.6.

3.9 Fire management

The development site is located within an existing highly modified and cleared environment, therefore there is no dense bushland and only limited vegetation in or surrounding the site. The site comprises a mixture of grazed and cropped paddocks.

Once the solar farm is constructed and operational, the lands in and around the PV panels, PCUs, and site office will require maintenance to ensure that the potential for fire is kept low. Areas easy to access will be maintained by the use of a tractor-mounted slasher. More difficult areas in between the PV panels will be maintained through the use of sheep to reduce grasses.

A water tank, solely for fire protection purposes, will be located adjacent to the site office. The tank will be located such that there is suitable all-weather access for the RFS fire tankers and appliances.

An ERP will also be prepared for the site which will detail an evacuation plan, fire response, location of fire services and contacts, and a site muster point.

An assessment of bushfire risk and relevant management and mitigation measures is presented in Section 8.10.

3.10 External lighting

External lighting at the solar farm will be restricted to the area where the maintenance shed, permanent site office and switch yard will be located. Lighting will be provided for security reasons and for staff and contractors using the site facilities during operation. All external lighting around buildings will be directed downwards and towards the facility to ensure there is no impact to neighbouring properties from lighting.

3.11 Site security

To ensure public safety, the solar farm will be fenced around the perimeter of the developable area. The security fence will be a height of 2.4 m and will feature closed-circuit television (CCTV) security cameras mounted at regular intervals for monitoring purposes. The fence is expected to be constructed of cyclone fencing material with a strand of barbed wire at the top to deter intruders.

3.12 Environmental management

The development will be constructed under a construction environmental management plan (CEMP) and operated under an operation environmental management plan (OEMP). The CEMP and OEMP will include the following key sections:

- Introduction
- Environmental policy
- Organisational structure
- Description of activities
- Identification of environmental issues and impacts
- Environmental management and monitoring
- Contingency plans and emergency response
- Complaints management
- Auditing and reporting
- Continuous improvement.

The CEMP and OEMP will be formally developed during the post-approvals process in consultation with relevant government agencies. The OEMP will be a living document that is updated as necessary to incorporate any key operational changes. A decommissioning management plan (DMP) will be prepared three years before the planned decommissioning of the project (see Section 3.13.1, below).

3.13 Site decommissioning

3.13.1 Decommissioning management plan

Three years prior to the commencement of decommissioning activities, a DMP would be prepared in consultation with the landholder and submitted for approval by DPE. The DMP would include the following key elements:

- rehabilitation strategies and objectives
- rehabilitation design criteria
- productivity targets to ensure the re-establishment of agricultural production (if agreed as the final land use)
- expected timeline for rehabilitation works
- mitigation measures and monitoring.

3.13.2 Infrastructure removal

At the end of the project's operational life of 40 years, the development area will be decommissioned. During decommissioning, all above ground infrastructure will be removed. Key elements of project decommissioning are expected to include:

- disconnection of the solar farm from the TransGrid connection point at the substation
- disconnection and removal of PV modules, and removal of mounting posts, mounting frames and trackers. Materials would be sorted and packaged for removal from the site and for recycling or reuse wherever possible. Many of the solar array panels are expected to be recyclable.
- removal of all buildings and equipment, with materials recycled wherever possible
- removal of steel columns and cabling for recycling
- removal of fencing (unless requested otherwise by the landholder)

- site rehabilitation, remediation (if required), and return to pre-existing land use (unless otherwise agreed with the landholder).

3.13.3 Site rehabilitation

Following infrastructure removal the following is expected to be undertaken to re-instate the site for agricultural activities:

- removal of gravel from internal tracks and roads (unless requested otherwise by the landholder).
- removal of any concrete and foundations
- deep ripping of any compacted areas to allow for the infiltration of water and to allow for cropping activities
- re-establishment of groundcover in any areas where cropping is not to occur to ensure the stabilisation of soil resources, using groundcover species that are compatible with the existing native species composition
- establishment of suitable erosion and sediment control measures.

3.13.4 Final land use

It is expected that the final land use after rehabilitation will be the resumption of current agricultural practices at the site.

4 Project justification and alternatives considered

The Sandigo Solar Farm can be justified against a range of criteria, including greenhouse gas mitigation, energy security, economic benefits, and commercial factors. Justification for the project taking these aspects into consideration is presented below, along with a discussion of alternatives considered by ESCO Pacific when developing the project.

4.1 Climate change and renewable energy

The greenhouse effect is a natural process whereby some of the sun's energy is absorbed by greenhouse gases (GHGs), increasing the temperature of the Earth's surface. Human activities, particularly burning of fossil fuels (coal, oil and natural gas), agriculture and land clearance, are dramatically increasing the concentration of GHGs and resulting in an enhanced greenhouse effect. GHGs include water vapour, carbon dioxide, ozone, methane, nitrous oxide, and chlorofluorocarbons (CFCs) (DoEE 2018a).

The enhanced greenhouse effect is resulting in (DoEE 2018a):

- a significant increase in the frequency and intensity of global extreme weather events such as bushfires, extreme rainfall, droughts, and tropical cyclones
- an increase in ocean and sea levels (and their acidity)
- changes in rainfall patterns (with wet regions becoming wetter and dry regions becoming drier).

Climate change poses a threat to Australia due to its environmental, social and economic impacts, particularly to water security, agriculture, coastal communities and infrastructure. This threat was acknowledged by scientists and politicians around the world at the 21st Conference of the Parties (COP21) in Paris in November/December 2015, where a historic global climate agreement was agreed to under the United Nations Framework Convention on Climate Change (UNFCCC), referred to as the Paris Agreement.

The Paris Agreement sets in place a framework for all countries to take climate action from 2020, and build on existing efforts in the period up to 2020. Key objectives of the agreement include:

- *A global goal to hold average temperature increase to well below 2°C and pursue efforts to keep warming below 1.5°C above pre-industrial levels.*
- *All countries to set mitigation targets from 2020 and review targets every 5 years to build ambition over time, informed by a global stocktake.*
- *Robust transparency and accountability rules to provide confidence in countries' actions and track progress towards targets.*
- *Promoting action to adapt and build resilience to climate impacts.*
- *Financial, technological and capacity building support to help developing countries implement the Agreement.*

At the COP21 conference, Australia committed to reducing its GHG emissions to 26-28% below 2005 levels, by 2030.

The replacement of energy from fossil fuel sources with energy from renewable sources, such as solar power, is a key mechanism for reducing GHGs. The Australian and NSW governments are making efforts to reduce GHG emissions through development of strategies and targets in relation to renewable energy generation, which are discussed further in Section 4.2 below.

4.2 Energy context in Australia

In addition to GHG reduction, efforts are being made by governments at both Commonwealth and State level, to improve energy security, reduce prices for consumers, diversify the energy mix and facilitate the adoption of renewable technologies.

4.2.1 Electricity generation in Australia

Renewable Energy Target

Since 2001, the Commonwealth Government has mandated the use of energy from renewable resources in electricity generation. In 2009, the Renewable Energy Target (RET) scheme mandated that 20% of Australia's electricity supply was to come from renewable sources by 2020 (DoEE 2018b).

In 2011, the RET was split into two parts comprising a large-scale RET (LRET) and a small-scale renewable energy scheme (SRES). The LRET created a financial incentive to establish and expand renewable power stations such as solar farms, wind farms and hydro-electric power stations and deliver the majority of the 2020 target. Reforms were made to the RET in 2015 with a target for large-scale energy generation of 33,000 GWh by 2020 i.e. 23.5% of Australia's electricity supply will come from renewable sources by 2020 (DoEE 2018b).

The LRET scheme sits within the broader context of Australia's need to reduce greenhouse gas emissions to meet its commitments under the 1997 Kyoto Protocol and Paris Agreement (DoEE 2018b) (see Section 4.1).

The SRES provides an incentive for communities, including households and small businesses, to install eligible small-scale renewable energy systems including solar water heaters, PV systems, and small-scale wind systems (DoEE 2018b).

National Energy Guarantee

The Commonwealth Government has recently committed to implementing a National Energy Guarantee, as recommended by the independent Energy Security Board. The Energy Security Board comprises an independent chair and deputy chair along with the expert heads of the Australian Energy Market Commission (AEMC), the Australian Energy Regulator (AER) and the Australian Energy Market Operator (AEMO).

The guarantee is made up of two parts that together will require energy retailers and some large users across the national energy market to deliver reliable and lower emissions energy generation each year. The two parts are (DoEE 2018c):

- A reliability guarantee that will be set to deliver the right level of dispatchable energy – from ready-to-use sources such as coal, gas, pumped hydro and batteries – needed in each state. It will be set by the AEMC and AEMO.
- An emissions guarantee that will be set to contribute to Australia's international commitments. The level of the guarantee will be determined by the Commonwealth and enforced by the AER.

The aim of the National Energy Guarantee is to deliver affordable and reliable energy for households and businesses without subsidies, taxes, emissions trading schemes or carbon prices. It is intended as a market-based solution that will integrate energy and climate policy to deliver a more affordable, more reliable and lower emissions energy system.

The development of renewable energy projects such as utility-scale solar farms is likely to be important if the guarantee is to be successful in achieving its aims, which will help develop a favourable investment environment for such projects.

4.2.2 Electricity generation in NSW

The NSW Renewable Energy Action Plan (the Plan) was released in 2013 by the NSW Government to support the achievement of the national target of 20% renewable energy by 2020 (NSW Government 2013).

The strategy of the Plan is to work with NSW communities and the renewable energy sector to increase renewable energy generation in NSW, with the least cost to the energy customer and the maximum benefits to NSW.

The goals of the Plan are to:

- attract renewable energy and investments, using practical steps to remove barriers to investment in renewable energy
- build community support for renewable energy by allowing the community to have a say on decisions that affect it and build community support for renewable energy
- attract and grow expertise in renewable energy technology, as well as focusing on moving renewable energy technologies from the research and development phase to demonstration and deployment.

4.3 Project benefits

4.3.1 Government level benefits

The Sandigo Solar Farm would contribute Australia's GHG commitments by reducing emissions associated with energy use and contributing to the achievement of the RET. The solar farm would also be part of the transition away from fossil fuel reliance to cleaner electricity generation, and the transition to increased energy security through a more diverse energy mix. It is therefore consistent with, and strongly supports, current policy direction at both a Commonwealth and State government level.

Key project benefits include:

- increased energy security through a more diverse energy mix (DoI 2016)
- generation of approximately 100 MW (AC) at full capacity, which is enough to power approximately 32,000 NSW homes (DoI 2016)
- reduction in State GHG emissions – based on an emission factor of 0.87 kg of carbon dioxide equivalent (CO₂-e)/kWh (DIICCS RTE 2013) the proposed solar farm would displace approximately 190,000 tonnes of CO₂-e or GHG emissions per year.

For context, a solar energy facility that displaces 100,000 tonnes of CO₂ per annum is the equivalent of taking approximately 30,000 petrol-fuelled cars off the road each year, based on an average car in NSW travelling 14,100 km per year (DIT 2011).

The project is classified as a State significant development and has an estimated capital investment value of approximately \$125 million. It therefore represents a significant new investment in the State of NSW, with significant direct and indirect economic flow-on effects. These effects will be particularly apparent at a regional level, where the project represents welcome investment in an important rural area of the State and will contribute to a more diversified and sustainable income base.

4.3.2 Local project benefits

At a local level, project benefits are expected to include:

- An increase in direct local employment. The project is expected to require up to 150 staff and contractors during the eight-month construction period, with many of these drawn from the local area. During operation the project is expected to provide long-term local employment opportunities for the four full-time and eight part-time staff, as well as requiring support from local contractors in site

management and maintenance activities. The expected 40-year duration of the project means that it will be a long-term employer in the region.

- Stimulation of the local economy, particularly during the construction period, through workforce demand for accommodation, hospitality, retail and other services, as well as through the local hire and supply of equipment and materials.
- The provision of education and training opportunities for contractors and local residents, as well as practical on-the-job experience, resulting in an increase and diversification of the local skills base – with many of these skills directly transferable to other projects.
- The project has the potential to act as a seed for further investment in the region, particularly in the area of renewables and new technologies. This will help diversify the local income base and provide alternate sources of income during periods when tough climatic or market conditions are depressing agricultural returns.

4.3.3 Commercial benefits

ESCO Pacific are investing in and developing the project because the company has confidence in the project's financial viability and the commercial returns it will generate. ESCO Pacific and management have a track record of developing utility-scale solar farms in Australia and overseas.

4.4 Ecologically sustainable development

Ecologically Sustainable Development (ESD) is the integration of environmental, social and economic considerations in policy development and decision-making processes. In 1991, the Commonwealth Government defined ESD as *'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'*.

In 1992, the Australian Government endorsed *The National Strategy for Ecologically Sustainable Development (1992)*, noting that implementation would be subject to budgetary priorities and constraints in individual jurisdictions. The strategy aims to provide governments with a framework for policy development and decision-making in Australia using ESD principles, particularly in relation to industry sectors that rely on utilisation of natural resources (ESDSC 1992).

Governments encourage industry and businesses to use the strategy to contribute to Australia's national goal of ESD which is:

'Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.'

Section 7 (subclause 1f) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 requires the EIS to include justifications for the development, with regard to biophysical, economic and social considerations, including the principles of ESD set out in subclause 4. Subclause 4 lists the principles of ESD as follows:

- a) the **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
 - i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
 - ii. an assessment of the risk-weighted consequences of various options,
- b) **inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

- c) conservation **of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
- d) improved **valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as:
 - i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
 - ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
 - iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

This EIS incorporates these ESD principles as outlined below and as demonstrated in Chapter 8.

Precautionary principle

The precautionary principle has been adopted by undertaking technical assessments of various project options so as to ensure serious or irreversible damage to the environment is avoided. The resultant project design has resulted in a project that is expected to have minimal impact on the environment. The management and mitigation measures proposed in this EIS are conservative where uncertainty exists over the extent of potential impact. The project is therefore consistent with the precautionary principle.

Inter-generational equity

The project is consistent with the principle of inter-generational equity. The project will assist in meeting the RET and helping to reduce climate change impacts, which will contribute to positive environmental and social outcomes for future generations. As a renewable energy project, it avoids the depletion of finite resources and does not reduce the capacity of future generations to generate energy. Once the site is decommissioned, it can be returned to primary production.

Conservation of biological diversity and ecological integrity

The development site is located on agricultural land that has been largely cleared of native vegetation. A biodiversity assessment was undertaken to identify existing ecological values of the site and potential project-related impacts. Areas of high ecological significance have been avoided during project design. Where impacts are unavoidable, these will be managed and offset appropriately. Further detail on the biodiversity assessment and relevant management and mitigation measures, including offset requirements, is provided in Section 8.1.

Improved valuation, pricing and incentive mechanisms

This principle places a monetary value on the environment to reduce future exploitation. This project uses a natural environmental resource, the sun's energy, to produce electricity which is a valued commodity. Additionally, solar power is increasingly able to compete economically with less environmentally friendly energy sources such as fossil fuels, providing a market-driven incentive mechanism for the adoption of sustainable and non-polluting energy production.

The removal of native vegetation on the development site would be offset in accordance with the NSW Biodiversity Offsets Policy for Major Projects, which would fund biological conservation activities. Offsetting is a means of placing monetary value on the environment to provide incentive for improved biodiversity outcomes.

The project is not expected to have any significant impacts to soil or waterways and therefore environmental resources will not be significantly depleted. Any pollution generated as a result of the project would be managed and remediated by the applicant.

4.5 Alternatives considered

4.5.1 Site selection

ESCO Pacific has undergone a process of constraints and opportunities analysis to identify potential project sites in NSW and other States. This process has included consideration of factors such as:

- regulatory settings for renewable energy projects
- solar irradiation levels
- access to and capacity of existing energy grids
- potential for land acquisition
- land suitability (topography, existing land use, flood risk, zoning etc.)
- need to minimise environmental and social impacts (e.g. avoiding sensitive environments or areas of cultural heritage value).

The Sandigo locality was chosen as the location for the project because of the high solar irradiance in the region and the capacity of the TransGrid electricity network to transmit the power generated.

A number of potential locations emerged as highly prospective sites for the development of a solar project, particularly due to the proximity of the two 132 kV Transgrid transmission lines and the 330 kV Transgrid transmission lines traversing the area. Accordingly, a decision was made to initiate pre-development investigations and activities.

Four potential sites within a 10 km area of Sandigo were initially identified and subjected to further assessment. In addition to considering technical feasibility, ESCO Pacific has followed a process to avoid, minimise and offset impacts to environmental and social values. The preliminary ecological investigations for the solar project included each of these four locations. These assessments found that each of the properties contained some ecological values, but concluded that the location that had the least number and lowest quality ecological constraints was the eastern-most property, the current development site (Ecolink 2017). Feasibility assessments were also undertaken by ESCO Pacific which reduced the number of sites from four to two (as presented in the PEA Scoping Report) and then confirmed the viability of the current site as being preferred.

4.5.2 Project design and configuration

The size of the solar project was determined by the connection capacity of the local electricity network through the TransGrid 132 kV transmission line. The design and configuration of the project take into account the findings of EIS studies and investigations. This includes consideration of environmental and social factors such as the need to:

- identify and operate within any environmental constraints (such as avoiding areas within the development site that may be of conservation significance)
- minimise disruption to local landholders
- minimise amenity issues through siting of infrastructure and screening
- take into account the expectations and any concerns of the local community and Narrandera Shire Council.

These considerations were balanced against the need to achieve design, construction and operational efficiencies to reduce projects costs and maximise solar yields.

4.5.3 Project footprint and micro-siting

The project footprint at the current development site was further refined during development of this EIS. An initial investigation area of 608 ha was reduced to the current 231 ha development site taking into consideration a number of technical and environmental factors. Environmental factors included the

ecological values of the site, waterway avoidance, hydrological constraints, the presence of Aboriginal cultural heritage, potential visual amenity impacts, potential noise impacts and traffic movements. A 100 MW solar farm can comfortably be located within the proposed development site, without causing a significant impact to environmental or social values.

As set out in Chapter 8, the avoidance of key environmental areas, in combination with appropriate environmental safeguards during construction of the project (to be detailed in the project's CEMP), is expected to ensure that the development meets the requirements to avoid and minimise impacts on environmental values.

4.5.4 A 'do nothing' approach

A 'do nothing' approach would forgo the benefits of the project outlined in Section 4.3. These benefits are expected to significantly outweigh the potential adverse environmental impacts of the project, which are expected to be of low to negligible significance when appropriate management and mitigation measures are implemented.

5 Planning and statutory framework

The following sections provide an outline of the planning and statutory framework that applies to the project, including relevant Commonwealth and NSW legislation, regulations and policies. The permissibility of the development and requirements for lot reconfiguration are also presented.

5.1 Commonwealth legislation

5.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Commonwealth Department of the Environment and Energy (DoEE), requires approval from the Environment Minister for actions likely to have a significant impact on a Matter of National Environmental Significance (MNES).

The EPBC Act identifies the following nine MNES:

- World Heritage properties
- national heritage places
- wetlands of international significance (Ramsar wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- water resources (relating to coal seam gas development and large coal mining development).

Any proposed actions falling within the following categories must be referred to DoEE to determine whether the action is a 'controlled action':

- actions that have a significant impact on MNES
- actions that (indirectly or directly) have a significant environmental impact on Commonwealth land
- actions carried out by the Commonwealth Government.

The assessment of the significance of the impact is based on the criteria listed in the DoEE's *Significant Impact Guidelines 1.1* (DoE 2003). Should the Environment Minister decide the action is to be taken in a manner that is not likely to have an adverse impact on the MNES, approval will be granted.

This project will be unlikely to significantly impact MNES. This is further discussed in Section 8.1.

5.1.2 Native Title Act 1993

The *Native Title Act 1993* provides a national framework for the recognition and protection of native title (i.e. the rights and interests, recognised by common law, possessed under traditional laws and customs of Aboriginal and Torres Strait Islander people).

The Act recognises the ownership (or set of rights and interest) of land or waters by Aboriginal and Torres Strait Island groups prior to European Settlement; provides a mechanism for determining where native title exists and who holds it; and identifies compensation for actions affecting it. The Act establishes ways in which future dealings affecting native title may proceed and sets standards for those dealings.

People who hold native title have a right to practice their traditional laws and customs, whilst respecting Australian laws, and have a right to a) be consulted with regarding any proposed action on their land b) receive compensation for that action.

No Native Title Determination Applications, Determinations of Native Title, or Indigenous Land Use Agreements exist over the development site and Native Title will not be further considered within this EIS.

5.1.3 Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* enables the Australian Government to respond to requests to protect areas and objects of particular significance to Aboriginal people if it appears that state or territory laws have not provided effective protection.

The Australian Government can make a declaration to protect an area, object or class of objects from a threat of injury or desecration. However, the government cannot make a declaration unless an Aboriginal person or group of persons has requested it. A declaration is only made if the relevant processes of the state or territory have been exhausted.

An ACHAR was prepared for this project, identifying some objects of Aboriginal cultural significance within the development site. The assessment is discussed further in Section 8.2.

5.2 New South Wales legislation

5.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the principle legislation regulating land use in NSW and is administered by DPE. The EP&A Act sets a framework for approval of developments in NSW and requires relevant planning authorities to assess potential environment and social impacts of proposed development or land-use change. The Act prescribes relevant planning bodies, environmental planning instruments, environmental assessment, and liability with regards to contaminated land.

The proposed project supports a number of objects of the EP&A Act by promoting and encouraging social, economic and environmental wellbeing through the use of land for power generation using renewable sources. Specifically, the project supports the following objects of the EP&A Act:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The project is also consistent with the remaining objects of the Act.

Consent for an SSD is granted under Part 4, Division 4.1, Section 89E of the EP&A Act:

(1) The Minister is to determine a development application in respect of State significant development by:

(a) granting consent to the application with such modifications of the proposed development or on such conditions as the Minister may determine, or

(b) refusing consent to the application.

As an SSD, the project requires the development of this EIS under Part 4 'Development Assessment' of the EP&A Act.

5.2.2 Environmental Planning and Assessment Regulation 2000

The Environmental Planning and assessment Regulation 2000 (EP&A Regulation) contains detail on various processes set out under the EP&A Act.

Schedule 2 of the EP&A Regulation provides:

- provisions for EIS development, including EIS content
- conditions for the preparation of environmental assessment requirements for a development, by the Secretary and approval bodies
- timing requirements for Development Applications (DAs)
- other provisions relating to state significant infrastructure.

Clauses 84 and 85 provide provisions relating to advertising of the development, and state the DA be placed on public exhibition for a period of no less than 30 days.

Section 7 (subclause 1f) of Schedule 2 requires the EIS include justifications for the development, with regard to biophysical, economic and social considerations, including principles of ecologically sustainable development (ESD) set out in subclause 4.

Division 6 of the EP&A Regulation relates to public participation for SSDs and includes provisions for the public exhibition period, notices of application, responding to submissions and lists the documents that are to be made publically available.

This EIS has been prepared in accordance with the EP&A Regulation. Justifications for the development, and its incorporation of ESD principles, are provided in Chapter 4. Notices of application are addressed further in Chapter 6.

5.2.3 State Environmental Planning Policy (State and Regional Development) 2011

The State Environmental Planning Policy (SEPP) (State and Regional Development) 2011 aims to identify development that is of State significance and confers functions on joint regional planning panels to determine development applications.

The following is considered an SSD under Clause 20 of Schedule 1 of the policy:

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

(a) has a capital investment value of more than \$30 million, or

(b) has a capital investment value of more than \$10 million and is located in an environmentally sensitive area of State significance.

The Sandigo Solar Farm project is classified as an SSD under Part 4 of the EP&A Act, as it has a capital investment value of more than \$30 million.

As an SSD, the project would be assessed by DPE and require approval from the Minister for Planning and Environment. SSDs require the preparation of an EIS detailing potential environmental impacts as a result of the project and appropriate management measures. The EIS is to be prepared in accordance with the requirements of the SEARs.

The Sandigo Solar Farm project is classified as an SSD under Part 4 of the EP&A Act, as it has a capital investment value of more than \$30 million. The EIS has been prepared in accordance with the SEARs as shown in Section 1.5.

5.2.4 State Environmental Planning Policy (Infrastructure) 2007

The SEPP (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State by providing for the development of electricity generating works on any land in a prescribed rural, industrial or special use zone for which there is consent, including large-scale solar energy systems.

Part 3 (Development controls), Division 4 (Electricity generation works or solar energy systems), Clause 34 (Development permitted with consent) of ISEPP specifically refers to solar energy systems, stating that (except as provided by subclause (8) relating to prescribed residential zones), *development for the purpose of a solar energy system may be carried out by any person with consent on any land.*

ISEPP states that development of electricity generation works or solar energy systems is a permitted activity on any land with consent within a 'prescribed rural zone'. Under Part 3, Division 4 of the ISEPP, the following clauses are relevant:

Clause 34:

- (1) Development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural, industrial or special use zone.*

Clause 33:

In clause 33, a 'prescribed rural zone' is defined as:

...any of the following land use zones or a land use zone that is equivalent to any of those zones:

- (a) Zone RU1 Primary Production... .*

Division 17 (Roads and Traffic), Subdivision 2 (Development in or adjacent to road corridors and road reservations) of the ISEPP sets out requirements for the management of road and traffic issues related to proposed developments adjacent to road corridors and road reservations. Clause 101 (Development with frontage to classified road) states that:

- (2) The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that:*

(a) where practicable, vehicular access to the land is provided by a road other than the classified road, and

(b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of:

(i) the design of the vehicular access to the land, or

(ii) the emission of smoke or dust from the development, or

(iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and

(c) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

ISEPP allows for the development of large-scale solar energy systems with consent even on land prescribed for rural use. Traffic access and management for the Sandigo Solar Farm has been designed taking the requirements of the ISEPP into account, as outlined in Section 8.6.

As required under the SEARs, a traffic management plan (TMP) is required for the project. ESCO Pacific accepts this requirement and will prepare a TMP consistent with the objectives of the ISEPP as a condition of the Development Consent.

5.2.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

SEPP No. 33 – Hazardous and Offensive Development (SEPP 33) defines and regulates the assessment and approval of potentially hazardous or offensive development.

A potentially hazardous industry is defined within SEPP 33 as “a development for the purpose of any industry which, if the development were to operate without employing any measures to reduce or minimise its impact, would pose a significant risk to human health, life or property, or to the biophysical environment”.

A potentially offensive development is defined within SEPP 33 as a “development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.”

The project is not considered as potentially hazardous or offensive and therefore SEPP 33 does not apply. This is discussed further in Section 7.

5.2.6 State Environmental Planning Policy No. 55 – Remediation of Land

SEPP No. 55 – Remediation of Land (SEPP 55) aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

Under Clause 7 of SEPP 55, a consent authority must not consent to the carrying out of any development on land unless it has considered whether the land is contaminated.

There is no reason to suggest that contamination exists at the development site requiring consideration during the development of the Sandigo Solar Farm. This is discussed further in Section 8.5.

5.2.7 State Environmental Planning Policy (Rural Lands) 2008

The SEPP (Rural Lands) 2008 aims to:

- facilitate the orderly and economic use and development of rural lands for rural and related purposes
- identify Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State
- implement measures designed to reduce land use conflicts
- identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture of that land, having regard to social, economic and environmental considerations

- amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

Land considered State significant agricultural land is listed in Schedule 2 of the SEPP.

The project is not considered State significant agricultural land, and is unlikely to impact on such, and is consistent with the aims of the SEPP. Lot subdivision will be required as part of the approval process for the project and this is discussed further in Section 5.3.1.

5.2.8 State Environment Planning Policy No. 44 – Koala Habitat Protection

State Environment Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) requires that for Development Applications ‘potential koala habitat’ must be determined. Such habitats are defined as having 15 per cent of trees of the species listed in the SEPP 44.

This EIS considers the presence of Koala habitat within the development site, concluding that no habitat is present (see Section 8.1).

5.2.9 Narrandera Local Environmental Plan 2013

The development site is located within the Narrandera Shire Council boundaries and is therefore subject to the relevant provisions of the 2013 Narrandera Local Environmental Plan (Narrandera LEP).

Aims of Narrandera LEP

The Narrandera LEP provides local environmental planning provisions for land in Narrandera in accordance with the relevant standard environmental planning instrument under section 33A of the EP&A Act.

The aims of the plan are:

- to protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources
- to encourage a range of housing, employment, recreation and community facilities to meet the needs of existing and future residents of Narrandera
- to promote the efficient and equitable provision of public services, infrastructure and amenities
- to conserve environmental heritage.

Land zoning

The proposed Sandigo Solar Farm and transmission line routes are located on land zoned RU1 – Primary Production. The objectives of the RU1 zone include the following:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

Additional local provisions

The Narrandera LEP contains a number of additional local provisions relating to matters such as earthworks, flood planning, stormwater management, terrestrial biodiversity, groundwater vulnerability, riparian land and watercourses, wetlands, salinity, development on river front areas, development on riverbeds and banks and airspace operations.

Subdivision

The development site is located within zone AF for subdivision. Section 4.1 of the LEP states that the size of any lot resulting from a subdivision of land to which this clause applies is not to be less than 400 ha. No exemption exists at council level, so subdivision, if required, may not comply with the LEP. ESCO Pacific has been consulting with Narrandera Shire Council regarding the potential need for subdivision and the implications for project approvals.

The project will address all the relevant provisions of the Narrandera LEP. Proposed lot subdivision is discussed further in Section 5.3.1.

5.2.10 Riverina Murray Regional Plan 2036

The proposed Sandigo Solar Farm falls within the Riverina Murray region of NSW. DPE has prepared the *Riverina Murray Regional Plan 2036* (RMRP) which provides a 20-year blueprint for the region (DPE 2017).

The RMRP sets out the NSW Government's vision for the Riverina Murray, which is to create a diversified economy founded on Australia's food bowl, iconic waterways and a strong network of vibrant and connected communities.

The Government has set four goals for the region to achieve this vision:

- a growing and diverse economy
- a healthy environment with pristine waterways
- efficient transport and infrastructure networks
- strong, connected and healthy communities.

The development of the Sandigo Solar Farms is consistent with these objectives, in particular the development of a growing and diverse economy.

The project will assist in meeting the objectives of the RMRP. This is discussed further in Section 8.12.

5.2.11 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides a framework for the management of roads in NSW. It provides for the classification of roads and the declaration of the Roads and Maritime Services (RMS) and other public authorities as roads authorities for both classified and unclassified roads. The Roads Act confers functions on RMS and other roads authorities, and allows the distribution of such functions between RMS and other roads authorities.

The Roads Act sets out procedures for the opening and closing of public roads and regulates the carrying out of various activities on public roads.

Under Section 138 of the Roads Act, consent is required for any works or activities in a public reserve, public road way or footpath (nature strip). Section 138 requires that all activities undertaken within council road reserves be approved by council prior to the activities being undertaken.

A traffic assessment report outlining any requirements for use of roads has been prepared as part of this EIS (see Section 8.6). If applicable, approval from the RMS or local council will be sought under section 138 of the Roads Act.

5.2.12 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) commenced on 25 August 2017 as part of the NSW Government's new framework for the conservation of biodiversity. It supersedes the *Native Vegetation Act 2003*, *Threatened Species Conservation Act 1995*, *Nature Conservation Trust Act 2001* and sections of the *National Parks & Wildlife Act 1974*. The BC Act governs the management and conservation of biodiversity in NSW, which includes all flora, fauna and ecological communities, consistent with the principles of ESD (as

described in section 6(2) of the Protection of the Environment Administration Act 1991). The BC Act establishes (amongst others):

- a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity
- a scientific method for assessing the likely impacts on biodiversity values of proposed development and land use change, for calculating measures to offset those impacts and for assessing improvements in biodiversity values
- a market-based conservation mechanism through which the biodiversity impacts of development and land use change can be offset at landscape and site scales.

A BDAR has been prepared as part of this EIS to identify the potential impacts of the Sandigo Solar Farm project on biodiversity. The project has been designed to avoid impacts to native vegetation. No threatened flora, fauna and populations are expected to be significantly impacted. The biodiversity assessment is discussed further in Section 8.1.

5.2.13 Biodiversity Conservation Regulation 2017

The Biodiversity Conservation Regulation 2017 (BC Regulation) supports the BC Act in outlining the framework for addressing impacts on biodiversity from development and clearing. The BC Regulation also establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme.

Section 6.8 of the BC Regulation requires that a BDAR for a development application must include details of offsets for impacts, including the number and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules. The credentials of the assessors that established these offsets and the date of the assessment is also required under the BC Regulation.

A BDAR has been prepared as part of this EIS, in accordance with the BC Regulation, and discusses the biodiversity offsets that will be required as a result of the Sandigo Solar Farm project. The biodiversity assessment is discussed further in Section 8.1.

5.2.14 Fisheries Management Act 1994

The Department of Primary Industries (DPI) administers the *Fisheries Management Act 1994* (FM Act) and associated regulations (FM Regulations). The broad objective of the FM Act is to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

Part 7 of the Act deals with the protection of aquatic habitats and Part 7A deals with threatened species conservation. When assessing and either approving or refusing proposals for developments (including SSD and infrastructure projects) or other activities affecting fish habitats, DPI take into account their Policy and Guidelines for Fish Habitat Conservation and Management (DPI 2013b).

Unless known to provide habitat for threatened species, for the purposes of these policies and guidelines, the following are not considered key fish habitat:

- farm dams constructed on unmapped gullies and first and second order streams
- purpose built irrigation and other water supply channels and off-stream storages
- irrigation, agricultural or urban drains.

A BDAR has been prepared as part of this EIS to identify the potential impacts of the Sandigo Solar Farm project on biodiversity. The site does not contain key fish habitat and is not known to provide habitat for threatened species. The biodiversity assessment is discussed further in Section 8.1.

5.2.15 Local Land Services Amendment Act 2016

The *Local Land Services Act 2013* (LLS Act) was amended on 25 August 2017 in relation to native vegetation land management and clearance in rural areas, replacing the *Native Vegetation Act 2003*, as part of the NSW Government's new framework for the conservation of biodiversity. The LLS Act provides a framework for the management of local land services which include programs and advisory services relating to agricultural production, biosecurity, natural resource management (including management of native vegetation, weeds and pests) and emergency management.

The LLS Act aims to ensure natural resources are managed in accordance with the principles of ESD (as described in section 6(2) of the *Protection of the Environment Administration Act 1991*) in the social, economic and environmental interests of the State.

The management of local land services, specifically relating to native vegetation clearance on rural land, and the management of weeds, has been considered in this EIS (see Section 8.1).

5.2.16 Water Management Act 2000

The objective of the *Water Management Act 2000* is to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular to:

- promote ESD
- protect, enhance and restore water courses
- recognise and foster social and economic benefits
- recognise the role of the community
- provide efficient and equitable sharing of water
- manage water sources together with other aspects of the environment including native vegetation and native fauna
- encourage the sharing of responsibility and efficient use of water
- encourage best practice management and use of water.

The management of surface water and groundwater, and potential impacts to hydrology, have been considered in this EIS and are addressed in Section 8.4.

5.2.17 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) provides a statutory framework for the management of biosecurity risks from diseases, pests (plant and animal) and contaminants that have the potential to cause harm to the environment, people and the economy. The Biosecurity Act aims to reduce risks by: preventing the entry of diseases, pests and contaminants into NSW; identifying, containing and eradicating new entries; and minimising potential impacts through appropriate management.

The Biosecurity Act has provisions in place for: conferring a power, function or right; or imposing an obligation, for the prevention of the introduction, or control or eradication of invasive pests (such as weeds and animals pests) which threaten ecosystems, habitats or species.

Under the Biosecurity Act, Local Control Authorities such as local councils may appoint authorised officers to enforce weed management and provide direction on complying with obligations under the Biosecurity Act.

The potential for project-related impacts from invasive weeds and pests has been considered in the EIS and is discussed in Section 8.1.

5.2.18 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the key legislation governing the State's care, control and management of all national parks, historic sites, nature reserves and Aboriginal areas. State conservation areas, karst conservation reserves and regional parks are also administered under the Act.

Places or objects of Aboriginal cultural heritage on or in the vicinity of the site will need to be managed in accordance with this Act. Clause 86 of this Act states: a person must not harm or desecrate an object that the person knows is an Aboriginal object.

Section 87 of the NPW Act establishes defences against prosecution under s.86 (1), (2) or (4) – harming or desecrating Aboriginal objects and Aboriginal places. The defences are as follows:

- An Aboriginal Heritage Impact Permit (AHIP) authorising the harm (s.87(1)).
- Exercising due diligence to establish Aboriginal Objects will not be harmed (s.87(2)). Due diligence may be achieved by compliance with requirements set out in the National Parks and Wildlife Regulation 2009 (the NPW Regulation) or a code of practice adopted or prescribed by the NPW Regulation (s.87(3)).

Under Section 89J of the EP&A Act, an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* would not be required for an SSD, unless the requirement of an environmental planning instrument for consultation or concurrence specifies that it applies to an SSD.

An ACHAR was prepared for this project, identifying some objects of Aboriginal cultural significance within the development site. The assessment, as well as a historic heritage assessment, are discussed further in Section 8.2 and Section 8.3.

5.2.19 National Parks and Wildlife Regulation 2009

The NPW Regulation 2009 (cl.80A) assigns the OEH (2010b) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* as one of the codes of practice that can be complied with pursuant to s.87 of the NPW Act. Disturbed land is defined by cl.80B (4) as;

“...disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable”. Examples given in the notes to cl.80B (4) include “construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure)”.

The presence and extent of ground disturbance is a key determinant in establishing the cultural heritage potential of an area under the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*.

An ACHAR was prepared for this project, identifying some objects of Aboriginal cultural significance within the development site. The assessment is discussed further in Section 8.2.

5.2.20 Heritage Act 1977

The *Heritage Act 1977* provides a legal framework for the management of items and places of State heritage significance, providing for their protection. The Act encourages conservation of the State's heritage and provides for the identification and registration of items of State heritage significance.

Under Section 89J of the EP&A Act, an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* would not be required for an SSD.

Any existing or unknown or other potential unknown State heritage items will be managed under the Act.

A search of the local and state heritage registers identified no recorded heritage items within the development site, and therefore the project is unlikely to impact on historic heritage, as discussed in Section 8.3.

5.2.21 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the regulatory framework to protect the environment of NSW, including land, air and water. It is the key piece of environment protection legislation administered by the EPA. PA 2.49 and PA 2.50 of the Act set out obligations regarding the receiving of wastes to be stored, processed or disposed on site and the classification of those wastes.

The control and mitigation measures for greenhouse gas emissions associated with the project will also be managed under this Act.

Under section 48 of the POEO Act, premises-based scheduled activities, as defined in Schedule 1, require an Environmental Protection Licence (EPL). Under Clause 17 of Schedule 1, electricity generation is a scheduled activity requiring an EPL. However, solar power is not included in this definition and therefore the project is not a scheduled activity under the POEO Act and an EPL is not required (NSW Government 2017).

This EIS considers emissions to land, air and water, including greenhouse gas emissions, in Chapter 4 and Chapter 8.

5.2.22 Rural Fires Act 1997

The Rural Fires Act 1997 (Rural Fires Act) provides:

- (a) for the prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts, and*
- (b) for the co-ordination of bush fire fighting and bush fire prevention throughout the State, and*
- (c) for the protection of persons from injury or death, and property from damage, arising from fires, and*
- (c1) for the protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires, and*
- (d) for the protection of the environment by requiring certain activities referred to in paragraphs (a)-(c1) to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the Protection of the Environment Administration Act 1991.*

As the project is an SSD, a bush fire safety authority under section 100B of the Rural Fires Act is not required. However, Section 63 of the Rural Fires Act imposes a duty of care on land managers and landholders to take appropriate steps to prevent bush fires and Section 64 requires that during the bush fire danger period land managers and landholders take steps to extinguish fire or call the local fire authority.

The site is not located on land mapped as Bush Fire Prone Land. The bush fire risk of this project is discussed in Section 8.10.

As required under the SEARs and requested by Fire and Rescue NSW (FRNSW), an emergency response plan (ERP) is required to be prepared for the site that specifically addresses foreseeable on-site and off-site fire events. ESCO Pacific accepts this requirement and will prepare an ERP as a condition of the Development Consent.

5.2.23 Mining Act 1992

The *Mining Act 1992* aims to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage Ecologically Sustainable Development.

There are no existing exploration or mining licenses encompassing the development site as discussed in Section 8.5.

5.2.24 Crown Lands Act 1989

The *Crown Lands Act 1989*, administered by the Minister for Crown Lands, regulates the management of Crown land for the benefit of the people of New South Wales and in particular to provide for:

- a) a proper assessment of Crown land,
- b) the management of Crown land having regard to the principles of Crown land management contained in this Act,
- c) the proper development and conservation of Crown land having regard to those principles,
- d) the regulation of the conditions under which Crown land is permitted to be occupied, used, sold, leased, licensed or otherwise dealt with,
- e) the reservation or dedication of Crown land for public purposes and the management and use of the reserved or dedicated land, and
- f) the collection, recording and dissemination of information in relation to Crown land.

Under Part 3 of the Act, a land assessment is required to be undertaken for any matters affecting Crown Land.

The project is not expected to have any impacts on Crown land, and the Crown Lands Act 1989 is not discussed further in this EIS.

5.2.25 Conveyancing Act 1919

The *Conveyancing Act 1919* provides a framework for the management of property and land and aims to improve the practice of conveyancing.

Under 7A, item 3A, of the Act, land that is, or is proposed to be, leased for more than a period of five years (including the period of any option to renew), will need to be reconfigured.

The project will lease land for a minimum of five years and therefore reconfiguration of the lots will be required. This is further addressed in Section 5.3.1.

5.3 Permissibility and lot reconfiguration

5.3.1 Project permissibility

Permissibility of solar farm development is determined by the relevant environmental planning instruments, including SEPPs and LEPs. The EP&A Act and the EP&A Regulation also establish the assessment and approval pathways and other development controls relevant to solar farm developments, which are not necessarily permitted in all zones. Key reference points include:

- Section 89E of the EP&A Act, under which consent for an SSD is granted (see Section 5.2.1)
- State Environmental Planning Policy (State and Regional Development) 2011 (see Section 5.2.3)
- the ISEPP (see Section 5.2.4)
- the zoning and land use provisions of the Narrandera LEP (see Section 5.2.9).

The project is sited on land zoned as RU1 Primary Production under the Narrandera LEP. Under zone RU1 Primary Production, the following applies:

Planning objectives (Item 1)

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

The LEP lists activities permitted in zone RU1 without consent (Item 2) and with consent (Item 3). Anything not listed in items 1 or 2 are prohibited activities (Item 4). Electricity generating works (including solar energy systems) are not listed under items 2 or 3 of the LEP and are therefore generally prohibited within zone RU1. However, as outlined in Section 5.2.4, the ISEPP states that development of electricity generation works or solar energy systems is a permitted activity with consent on any land within a prescribed rural zone.

Notwithstanding the provisions of the ISEPP, it is the expectation of DSE and council that large-scale solar developments are broadly compatible with local land use objectives such as those outlined in the LEP (see Section 5.2.9). In considering this, the following points are relevant:

- The primary objective of the RU1 zone is to encourage primary production. In this regard, the project will be compatible with local land use objectives as it will have minimal impact on the ground surface and, once the project is decommissioned, the site can return to primary production with no expected loss of land capability.
- Direct and indirect revenue from low impact renewable developments such as solar farms is also a means by which local landholders can diversify their income helping them to remain in primary production during years of low production or depressed market prices.
- The project will not result in the closure of, or restrict the use of, surrounding public roads and will therefore not fragment or alienate surrounding resource lands.
- The development will not conflict with or restrict activities in adjoining land use zones.

In addition, the project will have minimal impact on the ground surface and once it is decommissioned the site will be able to be returned to its existing state.

The proposed Sandigo Solar Farm is therefore a permissible development for which consent can be granted as an SSD under the Section 89E of the EP&A Act. The project as proposed in this EIS is also consistent with the requirements of the Narrandera LEP and relevant SEPPs.

5.3.2 Lot reconfiguration

Existing configuration

ESCO Pacific has signed an option to Lease with the landholders that own Lot 55 on Plan 754550, Lot 33 on Plan 754550 and Lot 35 on Plan 754550 (Figure 5.1).

Proposed reconfiguration

As outlined in Section 5.2.9, the Sandigo Solar Farm site is located within zone AF for subdivision under the Narrandera LEP and any lot resulting from a subdivision is not to be less than 400 ha. As per Section 7A of the *Conveyancing Act 1919*, the project is expected to require reconfiguration of the lots since the proposed lease with the landholder will exceed 5 years.

The reconfiguration of the lots proposed by ESCO Pacific is shown in Figure 5.2. The resultant lots would each be less than 400 ha as follows:

- The area leased for the project (249 ha, encompassing the solar farm boundaries) would create a new lot which would encompass part of Lot 55/DP754550, part of Lot 33/DP754550 and part of Lot 35/DP754550 (purple on the map).
- A new lot would be created within the solar farm boundaries for the switchyard (owned by TransGrid) with an area of approximately 300 m² (pink on the map).
- A new lot would be created as a residual land from Lot 55/DP754550 with an area of approximately 58 ha (green on the map).
- A new lot would be created as a residual land from Lot 55/DP754550 with an area of approximately 20 ha (orange on the map).

- A new lot would be created as a residual land from Lot 33/DP754550 with an area of approximately 77 ha (light yellow on the map).
- A new lot would be created as a residual land from Lot 35/DP754550 with an area of approximately 16 ha (brown on the map).

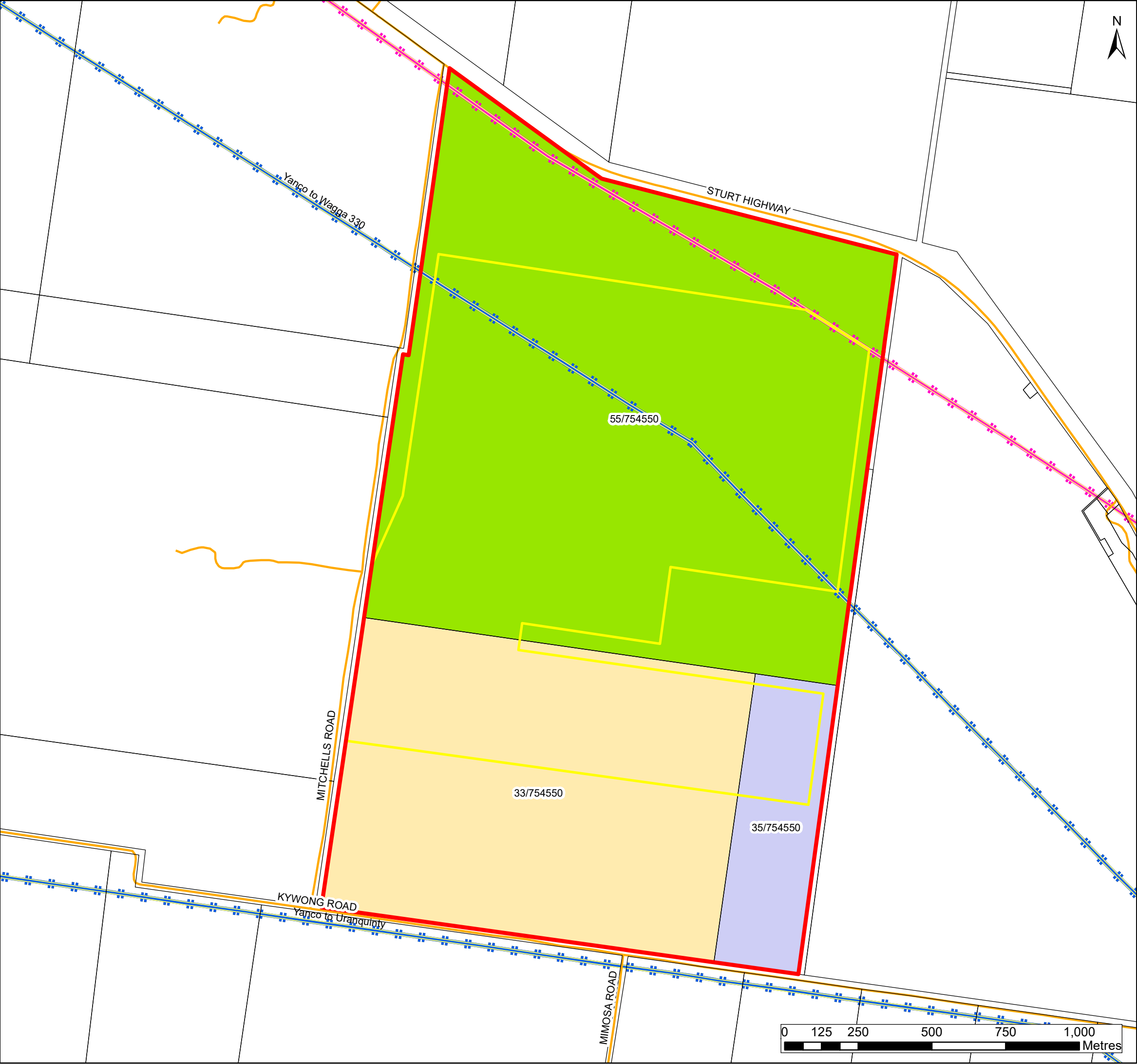
The proposed boundaries and areas shown on Figure 5.1 and Figure 5.2 are indicative at this stage and will need to be surveyed before execution of options to lease.

All lots will be able to be accessed from the roads surrounding the development site (shown in red on both figures), except the lot for the switchyard for which a shared access with TransGrid will be created. No dwelling entitlement will be attached to any of the newly created lots.

Land ownership would remain unchanged for all lots.

ESCO Pacific is in discussion with Narrandera Council to seek approval for the required subdivision of the existing lots. In a letter dated 19 February 2018, Narrandera Shire Council stated the proposed reconfiguration of the lots did not comply with the Local Environmental Plan 2013. However, council is supportive of the development and is therefore willing to provide in-principle agreement for the reconfiguration to proceed. Council wishes to ensure that no dwelling entitlement shall be attached to any newly created lots that are under the minimum lot size.

The in-principle agreement letter from Narrandera Shire Council regarding the subdivision is attached in Appendix C.



PROJECT

Sandigo Solar Farm

MAP TITLE

Figure 5.1. Existing Lot Configuration

Landowner

Title Info

LEGEND

Sandigo Solar Farm

Study Area

Solar Farm boundaries

Existing Cadastral Boundaries (same Landholder)

Lot 55 on Plan 754550

Lot 33 on Plan 754550

Lot 35 on Plan 754550

Others

Cadastral Boundaries

TransGrid 132kV Transmission Line

Essential Energy 66 kV line

TransGrid 330kV Transmission Line

Roads / Tracks

ESCO

Pacific

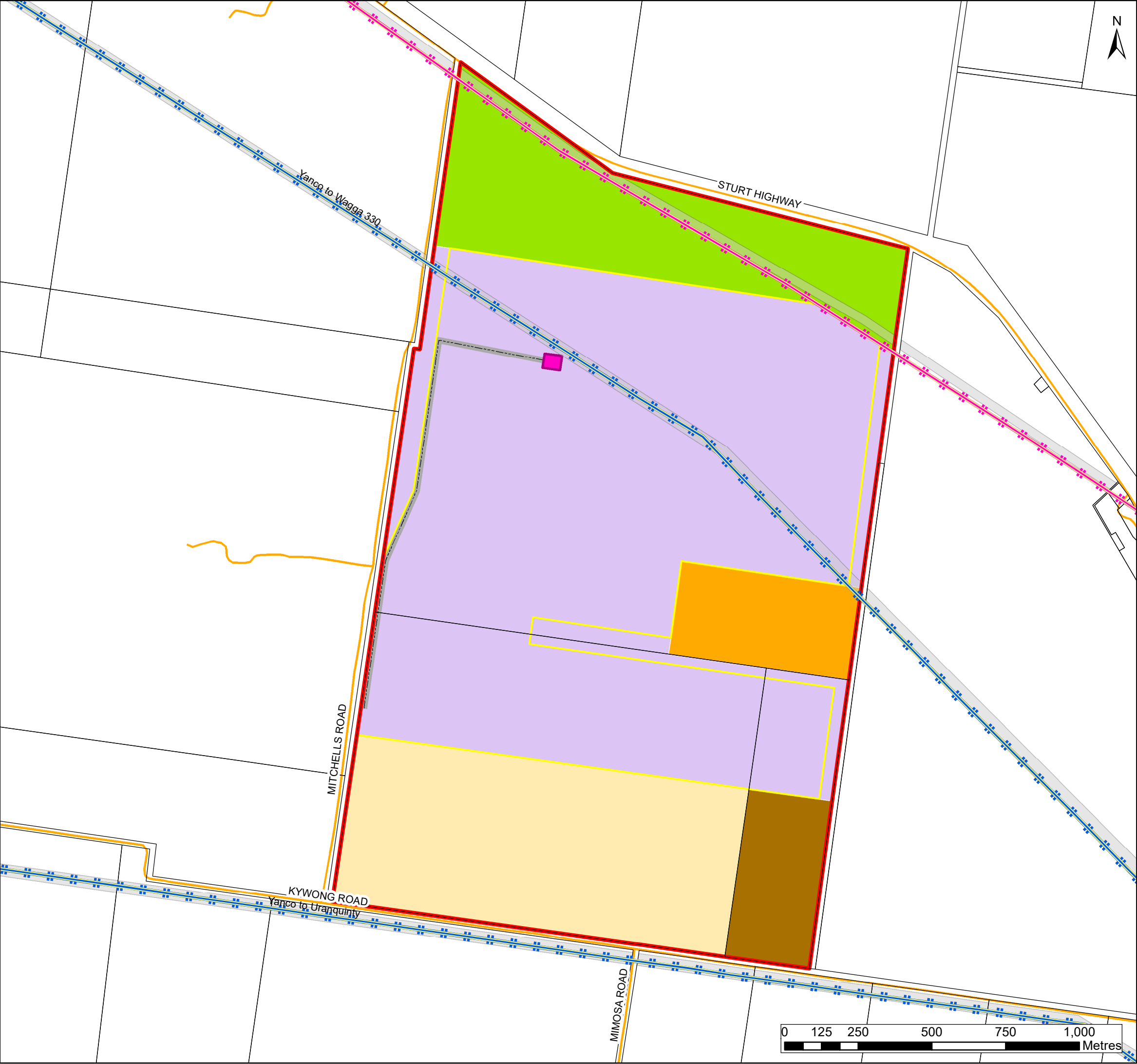
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Datasets: OpenStreetMap

Projection: GDA94 MGA55

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PROJECT

Sandigo Solar Farm

MAP TITLE

Figure 5.2. Proposed Lot Configuration

Landowner

Title Info

LEGEND

Sandigo Solar Farm

Study Area

Solar Farm boundaries (231 hectares)

Switchyard - TransGrid (300 sq. metres)

Shared Access to Switchyard

Proposed Cadastral Boundaries (same Landholder)

New Lot - Residual Land from Lot 55 (58 hectares)

New Lot - Residual Land from Lot 55 (20 hectares)

New Lot - Residual Land from Lot 33 (77 hectares)

New Lot - Residual Land from Lot 35 (16 hectares)

New Lot Leased to Sandigo Solar Farm (249 hectares)

Others

Existing Cadastral Boundaries

Easement

Essential Energy 66 kV line

TransGrid 132kV Transmission Line

Roads / Tracks

ESCO

Pacific

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6 Community and stakeholder engagement

6.1 Engagement overview

ESCO Pacific has prepared a Stakeholder and Community Consultation Plan to guide communication activities relating to the proposed project and assist in the preparation of the EIS. This plan provides an overview of stakeholder engagement, a description of the stakeholder engagement activities undertaken and a summary of the findings that have been incorporated into this EIS.

6.2 Formal consultation requirements

The SEARs for the Project state that:

“During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular you must undertake detailed consultation with affected landowners surrounding the development and Narrandera Shire Council.

The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS”.

Furthermore, the SEARs require that the EIS must:

“include adequate consultation with the local Aboriginal community”.

6.3 Government consultation

Consultation with government agencies was initiated by DPE during the preparation of the SEARs. Government Agencies that provided a response to DPE for inclusion in the SEARs included:

- Narrandera Shire Council
- NSW Department of Industries
- NSW Department of Planning and Environment, Resources & Energy - Division of Resources & Geoscience
- NSW Environment Protection Authority
- Fire & Rescue NSW
- NSW Office of Environment and Heritage (OEH)
- NSW Roads & Maritime Services

Consultation was undertaken by ESCO Pacific with numerous government agencies during the preparation of the EIS to clarify agency requirements, discuss methodologies, and to seek feedback. A summary of the consultation undertaken with Government Agencies is provided in Appendix C (Consultation Register).

6.4 Aboriginal community consultation

ESCO Pacific has been actively engaging with the local Aboriginal community in the region and the Local Aboriginal Land Councils (LALCs). Aboriginal consultation for the project is required to be undertaken in

accordance with the OEH Aboriginal Cultural Heritage Consultation Requirement's (ACHCRs). Aboriginal consultation is regulated under Clause 80C of the National Parks and Wildlife Regulation 2009. The process includes a four-stage Aboriginal consultation process that stipulates specific timeframes for components of each stage. All stages will be completed before obtaining Development Consent.

The four-stage consultation process is described below along with an outline of consultation activities undertaken to date for each stage. Section 8.2 and the ACHAR (Appendix D) provide further details regarding Aboriginal community consultation.

6.4.1 Stage 1 Identifying Aboriginal stakeholders to be listed as Registered Aboriginal Parties

Stage 1 requires that Aboriginal people who hold cultural information are identified, notified and invited to register an expression of interest in the assessment. This identification process should draw on reasonable sources of information including: the Registrar (Aboriginal Land Rights Act, 1983), the relevant OEH Environment Protection Regulation Group (EPRG) Regional Office, the Local Aboriginal Land Council(s), the National Native Title Tribunal, the Native Title Services Corporation Limited, the relevant Catchment Management Authority and the relevant local council(s). The identification process should also include an advertisement placed in a local newspaper circulated in the general location of the development site. Aboriginal organisations and/or individuals identified should be notified of the project and invited to register an expression of interest (Eoi) for Aboriginal consultation. Once a list of Aboriginal community stakeholders has been compiled from the expression of interest process, they need to be consulted in accordance with stages 2, 3 and 4 of the ACHCRs.

In accordance with Stage 1 of the ACHCRs, letters were sent (18/10/2017) to the Albury OEH office, the Registrar of Aboriginal Owners NSW, the Native Title Tribunal, Native Title Services Corporation Limited, and the Narrandera Shire Council requesting the identification of interested Aboriginal groups. A letter was also sent to local and regional LALCs. An advertisement was placed in the Area News, the Daily Advertiser, the Narrandera Argus, the Riverine Grazier and the Southern Riverina News for at least two weeks between 23 October and 8 November 2017, inviting expressions of interest from Aboriginal stakeholders. Letters inviting expressions of interest were sent to four Aboriginal organisations (18/10/2017 and 24/10/2017) as a result of feedback from the notification process.

ESCO Pacific had phone conversations with Narrandera LALC, but they did not wish to register their interest in the project.

The following organisations have been identified as Registered Aboriginal Parties (RAPs) (Table 6.1).

Table 6.1 Registered Aboriginal Parties

RAP	Contact	Date of Expression of Interest
Mark Saddler (individual)	Mark Saddler	24/10/2017

6.4.2 Stage 2 – Providing project information

Stage 2 requires that project information is provided to Aboriginal community stakeholders by the proponent. Relevant project information may include an outline of the project activities, proposed impact areas and environmental assessment process. The presentation of the project information should be documented and include any agreed outcomes with the Aboriginal community stakeholders. In some instances, depending on the nature, scale and complexity of the project, the applicant may create the opportunity for Aboriginal community stakeholders to visit the development site and/or may conduct additional project information sessions.

6.4.3 Stage 3 – Gathering cultural significance

The purpose of Stage 3 is to gather information regarding cultural significance. The aim is to facilitate a process by which Aboriginal community stakeholders can have input into the heritage assessment methodology and management options, and provide information on the cultural significance of Aboriginal objects or places. The applicant must provide a proposed methodology for the cultural heritage assessment and allow a minimum of 28 days to respond. If needed, protocols for the appropriate handling of culturally sensitive information may need to be developed with the Aboriginal community stakeholders. The applicant must also seek the views of the Aboriginal community stakeholders on potential management options for Aboriginal objects or places.

6.4.4 Stage 4 – Draft report

Stage 4 requires that the applicant prepare a draft cultural heritage assessment report and provide a copy to the registered Aboriginal stakeholders for comment. A minimum of 28 days must be provided for the registered Aboriginal stakeholders to comment on the draft report. To finalise the report the applicant must consider the submissions made by the registered Aboriginal stakeholders and include the applicant's response to each submission. The finalised report must be provided to the registered Aboriginal stakeholders and the relevant LALC.

6.5 Community consultation

The purpose of the stakeholder and community consultation plan is to identify the key community stakeholders, present the stakeholders with details of the proposed project and give the stakeholders an opportunity to provide feedback and identify any issues or concerns they may have. The plan has focused on the following groups:

- those landholders in close proximity to the project
- individuals within the wider community that have an interest in the project.

A range of consultation activities were undertaken before and during the preparation of the EIS. An overview of these activities is outlined below.

6.5.1 Project factsheet

A project factsheet was prepared to introduce the project to key community stakeholders to provide an overview of the project. The project factsheet provided information on ESCO Pacific, a project summary and a website address for further information on the Project.

Narrandera Shire Council distributed ESCO Pacific's project factsheet to community stakeholders via mailout. The project factsheet and other information about the project were also available during the community information session (Appendix C).

6.5.2 Mail-out

Introductory letters and project factsheets were mailed by Narrandera Shire Council to all landholders within approximately 5 km of the proposed project. The letters introduced the proposed project, ESCO Pacific and encouraged landholders to contact ESCO Pacific to discuss the project further. Letters also included an invitation to the Community Consultation Meeting.

A copy of the introductory letter is provided in Appendix C.

6.5.3 Individual meetings

ESCO Pacific representatives contacted landholders closest to the project offering to meet with them to discuss the project in person prior to and after the Community Consultation Meeting. ESCO Pacific met with two of the closest landholders and contacted by phone four other landholders located close by to introduce the project and discuss any concerns or feedback.

A copy of the consultation register is provided in Appendix C.

6.5.4 Community consultation meeting

A Community information session was held at the Narrandera Ex-Servicemen's club, 41 Bolton Street, Narrandera, between 6 pm and 7 pm on Thursday 14 December 2017.

The event was advertised to government agencies, the local Aboriginal group and project neighbours and the broader community as detailed below:

- the mail-out by Narrandera Shire Council, including all houses within 5 km of the project
- the Narrandera Argus (7th, 12th and 14th December 2017 editions)
- the Sandigo Solar Farm website
- emails sent to key government stakeholders, including DPE and council.

The community information session was attended by ESCO Pacific representatives. The session provided an opportunity for community stakeholders to view the proposed plans and to speak to members of the project team to find out more. Stakeholders were encouraged to read and take a copy of the project factsheet, visit the website and or download a copy of the application (PEA Scoping Report) and complete a feedback form.

6.5.5 Project website

Project information has been provided on the Sandigo Solar Farm website www.sandigosolarfarm.com.au. The website includes an up-to-date overview of the project and offers stakeholders the opportunity to provide feedback on the project.

6.5.6 Consultation database

A consultation database has been created and maintained to record stakeholder contact details and any issues, concerns or feedback received. A copy of the Consultation Register is provided in Appendix C.

6.5.7 Issues raised

Community consultation is ongoing. Issues raised to date have been addressed within the EIS. An up to date consolidated summary of the responses received from the community consultation activities, correspondence can be provided upon request. The consultation Register is presented in Appendix C.

6.6 Continuing consultation activities

ESCO Pacific will continue to undertake consultation with stakeholders as necessary, at various times through the project including:

- EIS Public exhibition
- any other time as interest levels dictate
- as otherwise recommended by DPE.

Lines of communication between the applicant and stakeholders will remain open through various communication mediums as detailed in Section 6.5 above.

6.6.1 EIS public exhibition and post exhibition

This EIS will be placed on public exhibition for a minimum period of 30 days.

ESCO Pacific will continue to commit resources to satisfy consultation requirements during the public exhibition phase and throughout the life of the Project.

ESCO Pacific will actively engage with key stakeholders to ensure they are aware the EIS is on exhibition.

Information about the EIS will be made available on:

- the project website www.sandigosolarfarm.com.au
- the website of Department of Planning & Environment – Major Project Assessment – <http://majorprojects.planning.nsw.gov.au/>.

Contact details for ESCO Pacific will continue to be made available on the project website and on any distributed material.

ESCO Pacific will continue to undertake consultation with stakeholders as necessary post determination of the EIS for the project.

7 Risk assessment

Environmental risk assessment is the process of identifying, evaluating and controlling risks that may lead to impacts on the environmental aspects of a project. It includes identifying a clear pathway to one or more sensitive receivers, and assessing the risk of potential impacts on the sensitive receivers as a result of the project.

Key risk assessment terms and definitions are provided in Table 7.1.

Table 7.1 Key risk assessment terms and definitions

Term	Definition
Risk	The potential for an event to occur that impacts on a sensitive receiver, assessed by considering likelihood and consequence. An inherent risk is a risk before the application of risk controls and a controlled risk is a risk after the application of risk controls.
Likelihood	The likelihood of the event occurring, determined based on the history of similar incidents occurring and/or professional judgment.
Consequence	The consequence of the event occurring determined based on the history of similar incidents occurring and/or professional judgment.
Standard controls	Risk management controls considered accepted practice in industry for reducing the likelihood and/or consequence of a potential impact on a sensitive receiver. Standard controls are recognised procedures, guidelines, methods, and codes of practice that can be sourced from regulations, policies, guidelines and leading practice references.
Non-standard controls	Risk management controls that are specific to the site or the project, or are required in response to a specific project commitment or regulator/community requirement.

The risk assessment process adopted for the Sandigo Solar Farm can be summarised as follows:

- **Step 1.** Sensitive receivers were identified, corresponding to potentially 'at risk' aspects or components of the environment.
- **Step 2.** The hazards and risk sources that are applicable to the project and the development site were identified.
- **Step 3.** Project-related events that may result in an impact on a sensitive receiver were identified.
- **Step 4.** Likelihood and consequence categories were defined, including different definitions of consequence for different environmental aspects.
- **Step 5.** The inherent risk of each potential event occurring was assessed by assigning a likelihood and consequence category, and using a risk matrix (Figure 7.1) to assign a risk rating.
- **Step 6.** Standard and non-standard risk controls were applied, based on the management and mitigation measures identified during the EIS investigations, to reduce the likelihood and/or consequence of each event occurring and thereby reduce its overall risk rating.
- **Step 7.** The controlled risk of each potential impact event occurring was assessed and a new risk rating assigned.

Table 7.2 shows the likelihood levels and definitions used for the risk assessment. Table 7.3 shows the consequence levels and definitions. Consequences have been considered for the following aspects:

- environment
- heritage
- community
- project design and management.

For each event, the aspect resulting in the highest consequence category was used to assign an overall rating to the risk.

Consequence	Critical (5)	Medium	High	Very high	Very high	Very high
	Major (4)	Medium	Medium	High	Very high	Very high
	Moderate (3)	Low	Medium	Medium	High	Very high
	Minor (2)	Low	Low	Medium	Medium	High
	Insignificant (1)	Low	Low	Low	Medium	Medium
		Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Likelihood						

Figure 7.1 Risk matrix showing classification of risk ratings

Table 7.2 Likelihood categories and description

Category	Definition
Rare	May occur only in exceptional circumstances. This risk event is known to not have occurred elsewhere (likelihood < 5%).
Unlikely	Could occur at some time. This risk event is not expected to occur but could occur at some time (likelihood 5% to 30%).
Possible	Might occur at some time. This risk event could occur at any time during planned works (likelihood > 30% to 70%).
Likely	Will probably occur in most circumstances. This risk event will likely occur several times during the planned works (likelihood > 70% to 90%).
Almost certain	Expected to occur in most circumstances. This risk event will likely occur frequently during the planned works (likelihood > 90%).

Table 7.3 Consequence categories and description

Category	Environment	Heritage	Community	Project design and management
Critical	Major, irreversible impacts on viability of threatened ecological communities or species.	Irreversible damage to places or objects of very high cultural heritage significance.	Widespread, unplanned loss of major individual or community assets or infrastructure. Widespread, irreversible loss of land capability. Major debilitating injury or loss of life.	Requires extensive changes in design, construction and operation that threaten the viability of the wider organisation, and additional resources are required that may exceed the organisation's resource capability to resolve.
Major	Localised impacts on threatened ecological communities or species.	Irreversible damage to places or objects of high cultural heritage significance. Excavation and salvage of objects of high or very high cultural heritage significance.	Significant deterioration in community assets or infrastructure. Long-term loss of land capability or incompatibility of project with surrounding land use. Non-life-threatening and non-permanent injury. Substantial loss of local amenity.	Requires changes in design, construction and operation adversely impact the project's success, and additional resources are required that may exceed the project's resource capability to resolve.
Moderate	Localised, irreversible impacts on non-threatened ecological communities or species.	Irreversible damage to places or objects of moderate cultural heritage significance. Excavation and salvage of objects of moderate cultural heritage significance.	Moderate, reversible loss of land capability or land use. Occasional moderate level or frequent low-level impacts on amenity.	Changes in design, construction and operation may be required and additional resources are required, and may result in disruption to the project's timelines and activities.
Minor	Localised, reversible impacts on non-threatened ecological communities or species.	Excavation and salvage of objects of low cultural heritage significance.	Minor, reversible loss of land capability or current land use. Low level or occasional nuisance impacts on amenity.	Can be managed with no change in design, construction and operation, but may need to be prioritised and requires additional resources.
Insignificant	Localised, temporary disruption to non-threatened species.	No impact on places or objects of cultural heritage significance.	Negligible impacts on amenity, land capability or current land use.	Can be managed with no change in design, construction and operation or additional resources.

7.1 Sensitive receivers

This EIS and its supporting technical assessments have identified the following main categories of sensitive receivers that are at risk of impacts from the project:

- community – including local landholders, local businesses, registered Aboriginal parties, the broader community, council and other regulatory agencies
- environment – including terrestrial and aquatic flora and fauna, ecosystems and waterways
- heritage – including places and objects of Aboriginal or historic heritage significance.

7.2 Risk identification

Based on an understanding of the sensitive receivers potentially affected by the project, and a review of project location, design, configuration and activities, the following risks have been identified:

- loss of threatened ecological communities or species adversely impacting on biodiversity values
- injury and death of non-threatened fauna impacting on local biodiversity
- weed and pest introduction and spread impacting on local biodiversity and agriculture
- harm of Aboriginal or historic cultural heritage
- dust or other emissions affecting nearby dwellings
- increased electromagnetic interference potentially affecting public health
- increase in bushfires or electrical fires as a result of the development
- increase in downstream flood risk as a result of the development
- loss of containment of hazardous materials affecting surface waters, groundwater, soils or ecology
- loss of land capability affecting agricultural and other uses
- erosion and sedimentation affecting agricultural and other uses
- conflict with land use in surrounding areas
- noise from site activities or traffic affecting local landholders
- altered property values and reduced agricultural viability affecting the local community
- traffic accidents involving the public
- reduced visual amenity affecting nearby landholders or adjacent road users
- nuisance glint and glare affecting nearby dwellings
- excessive resource use or waste generation degrading natural capital
- cumulative impacts.

The applicability of these risks to different phases of the project phases (construction, operation and decommissioning) is summarised in Table 7.4.

Table 7.4 Potential impacts and applicability to project phases

Risk categories	Construction	Operation	Decommissioning
Biodiversity impacts	Yes	Yes	Yes
Heritage impacts	Yes	-	Yes
Dust/air emissions	Yes	-	Yes
Electromagnetic field impacts	-	Yes	-
Fire and bushfire issues	Yes	Yes	Yes
Flood and hydrology impacts	Yes	Yes	Yes
Hazardous substances issues	Yes	Yes	-
Land use impacts	Yes	Yes	Yes
Light emissions	-	Yes	-
Noise pollution	Yes	Yes	Yes
Socioeconomic and community impacts	Yes	Yes	Yes
Soils, erosion and sedimentation	Yes	-	Yes
Traffic and transport impacts	Yes	Yes	Yes
Visual amenity impacts	Yes	Yes	-
Resource use and waste generation	Yes	Yes	Yes

7.3 Preliminary risk assessment

A preliminary risk assessment is shown in Table 7.5. The preliminary risk assessment does not take into consideration the application of risk controls.

Table 7.5 Preliminary risk assessment

Aspects	Sensitive receivers	Potential risk	Likelihood	Consequence	Risk
Biodiversity	Environment	Loss of threatened ecological communities or species	Likely	Major	Very high
	Environment	Injury and death of non-threatened fauna	Likely	Moderate	High
	Environment	Weeds introduction and spread	Possible	Minor	Medium
	Environment	Pest introduction and spread	Possible	Minor	Medium
Cultural heritage (Aboriginal and historic)	Heritage	Harm of Aboriginal cultural heritage	Likely	Major	Very high
	Heritage	Harm of historic heritage	Rare	Major	Medium
Dust/air emissions	Community	Nuisance emissions	Unlikely	Minor	Low
Electromagnetic fields	Community	Increased electromagnetic interference	Unlikely	Insignificant	Low
Bushfire and electrical fire issues	Community/Environment	Development causing increase in fires	Rare	Major	Medium
Flood and hydrology	Community/Environment	Development causing flooding impacts downstream	Rare	Minor	Low
Hazardous substances	Environment	Loss of containment following spills	Unlikely	Major	Medium
Land use	Community/Environment	Loss of land capability	Unlikely	Minor	Low
	Community	Conflict with adjacent land use	Unlikely	Minor	Low
Light emissions	Community	Operations causing nuisance light	Unlikely	Minor	Low
Noise pollution	Community	Nuisance noise	Unlikely	Minor	Low
	Community	Cumulative project noise impacts	Unlikely	Minor	Low
Soils, erosion and sedimentation	Community/Environment	Erodible soils and sedimentation from construction and rehabilitation	Unlikely	Minor	Low
Socioeconomic and community	Community	Altered property values and reduced agricultural viability	Rare	Minor	Low
Traffic and transport	Community	Traffic accidents involving public	Unlikely	Critical	High

Aspects	Sensitive receivers	Potential risk	Likelihood	Consequence	Risk
	Community	Reduced amenity	Unlikely	Minor	Low
	Community	Increased traffic from cumulative projects	Unlikely	Minor	Low
Visual amenity	Community	Local amenity reduced	Unlikely	Moderate	Medium
	Community	Nuisance glint and glare	Unlikely	Minor	Low
	Community	Amenity reduced for extent of visibility	Unlikely	Minor	Low
Resource use and waste generation	Environment	Excessive resource use	Unlikely	Minor	Low
	Environment	Excessive waste generation	Unlikely	Minor	Low

7.4 Risk management and controls

Five key risks associated with the development were identified as potentially having high or very high consequences in the absence of risk controls:

- loss of threatened native vegetation communities or species
- injury and death of non-threatened fauna
- loss of Aboriginal cultural heritage
- traffic accidents involving public
- local amenity reduced.

These risks required detailed investigation and assessment by specialists (see specialist reports appended to this EIS) to assess potential risks in greater detail, and develop management and mitigation measures to reduce risks and avoid or mitigate impacts.

The proposed management and mitigation of the potential impacts associated with these keys risks is outlined in detail in Chapter 8 and the supporting technical appendices. Key risk controls include:

- locating the development site to avoid and minimise impacts on threatened ecological communities or species
- committing to having a licenced wildlife salvage team on site during vegetation removal when active hollows are identified
- locating the development site to avoid scarred trees, and preparing the ACHAR in cooperation with the RAP
- managing project-related traffic in accordance with RMS requirements to minimise the risk of accidents
- locating the development site away from nearby dwellings.

7.5 Residual risk assessment

A residual risk assessment was undertaken taking risk controls into account and is shown in Table 7.6. The revised risk rating considers the proposed management and mitigation measures for the project as described in Chapter 8 and summarised in Chapter 9.

Table 7.6 Residual risk assessment

Aspect	Sensitive receivers	Potential Impact	Mitigated Likelihood	Mitigated Consequence	Residual Risk
Biodiversity	Environment	Loss of threatened ecological communities or species	Unlikely	Moderate	Medium
	Environment	Injury and death of non-threatened fauna	Possible	Minor	Medium
	Environment	Weeds introduction and spread	Unlikely	Minor	Low
	Environment	Pest introduction and spread	Unlikely	Minor	Low
Cultural heritage (Aboriginal and historic)	Heritage	Harm of Aboriginal cultural heritage	Unlikely	Moderate	Medium
	Heritage	Harm of historic heritage	Unlikely	Minor	Low
Dust/air emissions	Community	Nuisance emissions	Unlikely	Insignificant	Low
Electromagnetic fields	Community	Increased electromagnetic interference	Unlikely	Insignificant	Low
Bush fire and electrical fire issues	Community/ Environment	Development causing increase in fires	Rare	Moderate	Low
Flood and hydrology	Community/ Environment	Development causing flooding impacts downstream	Rare	Insignificant	Low
Hazardous substances	Environment	Loss of containment following spills	Unlikely	Minor	Low
Land use loss	Environment	Loss of land capability	Rare	Insignificant	Low
	Environment	Conflict with adjacent land use	Unlikely	Minor	Low
Light emissions	Community	Operations causing nuisance light	Rare	Insignificant	Low
Noise pollution	Community	Nuisance noise	Rare	Insignificant	Low
	Community	Cumulative project noise impacts	Rare	Minor	Low
Soils, erosion and sedimentation	Environment	Erodible soils and sedimentation from construction and rehabilitation	Rare	Insignificant	Low
Socioeconomic and community	Community	Altered property values and reduced agricultural viability	Rare	Minor	Low

Aspect	Sensitive receivers	Potential Impact	Mitigated Likelihood	Mitigated Consequence	Residual Risk
Traffic and transport	Community	Traffic accidents involving public	Rare	Critical	Moderate
	Community	Reduced amenity	Rare	Insignificant	Low
	Community	Increased traffic from cumulative projects	Rare	Minor	Low
Visual amenity	Community	Local amenity reduced	Rare	Minor	Low
	Community	Nuisance glint and glare	Rare	Insignificant	Low
	Community	Amenity reduced for extent of visibility	Rare	Insignificant	Low
Resource use and waste generation	Environment	Excessive resource use	Rare	Insignificant	Low
	Environment	Excessive waste generation	Rare	Insignificant	Low

The application of standard and non-standard risk controls results in the residual risk ratings being considered low for all environmental issues, apart from the following four exceptions for which the risk is moderate:

- loss of threatened ecological communities or species
- injury and death of non-threatened fauna
- harm of Aboriginal cultural heritage
- traffic accidents involving public.

The level of risk associated with the construction, operation and rehabilitation of the project, taking into account the implementation of the proposed risk controls, mitigation strategies and management plans, is considered acceptably low.

7.6 SEPP 33 preliminary risk screening

In addition to the risk assessment above, the SEARs require:

a preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011).

The preliminary risk screening is detailed below.

7.6.1 Potentially hazardous industry

A potentially hazardous industry is defined within SEPP 33 as “a development for the purpose of any industry which, if the development were to operate without employing any measures to reduce or minimise its impact, would pose a significant risk to human health, life or property, or to the biophysical environment”.

DPE have checklists and a risk screening procedure to assist in determining whether a development proposal falls within the definition of potentially hazardous industry.

Lists of potentially hazardous industry

Industries that may fall within SEPP 33 are listed in:

- SEPP 33: Appendix 3 Table: Industries that may be potentially hazardous
- Multi-Level Risk Assessment Guidelines: IAEA Table II Checklist (DPI 2011).

Solar farms are not listed in either checklists.

Screening potentially hazardous industry

The screening procedure is based on the quantity of dangerous goods involved in the development and, in some cases, the distance of these materials from the site boundary.

Materials identified as dangerous goods for the Sandigo Solar Farm project include:

- liquefied petroleum gas (LPG)
- fire suppression gas
- fuel
- herbicides
- lithium-ion batteries (in the event a battery storage facility is developed on-site).

If any of the above materials results in a screening threshold being exceeded, the proposed project will be considered potentially hazardous and SEPP 33 will apply.

Materials need to be classified according to the National Transport Commission (2017) *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code) (NTC 2017).

The ADG Code lists the following classes of dangerous goods:

- Class 1 Explosives
- Class 2 Gases
- Class 3 Flammable liquids
- Class 4 Flammable solids
- Class 5 Oxidising substances and organic peroxides
- Class 6 Toxic and infectious substances
- Class 7 Radioactive material
- Class 8 Corrosive substances
- Class 9 Miscellaneous dangerous substances and articles, including environmentally hazardous substances.

The ADG Code classes were assigned to the materials identified as dangerous goods that are likely to be used on site. Table 7.7 presents the screening threshold levels from SEPP 33 for the dangerous goods to be considered potentially hazardous and requiring further assessment.

Table 7.7 Dangerous goods and SEPP 33 thresholds

Hazardous material	Dangerous goods class	SEPP 33 storage threshold	SEPP 33 transport threshold	
			Movements	Quantities
LPG	Class 2.1	10 tonne or 16 m ³	>500 cumulative/year >30/week	2-5 tonne
Fire suppression gas	Class 2.2	Not applicable	Not applicable	Not applicable
Fuel	Class 3 PGII	5 tonne	>750 cumulative/year >45/week	3-10 tonne
Herbicides	Class 6.1	2.5 tonne	Yes	1-3 tonne
Lithium-ion batteries	Class 9	Not applicable	>1000 cumulative/year >60/week	No limit

Assessment

Based on the quantities of dangerous goods required for solar farms, none of the screening threshold levels were exceeded and the project is therefore considered NOT potentially hazardous. Accordingly, SEPP 33 does not apply and a PHA is not required.

The major hazard associated with lithium-ion battery technologies is fire, as a result of the flammability of the substances used in the battery (Recharge 2013). Fire risks associated with lithium-ion batteries are discussed in Section 8.10.

7.6.2 Potentially offensive industry

A potentially offensive industry is defined under SEPP 33 as:

“development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.”

Identifying potentially offensive industry

The process for identifying a potentially offensive industry is based on whether a pollution control license or approval is required for the development and/or if the development causes offence having regard to the sensitivity of the receiving environment.

In the case of the Sandigo Solar Farm:

- a pollution control licence or approval is not required
- this EIS (specifically Chapter 8) assesses the impact on the environment.

Assessment

Based on the identification process and the outcomes of this EIS, the project is not considered to be potentially offensive and therefore SEPP 33 does not apply.

8 Impact assessment and management

8.1 Biodiversity

A biodiversity assessment was undertaken by Ecolink and EnviroKey to identify ecological constraints for the project and is detailed in the BDAR provided in Appendix B. This section provides a summary of the BDAR and discusses the potential impacts of the project on biodiversity.

8.1.1 Methodology

The SEARs require that an assessment of the likely biodiversity impacts of the development be conducted, having regard to the BC Act, BC Regulation, Biodiversity Assessment Method (OEH 2017a) and the Threatened Species Assessment Guidelines - Assessment of Significance (DoECC 2007).

The SEARs provide a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the biodiversity assessment for this development. Other policies and plans relevant to this biodiversity assessment include:

- Policy and Guidelines for Fish Habitat Conservation and Management (DPI 2013a)
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003)
- SEPP No. 44 – Koala Habitat Protection
- Narrandera LEP 2013

The Biodiversity Assessment Method (BAM) comprises three stages that set out the biodiversity assessment requirements and offset practices for major projects (OEH 2017a), which are as follows:

- **Stage 1** – Biodiversity assessment requirements and survey methods that must be undertaken by an applicant to identify, map and describe the native plant community types (PCTs), threatened species and threatened species' habitat on the development site and an offset site.
- **Stage 2** – Impact assessment requirements for demonstrating how any impacts on biodiversity values have been avoided and minimised at the planning, construction and operational phases of the development.

Stage 2 measures the loss to biodiversity caused by the remaining direct and indirect impacts of the development. The assessments quantify the loss and gain in biodiversity values through the determination of biodiversity credits. The loss of biodiversity values caused by the project is expressed as a biodiversity credit requirement (i.e. the number and type of biodiversity credits that would be required to offset the impact of development).

Both Stage 1 and Stage 2 are documented in the BDAR provided in Appendix B.

- **Stage 3** – An assessment of the management requirements at a biodiversity stewardship site, where offsets for impacts to biodiversity values can be managed to achieve an improvement of biodiversity values within the state. Stage 3 is typically undertaken after submission of the BDAR.

Assessment area

Preliminary biodiversity assessments undertaken as part of scoping works for the project investigated four properties in the Sandigo area (Ecolink 2017). These assessments provided the applicant with a broad overview of ecological constraints of the properties. As a result of these assessments, the applicant refined the proposed development site to the current property at 174 Mitchells Road, Sandigo. The proposed area of impact has further been refined, on the basis of the preliminary biodiversity assessment, to avoid key

ecological values within this property. This approach is consistent with the applicant's commitment to avoid and minimise biodiversity impacts and is in line with purpose of the Biodiversity Offsets Scheme provided in the BC Regulation.

The biodiversity assessment undertaken for the purpose of preparing the BDAR assessed the 231 ha development site as part of a broader survey within a larger 608 ha area that is managed by the same landholder, extending south of Kywong Faithfull Road. The areas surveyed outside the 231 ha development site will not be impacted by the proposed development. The road reserves of Mitchells Road and Kywong Faithfull Road, as well as the proposed site access along Kywong Boree Creek Road, to the east of the development site, have been included in the assessment.

Desktop assessment

The potential ecological constraints within the development site were identified based on a desktop assessment of the following information sources:

- Department of Environment Protected Matters Search Tool, to identify Matters of National Environmental Significance (MNES) under the EPBC Act
- existing threatened species listings under the BC Act, FM Act and EPBC Act
- existing records of threatened species observations in the development site, as recorded in the Threatened Species Database in the Atlas of NSW Wildlife (OEH 2017b) and BioNet Atlas (OEH 2017c).

Site assessment

A site assessment was undertaken between 27 November and 1 December 2017, by two ecologists from Ecolink under the guidance and supervision of Steven Sass from EnviroKey (Biodiversity Accreditor Assessor BAAS17047). The entire development site was walked and/or driven to assess the location and quality of habitats that were present. Areas adjacent to the development site that contained higher ecological values than the development site were also assessed as reference areas to the pre-impact conditions of the site.

Key parameters of the habitats present within each location (such as the presence/absence of shelter, foraging, and/or nesting resources) were recorded to determine the quality of the habitats present. Areas with the highest likelihood of containing native fauna, including threatened species, were inspected more closely in an attempt to inform the presence of these species based on the habitat quality. Active searches were undertaken underneath debris and leaf litter, and signs, tracks and scats were recorded to confirm the presence of particular species or fauna groups. Incidental observations of all fauna species were recorded throughout the assessment.

Plot / transect surveys

A total of 30 plot/transects were assessed during the site assessment to confirm PCTs in the development site and areas immediately adjacent. Data collected from seven of these plot/transects (as detailed in the BDAR in Appendix B) were used in accordance with the data requirements of the BAM Credit Calculator (used to calculate offsets required) to assess site values within the development site. The remainder of the plot/transects have been used to determine PCT classification and as reference data to determine vegetation quality.

Identifying patches of native vegetation

Although most of the vegetation within the development site is non-native, native scattered trees within the paddocks were classified as extant examples of historic PCTs within the landscape. These trees do not meet the definition of a 'paddock tree', as described below and in Section 2.3.3 of the BDAR, and therefore required plot/transect assessments to identify the quality and character of the vegetation. To do this, a polygon of 10 m was created around each tree within the development site, with the polygon conservatively deemed a patch of native vegetation. The area of these polygons has been used to calculate the impact to native vegetation described within this section.

Paddock tree assessment

An assessment of all paddock trees within the development site was undertaken. However, the paddock trees within the development site did not meet the definition of a paddock tree under the BAM (refer to Section 2.3.3 of the BDAR), as the foliage cover for the tree growth form group was most likely within 25% of the benchmark for the PCT most likely to occur (i.e. PCT 76).

Threatened species surveys

All threatened species surveys were undertaken from 17 to 19 October, and 27 November to 1 December 2017. Nocturnal surveys could not be undertaken on 27 November due to storms over the development site, so were undertaken from 28 to 30 November. The location of targeted threatened species is shown in Section 10.1 of the BDAR.

8.1.2 Existing conditions

Site condition

The land parcels that comprise the development site are a mixture of grazed and cropped paddocks with houses and supporting infrastructure (e.g. driveways, silos and sheds). Crops within the development site include Wheat *Triticum aestivum*, Barley *Hordeum* spp. and Canola *Brassica napus*. All three of these crops are grown in rotation, interspersed with years in which the paddocks are sowed with Rye-grass *Lolium* spp., Lucerne *Medicago sativa* subsp. *sativa* or other crops that are nitrogen fixing, return nutrients to the soil, and are also suitable for grazing. In those years, sheep graze the paddocks keeping the biomass low.

Native vegetation is largely absent from the development site, with scattered paddock trees the most obvious remnants of the historic vegetation communities that once covered the area. Despite this, some areas of native vegetation remain around the edges of the site and in the road reserves that adjoin it. Most of this vegetation consists of an overstorey of White Cypress Pine *Callitris columellaris*, Western Grey Box *Eucalyptus microcarpa*, and Buloke *Allocasuarina luehmannii* (in descending order of dominance), over a highly modified and predominantly exotic understorey. The mid-storey is largely absent, and recruitment is limited or excluded by regular grazing, and ongoing soil disturbances from cultivation and cropping.

There are three dams within the development site which generally appear to have been lined with clay and this, in combination with regular grazing by sheep, has resulted in the absence of fringing or aquatic native vegetation. There are no creeks or constructed drains within the development site, only ephemeral waterways as discussed in Section 8.4, and no natural wetlands or swamps were observed during the biodiversity assessment. North of the development site and the Sturt Highway, Sandy Creek, a tributary to the Murrumbidgee River, is located (see Photo 2.3). The vegetation in this area changes from that typical of plains to riparian in nature, with River Red-gums *Eucalyptus camaldulensis* becoming the dominant species, replacing the Grey Box and White Cypress Pine trees. There is not expected to be any impact to this vegetation.

The land-use within the development site is similar to that surrounding it (i.e. cropping and grazing). These surrounding properties generally support very little native vegetation, apart from scattered paddock trees and vegetation within road reserves or fringing the boundaries of the property. Properties to the south and west of the development site are owned by the same landholder and form part of the crop rotation system employed within the development site.

Landscape features

For all analyses of landscape features within the BDAR, a 1.5 km (1,912 ha) assessment circle around the development site was used in accordance with the BAM (OEH 2017a), using GIS layers and aerial imagery.

Bioregions, sub-regions and Mitchell landscape regions

The development site and assessment circle occur wholly within the South Western Slopes Bioregion, which lies in the foothills and isolated ranges comprising the lower inland slopes of the Great Dividing

Range, extending into western Victoria. The bioregion extends from Albury in the south to Dunedoo in the northeast. Within its boundaries lie the towns of Wagga Wagga, Mudgee, Cootamundra, Narrandera, Parkes, Gundagai and Young. The bioregion also includes parts of the Murray, Murrumbidgee, Lachlan and Macquarie river catchments.

The development site and assessment circle also occur wholly within the Lower Slopes Subregion (NSS02), which comprises of undulating and hilly ranges and isolated peaks set in wide valleys at the apices of the Riverina alluvial fans. Vegetation in this subregion consists of: Dwyer's Gum *Eucalyptus dwyeri* on granite, Red Ironbark *Eucalyptus sideroxylon* on sedimentary rocks; Hill Red Gum *Eucalyptus dealbata*, White Cypress Pine and Red Stringybark *Eucalyptus macrorhyncha* in the ranges; Grey Box woodlands with Yellow Box *Eucalyptus melliodora*, White Cypress Pine and Belah *Casuarina cristata* on lower areas.

Three Mitchell Landscapes occur within the 1.5 km assessment circle: the Lockhart Hills and Footslopes; the Murrumbidgee – Tarcutta Channels and Floodplains; and the Murrumbidgee – Tarcutta Source-bordering Dunes. The development site straddles each of these landscapes, with 87% of the site located in Lockhart Hills and Footslopes which consists of isolated steep rocky ridges and crests with wide foot slopes.

Native vegetation and cleared areas in the landscape

Regional mapping identified 223.85 ha of native vegetation within the assessment circle. Site surveys within the development site, and more broadly from publically accessible areas within the assessment circle, confirmed the location and character of this vegetation. Ten PCTs were identified within the assessment circle with the remainder being cleared land or non-native vegetation that is predominantly used for cropping and grazing (see Figure 8.1). Detailed descriptions of these PCTs are provided in the BDAR (Appendix B). Scattered paddock trees also occur within the assessment circle and are isolated by more than 50 m from the nearest patch of vegetation

Small patches of native vegetation and scattered trees within the development site are discussed in detail below.

Rivers, streams and wetlands

Sandy Creek is located within the assessment circle, approximately 500 m north of the development site. There are no rivers or streams within the development site.

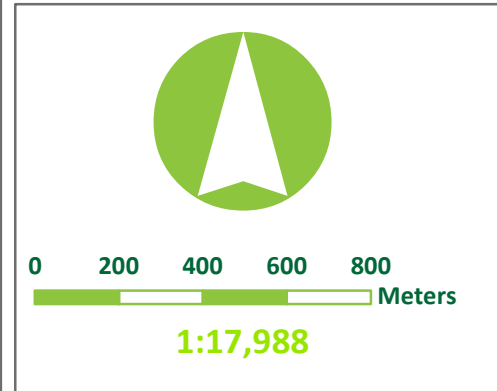
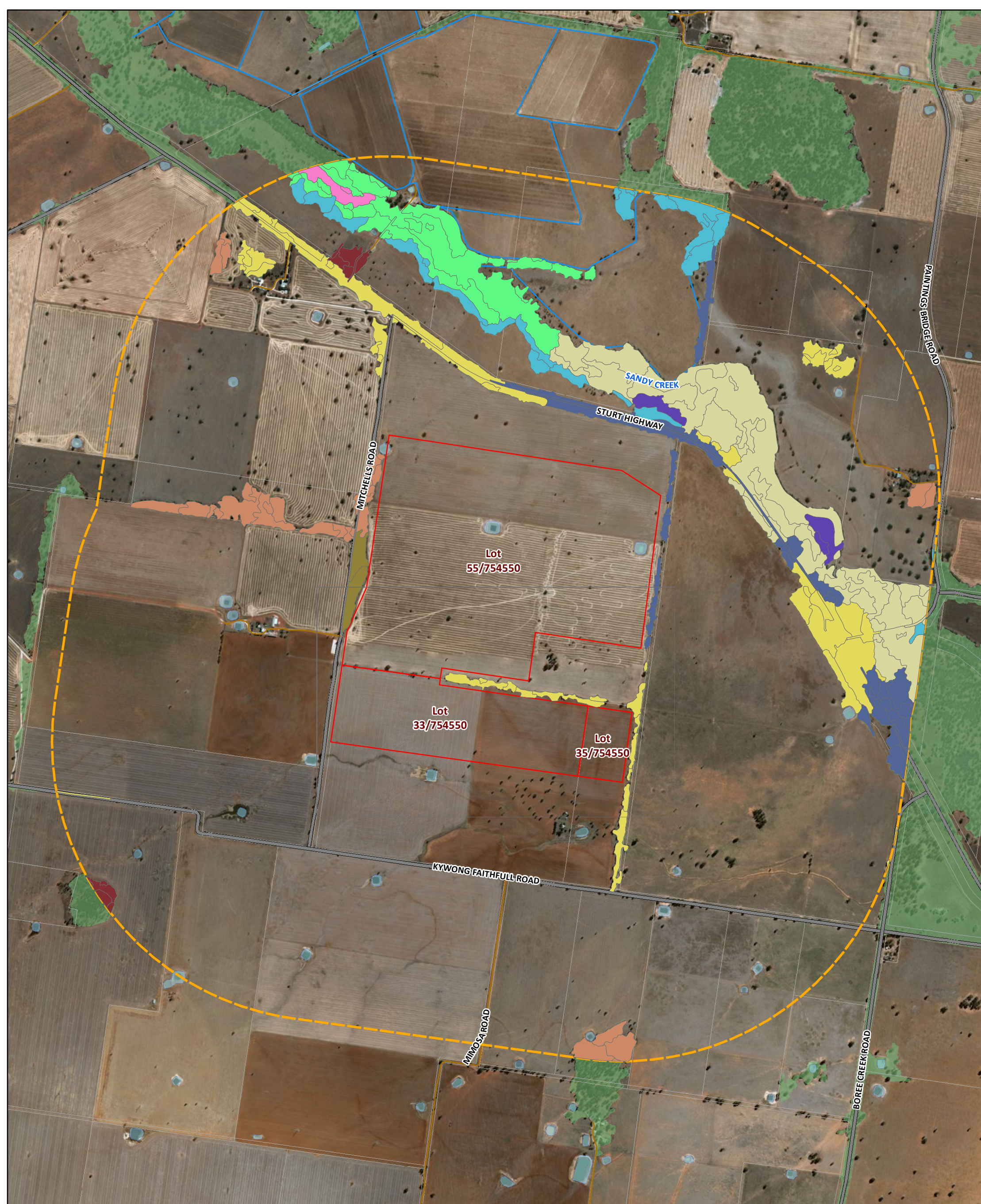
No important local wetlands, national wetlands (i.e. as listed in The Directory of Important Wetlands of Australia (Environment Australia 2001)) or international wetlands (e.g. Ramsar listed) are located in the vicinity of the development site.

Connectivity

Vegetation along the road reserve of Mitchells Road to the south of the development site provides some connectivity to longer habitat corridors associated with riparian vegetation along Sandy Creek, north of the development site, as well as roadside vegetation along Sturt Highway. Strips of vegetation along the eastern boundary of the development site also provide connections to these areas of vegetation. This vegetation will not be directly impacted by the project, as the development site avoids these areas.

Scattered paddock trees on the development site provide stepping stone habitat between larger blocks of native vegetation at Buckinbong and Gillenbah (approximately 16 km west and 24 km northwest of the development site, respectively).

Three threatened fauna species have been identified within the development site and /or immediate vicinity: Superb Parrot *Polytelis swainsonii*; Grey-crowned Babbler *Pomatostomus temporalis temporalis* and White-fronted Chat *Epthianura albifrons*. Each of these three species may use the remnant vegetation to facilitate movement within the landscape for feeding or juvenile dispersal.



0 200 400 600 800
Meters

1:17,988

Native vegetation within the development site

All areas within the development site are regionally mapped as non-native. Native vegetation within the development site is limited to small patches of remnant vegetation and scattered native trees. An assessment of the benchmarks for four PCTs most likely to have occurred pre-clearing was undertaken, based on their extant proximity to the development site, against the remaining native vegetation observed within the development site.

Of the four PCTs, PCT 76 is the most similar to vegetation present on the development site, based on limited floristic data, soil profile and landform. Eleven native plant species were recorded in the surveys undertaken for the BDAR, including seven species listed as either understorey or overstorey species for PCT 76. The vegetation is located within the floodplain of Sandy Creek, which meets the landform characteristics of this PCT.

PCT 76 is the endangered Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepine, Nandewar and Brigalow Belt Bioregions community which is listed under the BC Act, but does not qualify as the nationally significant Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia community. Species identified on the development site as belonging to PCT 76 include Western Grey Box *Eucalyptus macrocarpa* and White Cypress Pine *Callitris glaucophylla* in the upper stratum and Sprawling Bluebell *Wahlenbergia gracilis*, Corrugated Sida *Sida corrugata*, Rough Spear-grass *Austrostipa scabra* subsp. *falcata*, Plains Grass *Austrostipa aristiglumis*, and Windmill Grass *Chloris truncate* in the ground stratum.

To address the SEARs, the potential presence of Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes Bioregions was considered. However, it is considered unlikely to occur on the development site based off plot/transect surveys.

The benchmark data for PCT 76 was therefore used to assess the paddock tree data for the development site.

Vegetation zones

Vegetation zones identified within the development site are summarised in Table 8.1 and shown in Figure 8.2. The land use was accurate at the time the assessment. However, all paddocks within the development site are on a five-year cycle of cropping and grazing (year 1: wheat; year 2: barley; year 3 canola; years 4 and 5 grazed by sheep).

Table 8.1 Vegetation zones within the development site

Zone	Name and description	Total area (ha)
1	Cleared Land – dominated by crops of wheat, barley and canola, and exotic pasture grasses such as Perennial Rye-grass and Lucerne; weeds such as Common Sowthistle <i>Sonchus oleraceus</i> , Prickly Lettuce <i>Lactuca serriola</i> and the high-threat weed African Lovegrass <i>Eragrostis curvula</i> . See Photo 8.1.	228.99
2	PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (low condition). See Photo 8.2.	1.63
Total		230.62

Hollows were recorded in 15 of the remnant trees, and stick nests were recorded in 12 trees (five Corvid, four old roosting nests of a Grey-crowned Babbler and two unidentified small, stick nests). All of the nests were empty at the time of the assessment.



Figure 8.2: Vegetation Zones within the development site, scattered paddock trees and location of plot/transect surveys

Legend

Study Area

Native Vegetation

Dams

Vegetation Zones

Zone 1 - Cropped

Zone 2 - Grazed

Plot/Transects

Paddock Trees

Grey Box

Grey Box (Hollows)

Hooked Needlewood (Hollows)

White Cypress Pine

Yellow Box

0

200

400

600

800

Meters

1:13,000



Photo 8.1 Transects in Zone 1 (looking southwest and northeast)



Photo 8.2 Transects in Zone 2 (looking south and north)

Threatened species potentially present

Approximately 18 (nine fauna and nine flora) threatened species (under the BC Act) were identified by the BAM Calculator as potentially occurring on the development site. Targeted surveys were undertaken for each of these species to identify species presence or potential presence based on habitat. The Superb Parrot was identified in the trees along Mitchells Road during the field survey, immediately adjacent to the development site to the west, however no other fauna were identified. No threatened flora species were identified as occurring or potentially occurring on the development site.

Surveys for the Sloane's Froglet *Crinia sloanei* were not undertaken as there were no suitable locations for the surveys to be undertaken (as it is associated with periodically inundated areas) and the timing of the biodiversity assessment was outside the recommended survey period to detect this species. Therefore, in terms of approvals and offsetting, it has been assumed that Sloane's Froglet is present within the development site.

Other species identified as present or potentially present, which were not identified by the BAM Calculator but considered by the preliminary biodiversity assessment (Ecolink 2017) to have potential habitat, were the Grey-crowned Babbler, for which roosting nests were identified on the development site, and White-

fronted Chat, for which individuals were observed immediately adjacent to the development site. Targeted surveys of the Plains Wanderer *Pedionomus torquatus* were also undertaken to address the SEARs, but no individuals or core habitat was identified within the development site. Further information on the Plains Wanderer, including a map showing important Plains Wanderer habitat in the region, is provided in the BDAR.

Other species identified as present or potentially present, which were not identified by the BAM Calculator but considered by the preliminary biodiversity assessment (Ecolink 2017) to have potential habitat, were the Grey-crowned Babbler, for which roosting nests were identified on the development site, and White-fronted Chat, for which individuals were observed immediately adjacent to the development site. Targeted surveys for the Plains Wanderer *Pedionomus torquatus* were also undertaken to address the SEARs, but no individuals or core habitat was identified within the development site. Further information on the Plains Wanderer, including a map showing important Plains Wanderer habitat in the region, is provided in the BDAR.

Targeted searches within the development site were undertaken within, and underneath, trees to look for evidence of occupation by Koalas *Phascolarctos cinereus*. No evidence was found and it is concluded that Koalas do not occur within the development site.

The EPBC Act Protected Matters Search Tool identified 29 threatened species, 10 listed migratory species (some of which are also threatened species), four threatened ecological communities and four Wetlands of International Importance (Ramsar wetlands) that are either known, or have the potential to occur, within a 10 km radius of the development site. Of these 39 species, only five have at least a moderate likelihood of occurrence within the development site, with none having been previously recorded within the site. However, one of these species, Superb Parrot, was recorded along Mitchells road adjacent to the development site, as discussed above. Two migratory bird species, Fork-tailed Swift *Apus pacificus* and White-throated Needletail *Hirundapus caudacutus*, are also likely to occur within the boundary of the development site on occasion. However the development site does not provide important or limiting habitat for these species and is therefore unlikely to have any significant impacts to any of the species identified using the search tool.

8.1.3 Impact assessment

The proposed development of the project may result in both direct and indirect impacts on biodiversity. The direct impacts of the project are expected to comprise:

- removal of up to 1.63 ha of PCT 76 (threatened ecological community), comprising 54 trees within the development site
- removal of up to 15 hollow-bearing trees (included within the 54 trees mentioned above).

The potential indirect impacts of the project on biodiversity may include:

- erosion of disturbed areas leading to sedimentation affecting any downgradient habitat
- water quality impacts (e.g. increased turbidity and suspended solids) affecting any downgradient habitat
- short-term disturbance of fauna during construction due to noise generated by vehicles, equipment and construction activities.

Based on the targeted threatened species surveys for 'candidate threatened species' identified by the BAM calculator, up to four threatened fauna species may be impacted by the proposed development:

- Superb Parrot (also EPBC Act listed)
- Sloane's Froglet (presumed present to expedite the approvals process, despite lack of habitat)
- Grey-crowned Babbler
- White-fronted Chat.

However, none of these species are likely to be significantly impacted as a result of the project, as discussed in Section 8.1.2 above, and therefore a referral to the Environment Minister under the EPBC Act will not be made by the applicant.

The offsets required for potential impacts to threatened PCT 76 and the threatened fauna species were calculated in accordance with Section 10 of the BAM and are outlined in Section 8.1.4 below.

8.1.4 Management and mitigation

The applicant has sought to reduce impacts on biodiversity values within the development site by avoiding and minimising the removal of native vegetation and disturbance of fauna habitat. The development site has been selected in part due to its high level of disturbance from a long history of primary production and its distance from areas of high environmental sensitivity. However, to mitigate residual impacts after initial avoidance and minimisation has been implemented, a number of management measures are proposed.

Site Selection and Planning

Site access for construction and operation will be from the south via Kywong Boree Creek Road, Kywong Faithfull Road, and then north along Mitchells Road, where the road reserve is of low ecological value, to minimise vegetation removal and the risk of impacts to threatened fauna species.

Offsetting strategy

Two ecosystem credit class offsets are required to the removal of up to 1.63 ha of PCT 76, including 15 hollow bearing trees. This offset will be provided in Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions and be sourced from PCT's 76, 80, 81, 82, 101, 110, 237, and/or 248. The offset site must be in the Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee or Nymagee bioregions, or any IBRA subregion that is within 100 km of the outer edge of the impacted site.

Potential impacts to the Superb Parrot, Sloane's Froglet, Grey-crowned Babbler and White-fronted Chat will require offsetting. Two ecosystem credit units are required to offset impacts to the Superb Parrot and two for the Sloan's Froglet. These ecosystem credits will include offsets for the Grey-crowned Babbler. Offsets for White-fronted Chat are yet to be considered by OEH for inclusion in offset calculations.

A total of six ecosystem credits will be offset by the applicant. The BDAR (Appendix B) provides further information on offsets required.

Construction

No direct impacts are expected to occur as a result of the construction phase other than the removal of scattered paddock trees described in Section 8.1.3 above.

Mitigation measures to avoid and minimise impacts will be outlined in the CEMP and include:

- Unless otherwise agreed by the Responsible Authority, the removal of hollow-bearing trees will be undertaken outside of the spring to early summer period to avoid the main breeding period for hollow-dependent fauna.
- Pre-clearance surveys will be undertaken to ensure that nests and hollows identified in paddock trees are inactive.
- Where an active hollow is identified, a licenced wildlife salvage team will be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered in vegetation or hollow-bearing trees.
- Demarcation and exclusion fencing will be installed around trees and vegetation to be retained in, or directly adjacent to (within the radius of an applicable tree protection zone (TPZ)), the development site, as follows:
 - TPZs should be clearly defined

- the radius of the TPZ should be calculated for each tree by multiplying its diameter at breast height (DBH) by 12 (i.e. $TPZ = DBH \times 12$) in accordance with the Australian Standard – Protection of trees on development sites AS 4970-2009 (Standards Australia 2009)
- a TPZ should not be less than 2 m or greater than 15 m, except where crown protection is required (Standards Australia Committee 2009)
- appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' should be installed around retained trees and vegetation
- the location of any 'No Go Zones' should be identified in site inductions
- fencing should comprise star pickets with high visibility bunting.
- All material stockpiles, vehicle parking and machinery storage will be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation.
- Where practical, all paddock and hollow-bearing trees to be removed will be placed in areas of retained vegetation to provide additional fauna habitat.
- Where appropriate, native vegetation cleared from the development site will be mulched for re-use on the site, to stabilise bare ground.
- Sediment and erosion control measures will be implemented prior to construction works commencing, to protect drainage channels and any downgradient habitat as outlined in Section 8.5.3.
- Standard noise controls should be implemented during construction as outlined in Section 8.7 to minimise disturbance to fauna.
- The site rehabilitation plan will be prepared and implemented to progressively rehabilitate disturbed areas.
- A WPMP will be prepared prior to construction, as outlined in Section 8.5.3.

Operation

The impacts arising from the operation of the project are expected to be negligible due to the inherently low impact nature of solar farm operation.

Decommissioning

Where relevant, the mitigation measures listed as part of the construction phase of the project will be implemented during the decommissioning phase.

8.2 Aboriginal cultural heritage

The project may impact on the aboriginal cultural heritage of the development site, particularly during construction, by activities such as vegetation clearance and topsoil stripping. This section provides an assessment of these potential impacts and the proposed mitigation measures.

In accordance with the requirements outlined in the SEARs, ESCO Pacific commissioned an ACHAR by Aboriginal Cultural Heritage Management (ACHM) to identify aboriginal cultural heritage values within the development site and surrounding area. A draft of the ACHAR (as issued to the RAP for review and comments) is attached as Appendix D. This section is based on the draft ACHAR and provides an assessment of the potential impacts of the project on Aboriginal cultural heritage.

8.2.1 Methodology

The following were undertaken to identify the Aboriginal cultural heritage values on the development site and surrounding area:

- a detailed Aboriginal Heritage Information Management System (AHIMS) search, undertaken on 12 October 2017

- a review of Aboriginal cultural heritage studies of the wider Narrandera region, provided by OEH
- predictive modelling to identify potential density of archaeological sites and/or objects
- identification of the relevant RAP (only one individual, from the Wiradjuri, registered as a RAP)
- a pedestrian archaeological survey of the development site to determine the extent of the disturbance and identify whether Aboriginal cultural heritage or any areas sensitivity were present with the development site (undertaken 11 to 13 December 2017 and 21 to 24 January 2018 by two qualified archaeologists, accompanied by the RAP).
- consultation and engagement with the RAP.

SEARs

Specific to the assessment of cultural heritage impacts, the SEAR's require that the EIS must include:

- an assessment of the likely impacts of the development on Aboriginal heritage (cultural and archaeological), including consideration of the significance of these objects or declared places to Aboriginal people and having regard to the OEH's requirements
- an assessment of the likely impacts of the development on non-Aboriginal heritage, paying particular attention to its settlement by Europeans and pastoral history and having regard to the OEH's requirements; and
- evidence of consultation.

The SEAR relating to non-Aboriginal heritage is addressed in Section 8.3.

Consultation

Consultation with Aboriginal people about cultural heritage places and the manner in which they should be managed is required under Part 6 of the NP&W Act. The processes of consultation are specifically outlined in the Department of Environment, Climate Change and Water publication 'Aboriginal cultural heritage consultation requirements for proponents 2010' (DECCW 2010).

The consultation steps employed in the cultural heritage assessment for the project included:

- notifying relevant agencies (including the National Native Title Tribunal, Local Aboriginal Land Councils, Narrandera Shire Council and OEH – the full list is provided in the ACHAR) of the project, requesting information on any Aboriginal people or organisations who may hold relevant cultural heritage knowledge for the area to be contacted as part of consultation
- advertising for RAPs in local and regional media
- providing written notification to invite those people identified by relevant agencies to take participate in the cultural heritage assessment process
- jointly participating with the RAP in the archaeological assessment of the development site
- facilitating consultation with the RAP on the cultural values of the development site, and Walks on Country to identify and record Aboriginal cultural heritage values
- archival investigation
- consulting with OEH as required
- assessing the key cultural heritage issues for the project, considering relevant guidelines, policies and plans and input from the RAP.

The Wiradjuri RAP accompanied the project archaeologists on the pedestrian archaeological survey and was requested to comment on site specific and cultural, social, historic and aesthetic values, including the significance of archaeological and cultural sites, and values associated with flora and fauna and landscape features to inform the assessment and management measures.

Archaeological and cultural values assessment

The archaeological and cultural values assessments presented in this ACHAR have been prepared in accordance with the requirements of the following:

- the SEARs
- the community consultation guidelines of the current Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW 2010)
- Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DECCW 2005)
- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011).

The ACHAR has also been prepared in accordance with, and complies with the intent of, the requirements and assessment methodologies outlined in the Burra Charter (1999).

A determination of cultural significance, consistent with the guidance provided in the Burra Charter and Indigenous Cultural Heritage Management Practice Note (Australia ICOMOS, 2013), was made and further detail provided is provided in Section 8.2.2 below.

8.2.2 Existing conditions

Desktop search

Prior to European occupation, the development site and wider region was inhabited by the Wiradjuri People who are believed to have known the area as '*Narrungdera*'.

The AHIMS search did not identify any:

- Aboriginal sites or places within 5 km of the development site
- Aboriginal cultural heritage studies undertaken within 10 km of the development site.

OEH provided references to four Aboriginal cultural heritage studies undertaken for the region. However they are located over 25 km from the development site.

Predictive modelling identified potential higher density concentrations of Aboriginal archaeological objects closer to Sandy Creek, with the presence of artefact scatters, isolated artefacts, scarred trees and grindstones being likely.

Archaeological survey

A total of three Aboriginal cultural heritage sites and 22 isolated artefacts were recorded within the development site.

Two grindstone sites were identified in the northern area of the development site which consisted of a grindstone at each site made from sandstone with some plough damage (Photo 8.3).

One artefact scatter site was identified, consisting of a stone tool assemblage of at least 20 artefacts, mainly quartz broken flakes, crystal quartz, siltstone quartz and small quartz core/cobbles (Photo 8.4).

The cultural material found within the development site is ubiquitous to most of the country and is not considered rare, with stone artefacts known to occur in varying densities throughout the region.

The development site has been farmed extensively for at least the last 100 years, and as such is a heavily modified and disturbed landscape. There is no potential for the presence of *in-situ* sub-surface deposits requiring additional examination.



Photo 8.3 Grindstone on the development site



Photo 8.4 Stone tools on the development site

Cultural significance

Assessing the cultural significance of places or objects is central to both understanding and managing heritage places and is a requirement of the Aboriginal cultural heritage assessment reporting process (OEH 2011):

OEH recognises and acknowledges Aboriginal people as the primary determinants of the cultural significance of their heritage. In recognising these rights and interests, all parties concerned with identifying, conserving and managing cultural heritage should acknowledge, accept and act on the principles that Aboriginal people:

- *Are the primary source of information about the value of their heritage and how this is best protected and conserved,*
- *Must have an active role in any Aboriginal cultural heritage planning process,*
- *Must have early input into the assessment of the cultural significance of their heritage and its management so they can continue to fulfil their obligations towards their heritage, and*
- *Must control the way in which cultural knowledge and other information relating specifically to their heritage is used, as this may be an integral aspect of its heritage value.*

Cultural significance can be associated with or attached to any place, concept or object by any group or groups of people and is embodied in the place itself (i.e. its fabric, use, associations, meanings, and relationship to other concepts, places or objects).

The nature of cultural significance is determined by understanding the interrelationship of the following core values: aesthetic; historic; scientific; social; and spiritual. Further detail on these values is provided in the ACHAR in Appendix D.

ACHM identified that all of the cultural material identified within the development site is of low scientific significance, determined through an analysis of the site condition, rarity, contents and structure.

A written report was provided by the RAP on the cultural significance of the development site, identifying natural values such as flora and fauna, and proposing measures for their protection. The RAP also recommended that the artefact scatter site identified during the archaeological survey should be test excavated.

8.2.3 Impact assessment

The project will impact the two grindstone sites and one artefact scatter identified during the archaeological assessment of the development site. However, the artefacts located at these sites are not considered to be of high conservation value and will be relocated in consultation with the applicant and the

RAP. There is potential for unidentified artefacts on the development site to be impacted as a result of the project, but these artefacts are also highly unlikely to be of high conservation value.

Although the project has been designed to avoid harm wherever practicable and the archaeological significance of the sites within the development site is generally low, the project's impacts will contribute to the cumulative loss of Aboriginal cultural values and archaeological sites within the local area, and the region more widely.

8.2.4 Management and mitigation

The following management measures are proposed for the project:

- Undertaking controlled surface collection of archaeological materials from within the development site by qualified archaeologists in consultation and cooperation with the RAP.
- Following the surface collection, a detailed salvage report will be written by a qualified archaeologist. The report will discuss the context of the finds, as well as the nature and extent of the assemblages within a local and regional context.
- The artefacts recovered during the salvage will be held by ACHM for analysis and reporting purposes. After construction works, the artefacts recovered during the surface salvage will be relocated to a location in agreement with the applicant and the RAP.
- If any Aboriginal object is discovered and/or harmed (in or under the land) while undertaking the proposed development activities, the applicant will:
 - not further harm the object
 - immediately cease all work at the particular location
 - secure the area so as to avoid further harm to the Aboriginal object
 - notify OEH as soon as practical on 131 555, providing any details of the Aboriginal object and its location
 - not recommence any work at the particular location unless authorised in writing by OEH.
- In the event that skeletal remains are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access, and NSW Police and OEH contacted.

Proposed management measures from the RAP

The RAP has suggested that the artefact scatter site identified during the archaeological survey be test excavated. However, ACHM has identified this site as a surface scatter with no likelihood of having in-situ sub-surface deposits. The sub-soils have been extensively disturbed from extensive ploughing and grazing activities and therefore it is highly unlikely that Aboriginal objects with high conservation value occur on the development site (DECCW 2010a). Therefore, excavation of the artefact scatter site is not warranted.

8.3 Historic heritage

An historic heritage assessment was undertaken by ACHM in accordance with the NSW Heritage Manual (HO&DUAP 1996) to identify historic heritage values of the land within the development site and assess the potential impacts to them as a result of the project.

This section provides an assessment of the potential impacts to historic heritage values.

8.3.1 Methodology

The following register searches were undertaken to identify historic heritage at the development site and surrounding area:

- Australian Heritage Database. This database includes:

- places in the World Heritage List
- places in the National Heritage List
- places in the Commonwealth Heritage list
- places in the Register of the National Estate
- places in the List of Overseas Places of Historic Significance to Australia
- places under consideration, or that may have been considered for, any one of these lists.
- State Heritage Register – lists place and objects of particular importance to the people of NSW.
- Narrandera LEP – lists local heritage place or objects important for the communities in the Narrandera LGA.
- National Trust Register (NSW) – lists items or places that have a cultural significance and that are worthy of conservation.

8.3.2 Existing conditions

Narrandera is a busy town with a rich post-contact history, focused on the Murrumbidgee River which passes through the town. The first European credited with passing through the area was Captain Charles Sturt in 1829.

Australian Heritage Database

There are nine properties on the Australian Heritage Database located in Narrandera, as shown in Table 8.2. However, none of these are in proximity to the development site.

Table 8.2 Australian Heritage Database listings within the wider Narrandera area

Place	Status
Dry Lagoon Area – Sturt Highway, Narrandera	(Indicative Place) Register of the National Estate (Non-statutory archive)
Narrandera Showground – Victoria Avenue, Narrandera	(Indicative Place) Register of the National Estate (Non-statutory archive)
St Johns Uniting Church and Hall – Cadell Street, Narrandera	(Indicative Place) Register of the National Estate (Non-statutory archive)
CBC Bank (former) – 142 East Street, Narrandera	(Registered) Register of the National Estate (Non-statutory archive)
Narrandera Courthouse and Police Station Group – Larmer Street, Narrandera	(Registered) Register of the National Estate (Non-statutory archive)
Narrandera Nature Reserve	(Registered) Register of the National Estate (Non-statutory archive)
Narrandera Post Office – 140 East Street, Narrandera	(Registered) Register of the National Estate (Non-statutory archive)
Narrandera Rail Bridge	(Registered) Register of the National Estate (Non-statutory archive)
Railway Station and Station Masters Residence – Whitton Street, Narrandera	(Registered) Register of the National Estate (Non-statutory archive)

State Heritage Register

There are five places listed on the State Heritage Register at Narrandera, as shown in Table 8.3.

Table 8.3 State Heritage Register places in the Narrandera area

Item name	Address
Berembed Weir and Site	Murrumbidgee River, Narrandera
Derrendi Cottage	30 – 32 Twynam Street, Narrandera
Narrandera rail bridge over Murrumbidgee River	June-Hay railway, Narrandera
Narrandera Railways Station and yard group	Whitton St (Newell Highway), Narrandera
Narrandera Showground Industrial Hall	Elizabeth Street, Narrandera

None of these places are located in or near the development site, and there are no listings for the Sandigo area.

Narrandera LEP

There are 73 local heritage places listed in the Narrandera LEP, as listed in Appendix D.

One of these is located at Sandigo (Sandigo Hall). However it is located approximately 6 km northwest of the development site and will not be impacted.

National Trust

There are no places on the National Trust Register in or near Narrandera or Sandigo.

8.3.3 Impact assessment

There are no known places of historic heritage value or significance within or intersecting the development site. Also, it is unlikely there are any unidentified items of historic heritage located on the development site. Therefore, the project will not have any direct impacts on known historic heritage and is highly unlikely to have impacts upon unknown historic heritage.

Potential indirect impacts to historic heritage places in the vicinity of the development site are highly unlikely as the nearest historic heritage place, Sandigo Hall, is located approximately 6 km northwest. Potential indirect impacts are considered to be insignificant at such a distance.

8.3.4 Management and mitigation

No management and mitigation measures are required to be undertaken as the project is highly unlikely to impact historic heritage.

8.4 Hydrology and water resources

The hydrology of a site and downgradient waterways can be modified due to earthworks or the construction of facilities or infrastructure, potentially increasing flood risk. Groundwater hydrology can also be affected by dewatering of excavations or water extraction to meet project supply needs.

Surface water and groundwater quality can be affected by issues such as erosion from soil disturbance, or the release of chemicals and hydrocarbons.

Changes to hydrology or water quality can cause impacts on surface water and groundwater resources affecting beneficial uses of these resources. This section provides an assessment of the potential hydrology and water resource impacts resulting from the project, including an assessment of flood risk. It aims to

address the SEARs and Agencies' comments regarding surface water and groundwater resources, water requirements and supply arrangements, and erosion and sediment control.

8.4.1 Methodology

A literature review was undertaken to assess the existing hydrology and water resources for the development site, including sourcing information from the Department of Primary Industries (DPI) and from and Narrandera LEP 2013 maps and website tools. A review was also undertaken of the geotechnical survey for the project, which included the drilling of boreholes (SMEC 2018).

Flood risk assessment

A flood risk assessment of the development site was undertaken by Alluvium, in response to the SEARs, and is provided as Appendix E.

To determine the flood extents of at the Sandigo Solar Farm, development of a 2D flood model was required to determine the channel and overland flows. High resolution digital elevation model data (200mm) was collected by an Unmanned Aerial Vehicle (UAV, or drone) and combined with existing 25 m interval data. The 2D flood model was built using TUFLOW software and used to determine the channel and overland flows. This approach was approved by OEH on 23 January 2018.

The Direct Rainfall Approach was used for the flood simulation. Rainstorms were applied to the model created above for the 0.2% [1:500] annual exceedance probability (AEP), 1% [1:100] AEP and 10% [1:10] AEP events for the 60 minute, 120 minute and 180 minute storm duration events. The 60-minute storm was found to be the critical duration event, which is quite common for small sized catchments under the rainfall temporal pattern data sets from Australian Rainfall and Runoff (1987).

To assist with validating the model, the Regional Flood Frequency Estimation Model (RFFEM 2016) was used to determine the upper limit discharges for the project catchment at the same measurement locations used in the TUFLOW model.

An investigation of the flooding hazard was achieved by multiplying the maximum flood depths and velocities of the 100-year ARI event (1% AEP).

To assess the risk to the site posed by riverine flooding external to the site along Sandy Creek, a review was undertaken of the Narrandera Flood Study Review and Levee Options Assessment (Lyll & Associates 2015), which was commissioned by Narrandera Shire Council.

Erosion and sediment control

SMEC was engaged by the applicant to undertake a geotechnical assessment for the project (SMEC 2018). The geotechnical assessment included an analysis of soils and an assessment of erosion and drainage risk that included:

- literature review and field observation
- drilling and logging 30 boreholes across the development site
- collection of representative soil samples from eight boreholes
- laboratory analysis of the eight samples using Emerson Dispersion Tests conducted in accordance with Australian Standard AS1289 3.8.1 Method of testing soils for engineering purposes.

8.4.2 Existing conditions

Surface water hydrology

Regional and local setting

On the broadest scale, the development site is located within the Murray-Darling Basin, a catchment that drains approximately one-seventh of Australia's landmass (Pilgrim 2007).

One of the main rivers in the Murray-Darling Basin is the Murrumbidgee River, which is located approximately 13 km to the north and northeast of the development site. This major west-flowing river passes through the township of Narrandera (25 km downstream of the site) and into the Murray River near Robinvale, a further 350 km away. Other named creeks in the vicinity of the site, all of which flow into the Murrumbidgee River, include:

- Old Man Creek 5.7 km to the northeast
- Boree Creek 5 km to the south
- Sandy Creek, 500 m to the north

The development site is located within the Sandy Creek sub-catchment of the Murrumbidgee catchment (NSC 2015).

As the site is located within the Murrumbidgee Irrigation Area (MIA) and the irrigation of agricultural is an essential component of the regional economy, the protection of surface water resources is paramount.

Development site

The development site is drained by a number of smaller unnamed and ephemeral tributaries of Sandy Creek. The northern part of the site drains to the north directly to Sandy Creek and the southern third drains to the south to an easterly flowing ephemeral tributary. Figure 8.3 shows the two sub-catchments within the development site and the direction of drainage. Note that the streamlines have been generated by the flood model and all drainage lines within the development site are ephemeral.

Two constructed farm dams are located along the ephemeral drainage lines within the northern part of the development site.

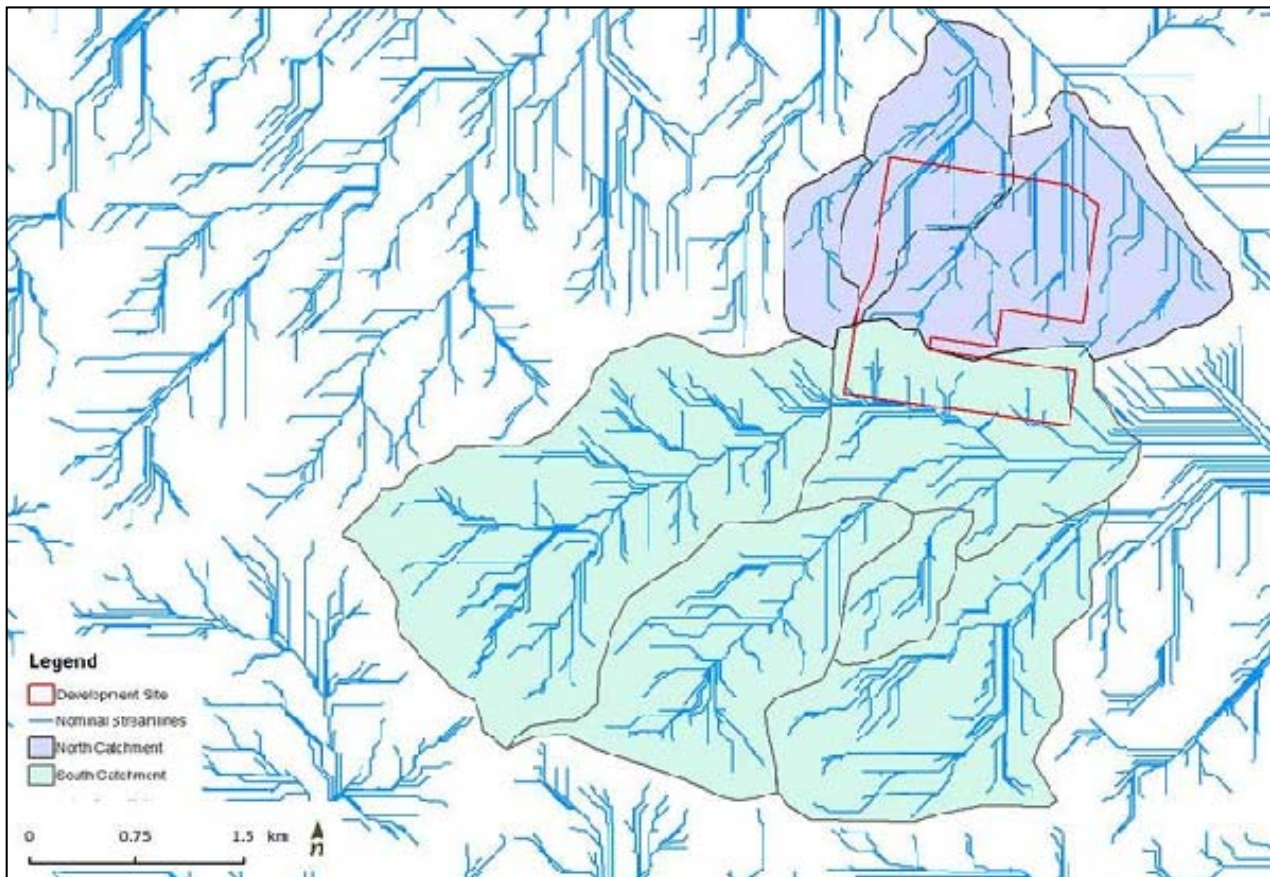


Figure 8.3 Development site sub-catchments (Alluvium 2018)

The development site is not located within a flood planning area as designated under the Narrandera LEP. However, due to an upstream catchment of 1,800 ha, the presence of farm dams and low-lying areas, and

the proximity of the site to Sandy Creek, flooding at the site is considered a risk. The flood risk assessment undertaken by Alluvium is discussed in Section 8.4.3 below.

Groundwater

Groundwater is a vital source of water for a number of communities throughout the mid and upper Murrumbidgee catchment. Town water supply is the largest use of the resource presently. However, irrigation development in the area since the late 1990s has resulted in a significant increase in groundwater usage (NSW Department of Water and Energy 2007). Groundwater is used for irrigation of winter and summer crops, fodder crops, dairy, rice, viticulture, horticulture and aquaculture.

NSW records for groundwater bores shows four bores within approximately 2 km of the development site. Three of these bores are within 50 m of Sandy Creek to the north and east with standing water level at 6.0 m below surface, and one is located on the plains to the south of the development site with a recorded standing water level 25.0 m (DPI 2017). A geotechnical survey undertaken for the project included boreholes drilled to depths of up to 6.45 m without intercepting groundwater (SMEC 2018).

Erosion and sediment

The soils of the development site are moderately dispersive and therefore prone to erosion (SMEC 2018).

8.4.3 Impact assessment

Flood risks

Two categories of flood risk have been considered:

- flood risks posed by the project
- flood risks posed to the project.

Flood risks posed by the project

There are two main potential impacts the Solar Farm development could have on flooding and runoff external to the site.

- impacts on riverine flood levels due to the project being an obstruction to flow
- impacts on flood levels due the development producing extra runoff.

As shown in Appendix E, the footprint of the development site is outside of the 1% AEP flood extent, and just on the verge of the probable maximum flood (PMF) flood extent. At these outer limits of flooding, flood waters and the associated floodplain will be acting as both 'minor conveyance' and also 'minor storage' as per the NSW Floodplain Development Manual (NSW 2005). As the development footprint has little or no intrusion into the 1% and PMF flood extents, and as the development itself (mostly vertical poles spaced at significant distances) will generate little or no afflux within slow moving flood waters, the potential of the development to be an obstruction to riverine flood flow is considered to be negligible.

Literature was reviewed by Alluvium regarding the potential for the solar panels to generate additional local stormwater runoff. It was concluded that so long as the developed site vegetation conditions are maintained to pre-development conditions, and that impervious areas are not increased substantially, additional runoff as a result of the project is unlikely to occur.

Risks posed to the project

The investigation of flooding hazard showed that the majority of the development site is of low risk with the exception of the southern boundary (Figure 8.4).



Figure 8.4 Flood hazard mapping of the development site for a 100 year ARI (1% AEP)

The conceptual design shows that the substation and office buildings are located away from drainage lines and outside the flooding zone. If they were moved to a different location along the transmission line as part of detailed design, the applicant would ensure that the new location was also located away from drainage lines and flooding zones.

Construction

Water quality

In addition to the hydrological impacts discussed in the flood risk assessment above, potential impacts to surface water and groundwater quality during construction could occur due to contamination from unintended spillages of fuel, lubricants, herbicides, sewage and other chemicals.

During the construction of the project, fuels, chemicals or other potential contaminants will be used or stored onsite. However, the quantities of chemicals used during construction will be relatively minor. With the management and mitigation measures proposed in Section 8.4.4, there are not expected to be any significant impacts to surface water or groundwater quality.

Any residual water within the farm dams will be pumped out prior to infilling. The water will be offered to the landholder for use or storage in another dam, used preferentially as a source of water during construction, or tested and, if of suitable quality, disposed of to surface drainage lines in accordance with EPA requirements.

The soils of the development site are moderately dispersive and therefore prone to erosion, which increases the risk of turbid and sediment-laden discharge to surface water (SMEC 2018). However, with the implementation of appropriate erosion and sediment control measures outlined in Section 8.5.3, impacts from soil erosion are expected to be minor and readily manageable.

Groundwater impacts are expected to be unlikely as excavation will not be required to erect the solar panels, and trenches for underground cables will be shallow. Earthworks will mostly occur within 1 m of the ground surface and are therefore highly unlikely to intercept the groundwater table.

Water use

Water use during project construction will be minimal and water will be trucked to fill onsite water tanks as required. Temporary toilets will be available throughout the construction period for use by contractors. These toilets will be pumped out by a local licenced waste contractor.

Therefore, the project is not expected to impact on the availability of current surface water or groundwater resources to local landholders.

Operation

Water quality

In addition to the hydrological impacts discussed in the flood risk assessment above, potential impacts to surface water and groundwater quality during operation could occur due to contamination from unintended spillages of fuel, lubricants, herbicides, sewage and other chemicals.

Only minor quantities of chemicals will be used and stored on site during operation and there will be no fuel storage. With the management and mitigation measures proposed in Section 8.5.3, there are not expected to be any significant impacts to surface water or groundwater quality.

The management of water flows on and offsite have been designed to minimise erosion and sedimentation from the site (see Section 8.5). The revegetation of the site following construction will minimise the risk of impacts.

Water supply

The project will collect water from building roofs and utilise onsite water storage tanks. It is anticipated that 500 kilolitres (kL) of water will be used during operation each year for cleaning, maintenance, and staff amenities. Water will be trucked in during periods when there is insufficient rainfall to fill onsite water tanks.

No impact on the availability of current groundwater resources used by local landholders is anticipated.

8.4.4 Management and mitigation

Design

During the conceptual design phase, the project footprint was specifically located to avoid the two larger ephemeral watercourses located close to the current development site.

The design of the project layout will ensure any high-risk site facilities (such as the substation) are located away from areas of potential flood risk. The indicative location of site facilities on the project layout (see Figure 3.1) avoids the ephemeral waterways within the development site as well as the flood hazard areas.

Project design will be in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004)

Construction

The following management and mitigation measures will be implemented during construction to limit the impacts of the project on hydrology and water resources:

- implementing erosion and sediment control measures during construction as outlined in Section 8.5.3, including minimising areas of disturbance and rehabilitating disturbed areas as soon as possible
- installing effective stormwater management and control measures during construction, in accordance with the erosion and sediment control plans for the site

- developing and implementing procedures for the testing and management of construction wastewater if disposal is required
- refuelling plant and machinery in an impervious bunded area at least 50 m away from water bodies and drainage lines
- storing fuel and chemicals in an impervious bunded area at least 50 m away from water bodies and drainage lines as outlined in Section 8.5.3
- implementing a spill response plan (to be prepared as part of the CEMP) which will include containment and remediation procedures, placement of spill kits and safety data sheets (SDSs), and training requirements for staff as outlined in Section 8.5.3
- disposing of all hazardous chemicals and waste offsite in accordance with relevant NSW government regulations and guidelines
- daily inspection of all machinery and plant to ensure no leakage of fuels, lubricants or other liquids.

Operation

The following management and mitigation measures will be implemented during operation to limit the impacts of the project on hydrology and water resources:

- maintaining vegetation cover under all solar panel arrays to maximise water infiltration
- undertaking regular inspection of equipment and facilities to identify any spills or leaks
- implementing a spill response plan (also used for the CEMP)
- treating sewage by an onsite bio-cycle system installed to comply with Building Code of Australia (BCA) requirements
- ensuring the Emergency Response Plan (ERP) for the project includes procedures to be followed in the event of flooding within the development site or surrounding area, including information on safe evacuation routes.

8.5 Soils and land use

Potential impacts of the project on agricultural land and flood prone land, and compatibility with existing land uses on the development site and adjacent land, including nearby mineral and exploration activities, are assessed in this section. They address the Agencies' comments on the SEARs such as provided by NSW Department of Industry and NSW Planning & Environment – Resources & Geoscience.

8.5.1 Existing conditions

Land use within development site

The development site, covering approximately 231 ha of rural land, is highly modified due to its history of agriculture and grazing, and is comprised largely of pasture grasses and environmental weeds. The site is generally flat and is crossed by a number of ephemeral watercourses.

The three lots on which the development site is located are a mixture of grazed and cropped paddocks. Crops include Wheat *Triticum aestivum*, Barley *Hordeum* spp. and Canola *Brassica napus*. All three of these crops are grown in rotation, interspersed with years in which the paddocks are sowed with Rye-grass *Lolium* spp., Lucerne *Medicago sativa* subsp. *sativa* or other crops that are nitrogen fixing, return nutrients to the soil, and are also suitable for grazing. In those years, sheep graze the paddocks keeping the biomass low. Due to the long history of grazing and cropping activities in the area, there has been significant disturbance in natural environment, and native vegetation is largely absent.

Two dams are present on the development site, but will be infilled during construction. No building structures or distinct tracks are present on the site.

The development site is zoned RU1 primary production under the provisions of the Narrandera Shire LEP 2003 (see Figure 2.1).

Surrounding land use

The land use immediately surrounding the site is similar to that of the site (i.e. mainly cropping paddocks). The wider landscape also consists largely of land historically cleared for agriculture, with vegetation cover occurring along road reserves and waterways such as Sandy Creek, located approximately 500 m north. Surrounding land use is shown in Figure 8.5.

The development site is located in the Riverina region of southwestern NSW which consists predominantly of irrigated land, with agriculture, forestry and fishing being the main industries.

North: The land immediately to the north is a strip of cropped land approximately 320 m wide and is bounded to the north by the Sturt Highway (A20). A further 200 m north of this road is Sandy Creek and the land between the road and Sandy Creek appears to be used for grazing purposes.

East: The land immediately to the east appears to be used for grazing, and is separated from the development site via a windrow of trees running the length of the development site's eastern boundary. This grazed paddock is bounded by the Sturt Highway to the north and northeast and by Kywong Boree Creek Road to the east and southeast.

West: The land immediately to the west is owned by the same landholder as the development site, and forms part of the crop rotation system employed within the site. The landholder's residence is located approximately 1 km northwest of the development site.

South: The land immediately to the south is also owned by the same landholder as the development site, and forms part of the site's crop rotation system. Paddock trees are present on the land.

Geology, soil and land capability

The geology of the area consists of Late Ordovician sedimentary rocks (largely obscured by residual and colluvial deposits) and minor Quaternary deposits of black and red clayey silt, and the sand and gravel of the Shepparton Formation (Figure 8.6).

A review of the eSPADE website (OEH 2018) shows two types of soil across site: one is classified as a Red Brown Earth which is a subset of the Chromosol group of soils; the other is classified as Grey, Brown and Red calcareous soils which is a subset of the Kandosol group of soils.

Chromosols are soils with a strong texture contrast between the sandy or loamy surface (A) horizon overlying a clayey subsoil (B) horizon. The subsoil is not strongly acid (pH greater than 5.5) and is not sodic (CSIRO 2018a).

Kandosols are soils that lack strong texture contrast between the surface (A) horizons and subsoil (B) horizons. They are also characterised by having massive (structureless) or only very weakly structured subsoils and are often 'earthy' in appearance. Some part of the weakly developed B horizon must have a clay content of more than 15%. Kandosols are usually well-drained, permeable soils and often have low fertility (CSIRO 2018b).

The northern and southeastern areas of the development site have exposed clay surfaces that are very dry and prone to erosion following cropping due to the lack of vegetation. Soil surveys undertaken by SMEC on the development site identified the soils as Emerson (dispersion) Class no. 2, correlating to moderately dispersive soil that is prone to erosion (SMEC 2018).

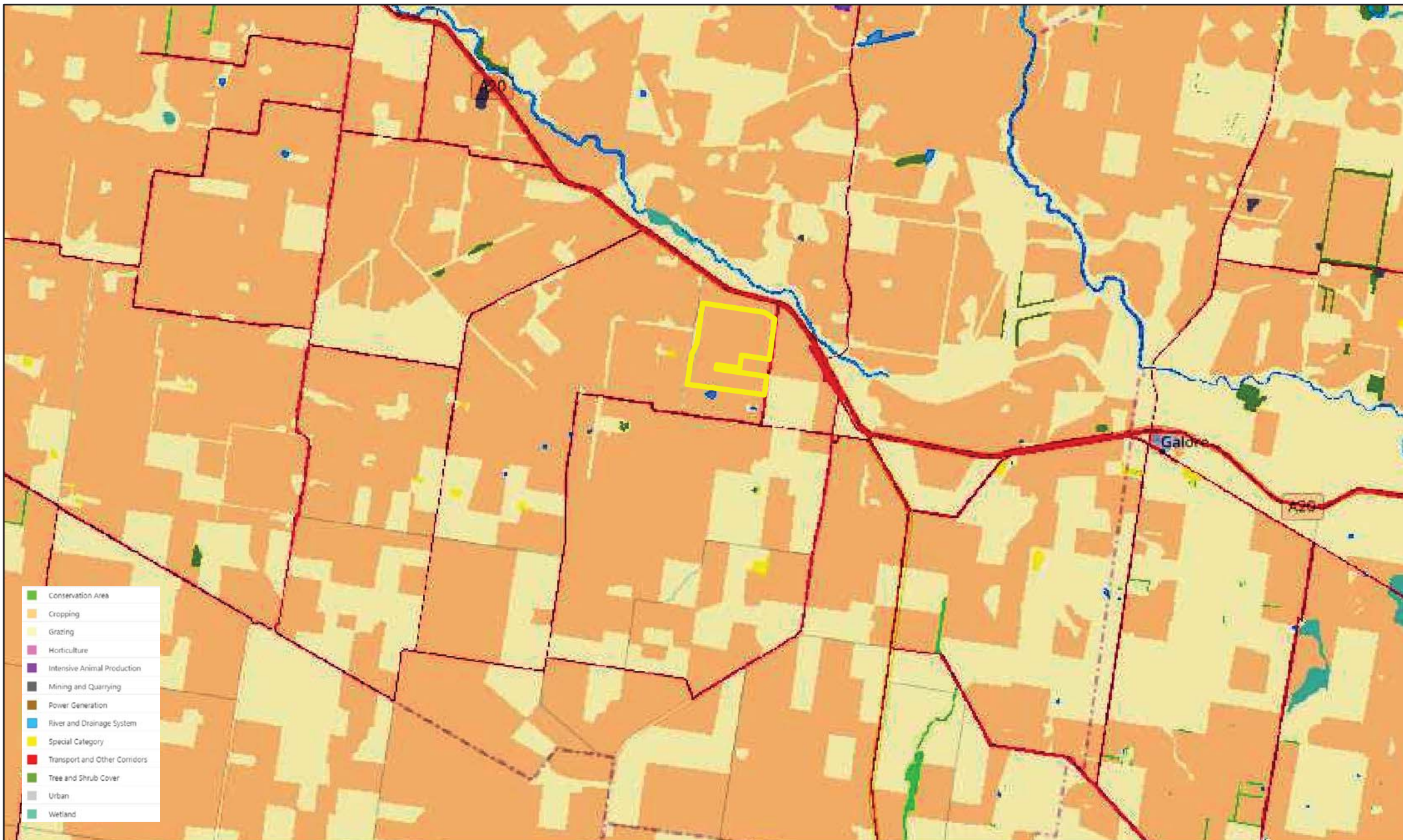


Figure 8.5

Local Landuse Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 16/02/2018

Legend

 Development Site

Map generated from SEED web map 11/01/2018



0 500 1,000 2,000
Metres

1:100,000 when printed @ A4



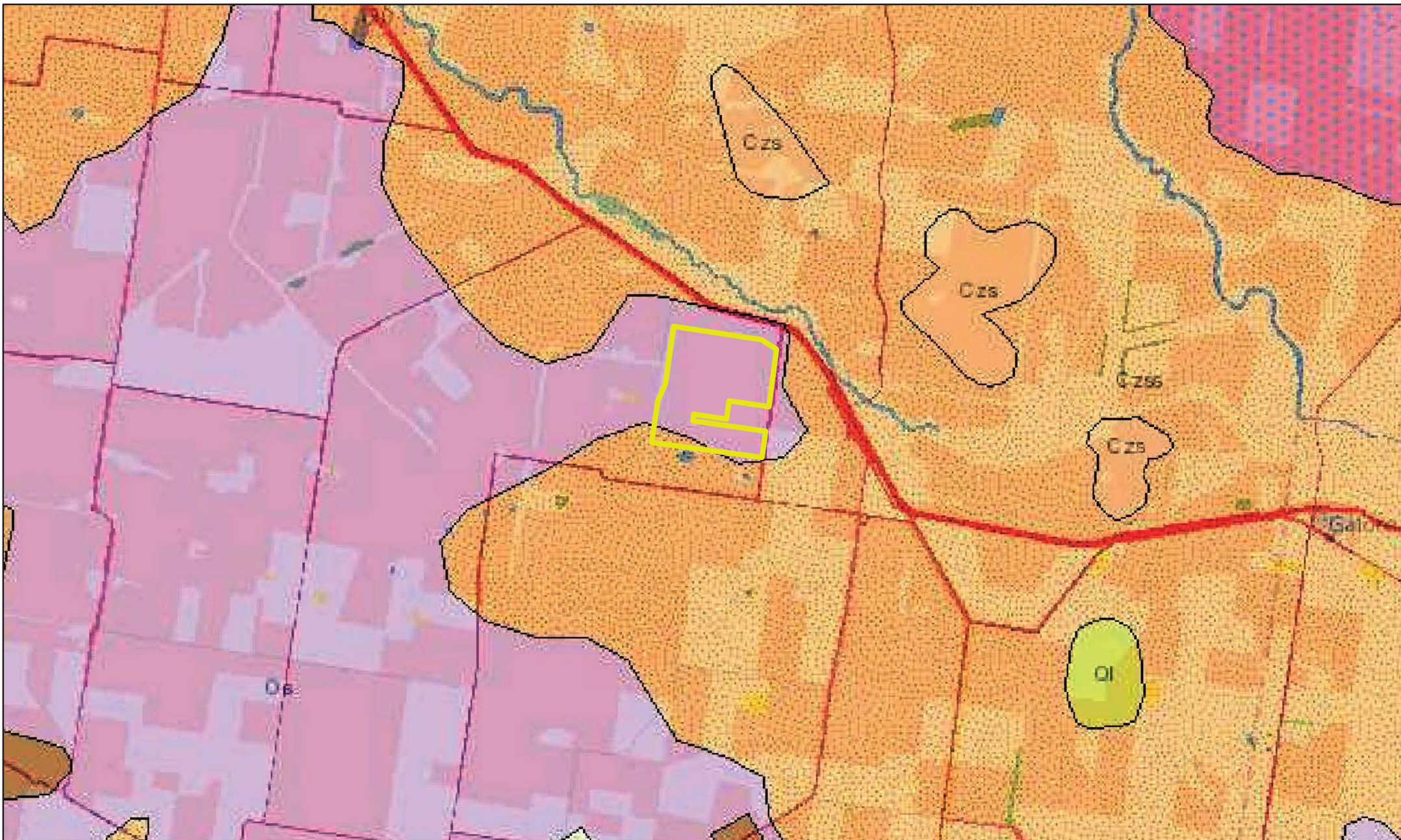


Figure 8.6

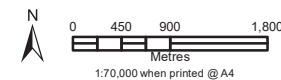
Local Geology Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 16/02/2018

Legend

Development Site

Map generated from SEED web map 11/01/2018



ACCENT
ENVIRONMENTAL

Legend

Unit Boundaries and Faults

- Administrative boundary
- Coastline
- Dyke or vein
- Fault
- Fault, concealed
- Geological boundary, concealed
- Geological boundary; Transitional geological boundary
- Shear zone
- Shear zone, concealed
- Water feature
- Water feature boundary

Rock Unit Pattern Fills

- Granite, A-type
- Granite, I-type
- Granite, I-S transitional type
- Granite, S-type
- Granite, unknown type
- Mafic volcanic
- Mafic intrusion
- Unconsolidated sedimentary rocks
- Metamorphic rocks
- Volcanic rocks
- Volcanic rocks, A-type
- Volcanic rocks, I-type
- Volcanic rocks, S-type
- Volcanic rocks, type unknown
- Volcanic and volcanoclastic rocks
- Volcanoclastic and volcanic rocks

Rock Unit Polygon Colours

- Qa - Quaternary alluvial deposits
- Qd - Quaternary coastal dune deposits
- Qdw - Quaternary Woornen Formation - poorly consolidated red-brown sand dunes
- Ql - Quaternary lacustrine deposits
- Qe - Quaternary estuarine and delta deposits
- Water
- Qdl - Quaternary Lowan Sand -

- unconsolidated red-brown sand dunes; locally mobile
- Qc - Quaternary colluvial deposits
- Czl - Quaternary lacustrine deposits
- Czd - Cenozoic sand dunes
- Czvm - Cenozoic mafic volcanic rocks
- Czs - Cainozoic undifferentiated sediments/sedimentary rocks
- Czss - Cenozoic Shepparton Formation - poorly consolidated clay, silt, sand and gravel
- Czi - Cenozoic silcrete and silicified, poorly consolidated sediments/sedimentary rocks
- Czvu - Cenozoic silicic to intermediate volcanics - undifferentiated
- Czgu - Cenozoic silicic to intermediate intrusives - undifferentiated
- Ks - Cretaceous sedimentary rocks
- Kgu - Cretaceous silicic to intermediate intrusives - undifferentiated
- Js - Jurassic sedimentary rocks
- Jvm - Jurassic mafic volcanic rocks
- RJs - Triassic-Jurassic sedimentary rocks
- RJvm - Triassic-Jurassic mafic volcanic rocks
- Jgu - Jurassic silicic to intermediate intrusives - undifferentiated
- Mzvu - Mesozoic silicic to intermediate volcanics - undifferentiated
- Rs & Rv - Triassic sedimentary and volcanic rocks
- Rgl - Triassic granites to intermediate intrusives
- Ps & Pvm - Permian sedimentary and mafic volcanic rocks
- Pvu, Pvl, Psv - Permian silicic to intermediate volcanic and volcanoclastic rocks
- Pgu, Pgl, Pgs - Permian granites
- CPs - Carboniferous-Permian sedimentary rocks
- Cs - Carboniferous sedimentary rocks
- Ct - Carboniferous metamorphic rocks

- Csv, Cvu - Carboniferous sedimentary and volcanic rocks
- Cgl, Cgu, Cgs - Carboniferous granites
- DCs - Devonian-Carboniferous sedimentary rocks
- Ds, Dsv, Dvl, Dvu, Dva, Dvs - Devonian sedimentary and volcanic rocks
- Dvm - Devonian mafic volcanic rocks
- DUs - Late Devonian sedimentary rocks
- SDs - Silurian-Devonian sedimentary rocks
- Dgl, Dga, Dgu, Dgs - Devonian granites
- Svm - Silurian mafic volcanic rocks
- Ss, Ssv, Svu, Svl, Svs - Silurian sedimentary and volcanic rocks
- Sgu, Sgl, Sgs - Silurian granites
- Os, Ot - Ordovician sedimentary & metamorphic rocks
- Osv - Ordovician sedimentary and mafic volcanic and volcanoclastic rocks
- Ogu - Ordovician silicic to intermediate intrusives - undifferentiated
- EOs - Cambrian-Ordovician sedimentary rocks
- Es, Esv, Et - Cambrian sedimentary, volcanic and metamorphic rocks
- Evm - Cambrian mafic volcanic rocks
- Paleozoic mafic intrusive rocks
- Pzx - Palaeozoic complex, melange or undivided rocks
- U - Palaeozoic ultramafic rocks and serpentized ultramafic rocks
- Ns - Neoproterozoic sedimentary rocks
- Lt - Palaeoproterozoic metamorphic rocks

To assess the land and soil capability (LSC), data presented on the Land and Soil Capability Mapping on the eSPADE website (OEH 2018) has been reviewed. This dataset indicates the proposed development is mapped as LSC Class 3 land which, according to the classification, has 'moderate limitations'. This class of land is capable of sustaining high impact land uses using more intensive, readily available and accepted management practices. LSC Class 3 land is suited to grazing, including the use of improved pastures. Cultivation is limited to cash or forage crops in rotation with pastures.

Figure 8.7 shows the land and soil capability for the site and surrounding area.

Potential contamination

To assess potential contamination in the area, searches of two publicly available databases were conducted on 18 January 2018. A search of the *OEH contaminated land public record* (NSW Government 2016a) was undertaken for contaminated sites within the Narrandera LGA and the search returned no results. The online list of *NSW contaminated sites notified to the EPA* (NSW Government 2016b) was conducted and returned three listings, two of which were in the Narrandera township and one in the hamlet of Gillenbah (2.5 km southwest of Narrandera). None of the sites are near the proposed development site.

Past and present agricultural activities at the site (e.g. use and disposal of herbicides and pesticides) have the potential to pose a contamination risk. However, no indications of soil contamination were observed during site inspections.

Acid sulfate soils

The Australian Soil Resource Information System indicates there is a low probability / low confidence that acid sulfate soils occur on the site (CSIRO 2013). No indications of acid sulfate soils were observed during site inspections.

Mineral Resources

A search of DPEs MinView tool on 16 January 2018 and consultation with Narrandera Shire Council identified there are no minerals, petroleum or coal exploration titles or applications over the development site (Figure 8.8) (DPE 2018).

The nearest mining or exploration title area to the development site is held by Thomson Resources Limited. The title is located approximately 36 km to the north and is highly unlikely to be affected by the project.

Other land uses in the vicinity of the site include extractive industry use, with five quarries intermittently operating within 12 km of the site. These sites are shown on Figure 8.8 and include:

- **Mimosa Pit:** 1.7 km north of the site. This intermittently operating pit is not currently being used. It provides sand for construction purposes.
- **Wrights Pit²:** 6 km northwest of the site. This pit is intermittently operated by Narrandera Shire Council (including currently), providing phyllite for construction materials.
- **Palmerston Pit:** 10 km northeast of the site. This is an intermittently operating gravel pit.
- **Birrego Pit:** 11 km west of the site. This intermittently operating pit extracts unprocessed construction materials.
- **Waurberrima Pit:** 12 km northeast of the site. This intermittently operating pit extracts unprocessed construction materials.
- **Buckingbong Pit:** 17.6 km northwest of the site. This is an intermittently operating pit extracts unprocessed construction materials.

² Referred to as Sandigo Pit in MinView search tool, but Wrights Pit in correspondence received from Narrandera Shire Council.

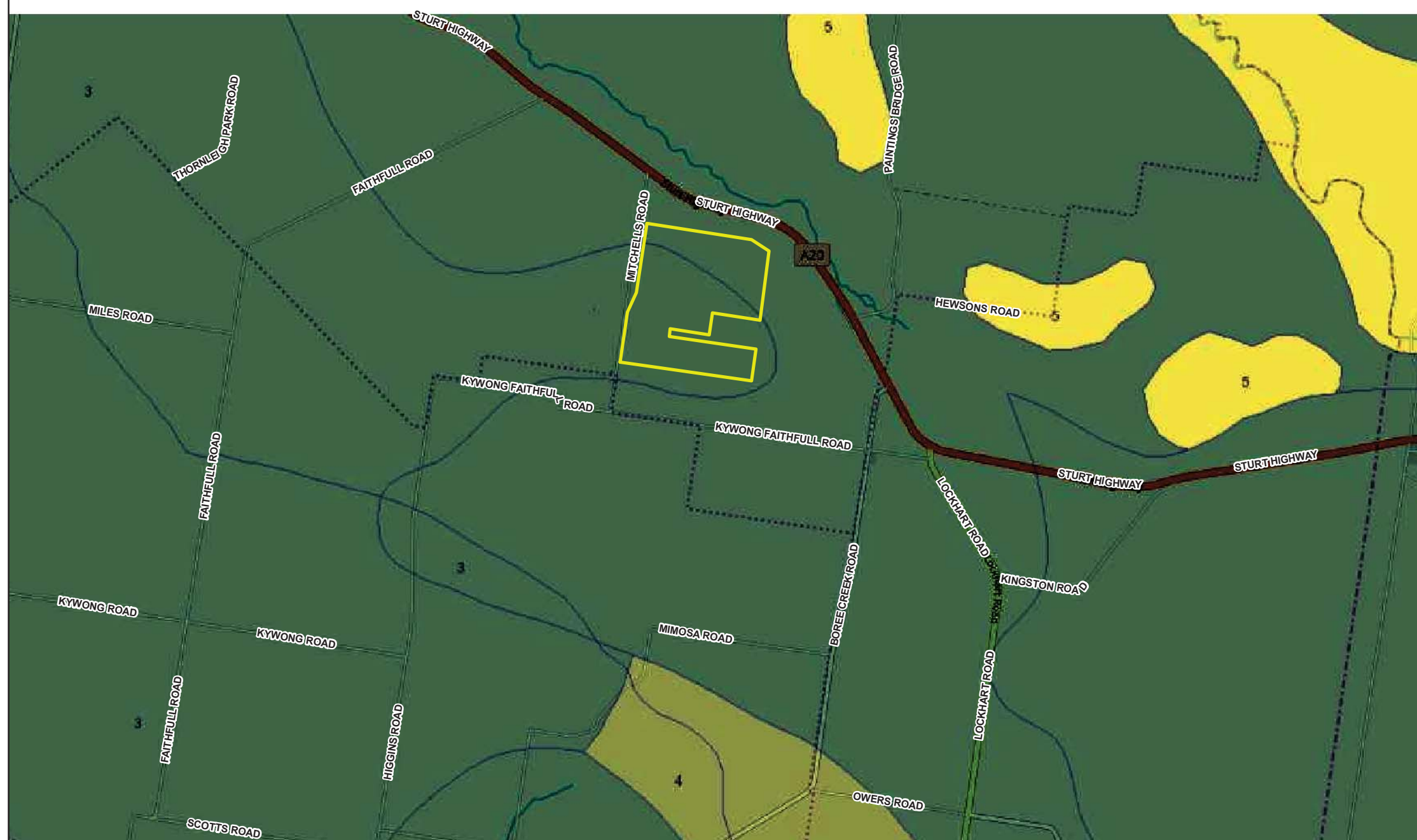


Figure 8.7

Land and Soil Capability

Sandigo Solar Farm

Client: Esco Pacific
 Project: Sandigo Solar Farm
 Project No: XXXX
 Mapping by GeoEccentric 20/12/2017

Legend

Development Site

	1 Very slight to negligible limitations
	2 Slight but significant limitations
	3 Moderate limitations
	4 Moderate to severe limitations
	5 Severe limitations
	6 Very severe limitations
	7 Extremely severe limitations

Map generated from SEED web map 11/01/2018

N

0 500 1,000 2,000

Metres

1:70,000 when printed @ A4





Figure 8.8

Recorded Mineral Occurrences
Sandigo Solar Farm

Legend

- Development Site
- Recorded Mineral Occurrences
- Watercourse
- Highway
- Main Road
- Local Road



0 500 1,000 2,000
Metres
1:90,000 when printed @ A4



Flooding and water resources

The development site is located within the Murray-Darling Basin. One of the main rivers of the basin, the Murrumbidgee River, is located 12.8 km to the north and northeast of the site. Other waterways in the vicinity of the site, all of which flow into the Murrumbidgee River, include:

- Sandy Creek, approximately 500 m to the north
- Old Man Creek, approximately 5.7 km to the northeast
- Boree Creek, approximately 5 km to the south.

The north and south of the development site is drained by a number of smaller unnamed and largely ephemeral tributaries of Sandy Creek. The development site is within the Sandy Creek sub-catchment of the Murrumbidgee catchment (Narrandera Shire Council 2015).

The development site is not located within a flood planning area as designated under the Narrandera LEP. However, due to the presence of ephemeral watercourses, farm dams and low-lying areas (particularly toward the centre of the development site), localised flooding of paddocks may occur. The potential for flooding within the development site is addressed in detail in Section 8.4.

Agriculture

The main land use in the Narrandera LGA is rural and the area consists predominantly of irrigated land. As described in Section 8.12, agriculture, forestry and fishing are the main employers with the main agricultural activities being sheep and cattle farming and grain growing.

Biophysical Strategic Agricultural Land (BSAL) is land that contains high quality soil resources suitable for agriculture. A review of the state-wide mapping under the SEPP (Mining, Petroleum Production and Extractive Industries) 2007 did not identify areas of BSAL on the development site (NSW Government 2018c). The nearest BSAL is located approximately 24 km east of the development site.

8.5.2 Impact assessment

Land use

The site landholder has signed an Option to Purchase with ESCO Pacific. He owns several parcels in the Sandigo area totaling approximately 1,500 ha. Of this area, 231 ha will be used for the project, which is approximately 15% of the total area of his landholding. The landholder would be able to continue farming activities on the remaining land without disruption.

The project will alter the current land use from agriculture to electricity generation, reducing the availability of land for agriculture during project operation. During construction, agricultural land use on the 231 ha development site would cease. However, during operation there may be an opportunity for grazing to occur on the site. Once the project is decommissioned, the site would be able to be returned to its existing state, including the re-excavation of the two currently existing farm dams that are to be infilled.

As outlined in Section 5.3.1, the project is considered compatible with surrounding land uses.

Geology, soil and land capability

Soils have the potential to be impacted as a result of construction activities such as excavation and earthworks, resulting in the risk of soil erosion and sedimentation, particularly due to the moderate dispersive property of the soils (SMEC 2018). Due to the relatively flat topography of the site, large-scale excavations and other earth works will not be required.

Key construction works with the potential to increase erosion and sedimentation impacts are:

- slashing/removal of areas of vegetation
- excavation for installation of underground cabling in trenches
- installation of internal roads, access tracks, and laydown areas

- construction of the permanent site office, maintenance shed, switchyard and battery storage facility, and temporary contractor facilities
- installation of drainage works
- levelling/backfilling of existing dams
- construction vehicle movements on the site.

The above activities will potentially reduce the stability of soil, particularly through removal and disturbance of vegetation. This will increase the risk of soil erosion, particularly on windy days or during heavy rainfall. By disturbing the soil profile, particularly topsoil, vegetation may also take longer to re-establish in these areas. However, soil disturbance will only occur in a small portion of the development site. Activities such as the pile driving of the steel posts supporting the solar panels and installation of fencing will result in impacts that are highly localised and unlikely to result in significantly disturbed soils.

Vehicle movement, as well as other construction and decommissioning activities, have the potential to generate dust. However, dust issues are expected to be readily manageable, as discussed further in Section 8.9.

Soil compaction in areas such as internal roads and access tracks can result in soil erosion through an increase in runoff during rainfall events due to the reduced soil permeability, resulting in concentrated flows. Effective road design and management is required to control such risks.

Impacts to soil during operation are expected to be minimal, however there is potential for some dust generation from vehicle movement. Disturbed areas used during construction, but not required during operation (e.g. laydown and construction parking areas), will require rehabilitation and soils stabilisation.

Concentrated runoff from solar panels during rainfall events has potential to increase the effect of erosion. However, retaining vegetation cover underneath and surrounding these panels will mitigate this.

There is some risk of soil contamination during construction as a result of the use of fuels, lubricants and other chemicals such as herbicides. Soil contamination from these chemicals could potentially inhibit plant growth on the site, reducing stabilisation of soil and increasing runoff into waterways after rainfall events. Contamination could also adversely affect land capability and cause wider ecological effects. If soil contamination from existing or past agricultural activities such as pesticide and herbicide use is identified during construction, it will be addressed in accordance with the CEMP.

Mineral resources

The development site is not located on an area identified as a mineral resource and therefore will not impact on the availability of resources to the extractive industry. The project is unlikely to impact upon the operation of surrounding mines or quarries, including the Mimosa Pit or Wrights Pit (see Section 8.6).

Flooding and water resources

As discussed in Section 8.4.3, the project the potential of the development to be an obstruction to riverine flood flow is considered to be negligible. The flat areas toward the centre of the development site could be susceptible to localised flooding (SMEC 2018).

Impacts to flooding and water resources are discussed further in Section 8.4.

Agriculture

Due to the nature of solar farms, impacts to the agricultural productivity of the site will be minimal. During construction, trenching works will separate topsoils from subsoils. At the end of operation, the site will be decommissioned and the land rehabilitated to its existing conditions as far as practical to continue the existing farming land use on the site.

During operation, the landholder will be allowed to graze livestock within the development site. The landholder is yet to decide if he will exercise this right.

The development site does not contain areas of BSAL and the temporary loss of 231 ha of agricultural land is not considered a significant loss for the Riverina region.

Due to the increased movement in people and vehicles to and from the site, particularly during construction and decommissioning, there is the potential for an increase in the spread of weeds and pathogens. Perishable waste such as food waste can attract pest animals to the site, including rats, foxes and rabbits. Weeds and pest animals should be able to be readily managed through the adoption of standard management and mitigation measures, as outlined in Section 8.5.3.

8.5.3 Management and mitigation

Construction

Potential erosion and sedimentation impacts as a result of construction will be managed in accordance with the CEMP for the project. The CEMP would be developed with the following guidelines to address potential erosion and sedimentation impacts:

- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition (Landcom 2004) (also known as the Blue Book)
- Volume 2A Installation of Services (DECC 2008a)
- Volume 2C Unsealed Roads (DECC 2008b).

The CEMP will include the following measures to reduce potential impacts to soils, land use and agricultural land:

- designing internal access roads, tracks and the site carpark with adequate runoff controls to prevent erosion from concentrated flows (e.g. as outlined in Landcom (2004))
- constructing and/or installing erosion and sediment control structures, and regular inspection of them, particularly following rainfall events (e.g. as outlined in Landcom (2004))
- lining drains with geotextile or plastic, where required to reduce erosion
- maintaining a register of erosion and sediment control activities, including records of inspection and maintenance
- minimising areas of disturbance and rehabilitating disturbed areas as soon as possible with appropriate plant species
- separating topsoil and subsoil and ensuring that soils are reinstated in the correct order
- filling trenches progressively after placement of underground cabling
- implementing a weed and pest management plan (WPMP) to be developed prior to construction, to reduce the spread of weeds and pathogens and control pest animals. This should include:
 - identification of areas on the development site which have environmental weeds
 - methods for controlling weeds e.g. herbicides, physical removal, grazing, etc.
 - ongoing monitoring of weeds
- implementing a vehicle hygiene protocol when entering and leaving the site to ensure vehicles and earthmoving machinery are free of debris, sediment and weeds
- ensuring any fill brought to site is weed and pathogen free
- implementing a TMP to ensure vehicles adhere to speed limits and keep to designated roads to reduce generation of dust. This is further outlined in Section 8.6 (traffic and transport) and Section 8.9 (air quality)
- ensuring appropriate stockpile management to reduce dust, erosive runoff and potential contamination (where relevant)
- implementing a contamination procedure (to be developed as part of the CEMP) outlining appropriate steps and authorities to be notified in the event buried contamination is uncovered

- refuelling plant and machinery in an impervious bunded area at least 50 m away from water bodies and drainage lines
- storing fuel and chemicals in an impervious bunded area at least 50 m away from water bodies and drainage lines
- implementing a Spill Response Plan (to be prepared as part of the CEMP) which will include containment and remediation procedures, placement of spill kits and MSDSs, and training requirements for staff
- disposing of all hazardous chemicals and waste offsite in accordance with relevant NSW government regulations and guidelines.

Operation

Assuming areas disturbed by construction are effectively rehabilitated, soil erosion during operation will be limited predominantly to dust generation from internal roads and access tracks and the site car park. There is a low potential for contamination to occur associated with vehicle use and some maintenance activities.

The OEMP will include the following measures to reduce potential impacts to soils, land use and agricultural land:

- undertaking regular inspection of drains and erosion and sediment control structures
- revegetating any residual areas still disturbed following construction (where no longer active) with appropriate plant species
- maintaining vegetation cover across the development site to reduce potential erosion impacts
- implementing a WPMP, to manage weed occurrence on site
- implementing a vehicle hygiene protocol for any earth moving machinery entering and leaving the site to ensure it is free of debris, sediment and weeds
- implementing a spill response plan.

Decommissioning

Management and mitigation measures to be implemented as part of decommissioning would be similar to those implemented during construction, as will be outlined in the DMP. Decommissioning will largely focus on reinstatement of the development site to its original (pre-construction) condition.

8.6 Traffic and transport

Traffic and transport can present a significant risk to human health, biodiversity and infrastructure by increasing traffic movements, removal of vegetation for improved sighting and disruption to existing businesses in the local area. This section provides an assessment of the potential impacts associated with traffic and transport.

In accordance with the requirements outlined in the SEARs, ESCO Pacific commissioned a Traffic Impact Assessment (report attached as Appendix F) undertaken by IMPACT Traffic Engineering Pty Ltd (IMPACT). This assessment identified the existing conditions including the existing road network, and assessed the impacts of the proposed development by considering the proposed vehicle access routes, site access, vehicular movements and sighting requirements.

8.6.1 Existing conditions

The existing road network

The existing road network in the vicinity of the development site is shown on Figure 3.1. Access to the site during construction and operation will be from the Sturt Highway, located immediately north of the site, via Kywong Boree Creek Road and Kywong Faithfull Road. These roads are described below.

Sturt Highway

The Sturt Highway to the north of the development site is a State Arterial Road which is aligned generally in an east – west direction and extends east from Gawler in South Australia to the Hume Highway in southern New South Wales.

In the vicinity of the site, the Sturt Highway has been constructed with a central seal in the order of 7 m (two 3.5 m lanes) plus sealed shoulders measuring approximately 2 to 3 m on each side.

Kywong Boree Creek Road

Kywong Boree Creek Road is a local council road which extends south / south-west from Sturt Highway for approximately 60 km before terminating as a T-intersection at Federation Way in Urana.

In the vicinity of the site, Kywong Boree Creek Road is constructed with a central sealed pavement width in the order of 6 m, with unsealed gravel shoulders on each side. Vehicles can use the unsealed shoulders to pass turning vehicles where necessary.

Kywong Faithfull Road

Kywong Faithfull Road is a small local access road (council controlled) which extends west from Lockhart Road through various landholdings, until terminating as a T-intersection at Faithfull Road. It is noted that very limited local traffic (predominantly farmers) would be expected to pass through this area, with no households directly accessed from this road.

Kywong Faithfull Road is constructed with an unsealed pavement in the order of 4.5 to 5 m which allows for two vehicles to pass one another as required.

Mitchells Road

Mitchells Road is a small unsealed access road (council controlled) which extends south from Sturt Highway for approximately 3 km until its intersection with Kywong Faithfull Road.

Road network limits

RMS is the state government agency that regulates vehicular load limits in NSW. RMS provides both General Mass Limits (GML) and Concessional Mass Limits (CML) for vehicles using roads in NSW. The RMS network plan confirms that the following roads in the vicinity of the site are all approved for GML and CML heavy vehicles: Sturt Highway (A20), Kywong Boree Creek Road, and Kywong Faithfull Road.

Mitchells Road, which runs along the site's western boundary, is not an approved GML or CML heavy vehicle route. Therefore, additional approvals are expected to be required if this road is to be used as part of the heavy vehicle delivery route.

Intersection sight distances

A sight distance assessment of the following key intersections in the vicinity of the site was undertaken by IMPACT:

- Sturt Highway – Kywong Boree Creek Road
- Kywong-Boree Creek Road – Kywong Faithfull Road
- Kywong-Faithfull Road – Mitchells Road
- Mitchells Road – site access.

Sturt Highway – Kywong-Boree Creek Road

Sturt Highway is generally flat, and trees along the verge of the highway are setback approximately 8 m from the carriageway. The sight distance at this intersection to the northwest and southeast is expected to comfortably exceed the minimum requirement.

Kywong Boree Creek Road – Kywong Faithfull Road

Kywong-Boree Creek Road is generally flat, with sparse vegetation along the western side of the carriageway and within 50 m of the intersection. Trees are setback more than 9 m from the carriageway. Approximately 80 m north of the intersection there is a cluster of trees setback approximately 5 m from the carriageway. The sight distance to the north and south is expected to comfortably exceed the minimum requirement.

Kywong Faithfull Road – Mitchells Road

Kywong Faithfull Road is flat with limited vegetation on either side of the carriageway and with sight distances in excess of 300 m from the Mitchells Road intersection. This would allow vehicles travelling from the site to select a gap in traffic along Kywong Faithfull Road.

Mitchells Road - Site access

Given the relatively straight horizontal alignment of Mitchells Road and limited vegetation along the southern end of this road (where it will be used for site access), sight distances more than 300 m are available from the indicative site access locations. This would allow vehicles entering and exiting the site adequate opportunity to select a gap in traffic.

8.6.2 Methodology

To assess the impacts of traffic on the site, the following aspects were considered:

- site location and local and regional context
- the existing road network
- vehicle access routes, including:
 - the anticipated access routes from Sydney to the site and from Melbourne to the site for the delivery of solar module/substation components
 - the anticipated access routes for delivery of construction materials such as aggregate and gravel, and water deliveries
 - the anticipated access routes for project workers
- site access points
- vehicle turning lane requirements
- sight distance requirements and assessed intersection sight distances
- traffic generation during construction, operation and decommissioning
- the impacts of the traffic on the local roads and nearby businesses (including the local mineral extraction pits).

To assist with the transport management assessment, the following documents were considered:

- AustRoads Guide to Road Design (and RMS supplements) (AustRoads 2009)
- National Heavy Vehicle Accreditation Scheme (NHVAS) Fact Sheet (NHVR 2016).

8.6.3 Impact assessment

Construction

Traffic generation

Total and peak vehicle movements have been estimated based on the eight month construction phase, and are shown in Table 8.4. Each vehicle movement includes both the trip to and from the development site.

Table 8.4 Estimated traffic – construction

Type of vehicle	Approximate total vehicle movements	Peak daily vehicle movements
Heavy vehicles	1,570	14
Light vehicles	2,816	16
Total vehicles	4,351	30

In non-peak months (months 1 to 4 and 6 to 8), total vehicle movements will range from 24 to 26 movements per day, comprising 8 to 10 heavy vehicle movements and a consistent average of 16 light vehicle movements.

It is anticipated the following vehicle movements will be required during the site construction:

- transportation of construction workers
- delivery of high voltage equipment, PV components, and related construction materials
- delivery of construction materials for the permanent site office, switch yard, and maintenance buildings
- delivery of temporary construction worker toilets, lunchrooms, and site office
- mobilisation and de-mobilisation of heavy plant and equipment
- delivery of aggregates and concrete for civil works.

Potential impacts

The following aspects have been identified as being potentially impacted by the proposed development:

- traffic efficiency, including:
 - disruption to existing public transport services including school bus routes along the Sturt Highway
 - minor delays to trip times caused by movements of project-related vehicles along the major transport routes
 - delays as a result a result of road closures (it should be noted that no road closures are currently planned during construction or decommissioning of project)
- safety, particularly increased collision risks with other vehicles, cyclists, pedestrians, stock and wildlife
- amenity associated dust (where traffic is on unsealed roads) and noise adversely affecting nearby residents.

Traffic impact on road network

Data provided by RMS indicates that Sturt Highway generally carries in the order of 1,200 vehicles per day in the vicinity of the development site. Therefore, the addition of project-related traffic during peak periods (30 vehicle movements/60 vehicle trips per day) equates to an approximate increase in traffic of 5%. Such an increase is expected to be comfortably absorbed by Sturt Highway, with no significant detrimental impacts to operation or safety.

Anticipated construction traffic on Kywong Boree Creek Road and Kywong Faithfull Road will represent a significant increase to the volumes on these roads. However, the two roads will have sufficient capacity to cater for such increase traffic movements, particularly given the short term nature of construction (8 months). Construction traffic will therefore not be expected to have any significant impact on the operation or safety of Kywong Boree Creek Road or Kywong Faithfull Road.

The applicant will undertake a pre-construction condition audit of both Kywong-Boree Creek Road and Kywong Faithfull Road, and both roads would need to be restored to their pre-construction condition once construction is complete.

Mitchells Road is not pre-approved for heavy vehicle deliveries, and council approval would be required for this use. It is anticipated that only the southern portion of Mitchells Road will be used by heavy vehicles.

Given the short-term nature of the construction traffic, it is expected that this road will be able to adequately cater for project traffic. It is noted, however, that some upgrades and/or regular maintenance may be required to rectify any construction-related defects that may occur.

The applicant will also undertake a pre-construction condition audit of Mitchells Road, and for it to be restored to its pre-construction condition once construction is complete.

Traffic impact on nearby mineral extraction sites

The potential impact of construction traffic on two nearby mineral extraction pits, Mimosa Pit (1.7 km north of the site and Wrights Pit (6 km northwest of the site), was assessed (see Figure 8.8). As Mimosa Pit is not currently operational, and no approvals for its use are pending, there is expected to be no impact on the use of this pit due to project-related heavy vehicle traffic. As Wrights Pit is located to the northwest and project-related heavy vehicles would be expected to access the proposed development site from the east, impacts on the use of this pit are expected to be minimal.

Project personnel accommodated in Narrandera would access the development site past the turnoff to Wrights Pit. However, given the anticipated relatively low numbers of staff making this journey and the level of traffic currently using Sturt Highway, their impacts on the use of Wrights Pit would be negligible.

Operation

Traffic generation

During the operational phase of a solar farm project such as this, minimal traffic movements are generated and this phase is anticipated to have a negligible impact upon traffic on the local road network.

Traffic generation during operation is not expected to exceed 19 movements (38 trips) per week.

Operational traffic will be generated from the following sources:

- electricians and operators
- water trucks and sewage disposal
- general delivery of replacement equipment and parts
- labour for PV module cleaning
- labour for general maintenance.

Traffic impact on road network

Compared with project construction traffic and background traffic levels along Sturt Highway, traffic during project operation will be minimal. Due to the minimal existing use of local roads (Kywong Boree Creek Road, Kywong Faithfull Road and Mitchells Road), operating traffic will be noticeable, but is not expected to have any material impact.

Traffic impact on nearby mineral extraction sites

As anticipated traffic during operation is much less than during the construction phase, traffic impact on the nearby mineral extraction sites is anticipated to be negligible.

Decommissioning

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 traffic generated during decommissioning and associated impacts would be similar to that during the construction phase.

8.6.4 Management and mitigation

Construction phase

Additional approvals (if required) will be obtained prior to construction for the use of Mitchells Road as part of the heavy vehicle delivery route.

The applicant will undertake a pre-construction condition audit of Kywong-Boree Creek Road, Kywong Faithfull Road and Mitchells Road. The roads will be restored to their pre-construction condition once construction is complete.

Traffic management measures will be put in place to mitigate any potential impacts. This includes the development of a TMP prior to construction, in consultation with the council, RMS and any other relevant stakeholders. The TMP will include the following:

- confirmation of the project construction timeframe and work stages
- confirmation of expected traffic volumes generated by the project for all work stages
- identification of all heavy vehicle and over-dimensional vehicle haulage routes for all work stages
- a mechanism to review identified haulage route road conditions prior to the commencement of works
- mechanisms/agreements (if deemed necessary) to maintain haulage route roads and road infrastructure, including local public roads used by site traffic, during construction works and to reinstate roads to at least pre-construction conditions
- any additional requirements for specific work stage construction traffic management plans
- any additional relevant mechanisms for over-dimensional vehicle permits and traffic management requirements.

Traffic-related impacts to amenity during construction (such as noise and dust) will be addressed in the CEMP with management measures proposed to mitigate these (see Section 8.7 (noise) and Section 8.9 (dust)).

Operation

Risks to road safety from operational traffic are expected to be minimal. However, an OEMP will be prepared, including traffic management measures to mitigate any potential nuisances from traffic.

Decommissioning

Traffic management measures will be implemented to mitigate any potential impacts.

8.7 Noise

The project has the potential to create noise impacts as result of the use of noise-generating activities such as operation of vehicles, equipment and machinery, and the presence of staff. The majority of these impacts will be temporary and primarily experienced during construction and decommissioning. This section provides an assessment of the potential noise impacts as a result of this project. Further detail regarding the noise assessment is contained in the noise impact assessment report, attached as Appendix G.

8.7.1 Existing conditions

The development site is located approximately 300 m south of Sturt Highway, 600 m north of Kywong Faithfull Road, 1.5 km west of Kywong Boree Creek Road, and is adjacent to Mitchells Road to the west. Sturt Highway is the nearest major road, is used by light and heavy vehicles, and is expected to be the main external noise source. The other roads experience local traffic and are used by light vehicles and

occasionally farm machinery and other heavy vehicles. These roads are also expected to be sources of external noise.

Land use in the vicinity of the development site is predominantly cropping and grazing, therefore the operation of noise generating machinery and equipment such as harvesters, boom sprayers and tractors, are a further source of external noise.

Other land uses in the vicinity of the site include extractive industry use, with the Mimosa Pit and Wrights Pit located approximately 1.7 km north and 6 km northwest, respectively, of the site. These pits operate intermittently, with Mimosa Pit not currently in operation. During extractive operations at these pits there may be an increase in noise generated from vehicles travelling to and from the sites on the Sturt Highway.

Dwellings in the landscape are sparse. These dwellings would be expected to generate low levels of noise as a result of equipment such as generators or on-site water pumps.

Noise from insects and wind through trees and vegetation would also contribute to background noise levels within and in the vicinity of the development site.

8.7.2 Methodology

Construction noise

Impacts from construction noise have been assessed in accordance with the 'Interim Construction Noise Guideline' (ICNG) (DECC 2009) which provides guidance on managing works to minimise noise (including airborne noise, ground-borne noise and blasting), with an emphasis on communication and cooperation with all involved in, or affected by, construction and noise.

Noise criteria

A rating background noise level (RBL) has been derived for noise assessment purposes. The RBL is the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (EPA 2017). As background noise monitoring was not undertaken as part of this assessment, it has been assumed conservatively that background levels are less than 30 dB(A) during all time periods. In accordance with the Noise Policy for Industry (NPI) (EPA 2017), 30 dB(A) for evening and night periods, and 35 dB(A) for daytime periods have therefore been adopted as RBLs.

The construction hours for the project (see Section 3.7) are in accordance with the ICNG recommended standard hours for construction work. There will be no evening or night-time work. The ICNG specifies noise thresholds at nearest sensitive receivers (NSRs) for construction activities where standard hours are worked as:

- Noise affected: RBL + 10 dB(A)
- Highly noise affected: 75 dB(A)

The 'noise affected' level represents the point above which there may be some community reaction to noise. The 'highly noise affected level' represents the point above which there may be strong community reaction to noise.

The derived noise affected level for construction impacts during standard hours is therefore 45 dB(A) and the highly noise affected level is 75 dB(A).

Noise sources

The construction activities include approximately four months of piling and installation of the mounting structures, and approximately five months of installation of the PV modules and inverter assemblies. Equipment to be used during construction is shown in Table 8.5, along with sound power levels (Lw) sourced from typical values for the listed equipment types. Lw is the intrinsic noise output of a piece of plant or equipment, and does not depend on distance or orientation of the machine. The Lw values in Table 8.5 are conservative in nature, representing the higher end of typical ranges.

Table 8.5 Sound power levels for construction noise sources

Plant	Sound power level (L _w) (dB(A))
Truck and dog	103
D6 dozer	86
24 tonne excavator	101
Grader	106
Vibrating roller	109
Front end loader	110
Piling rig	107
Franna crane	107
Trenchers	97
Generator	73

Noise calculation

In accordance with the ICNG, a calculation was used to estimate the magnitude of expected noise levels at the NSRs (dwellings D2 and D3, see Figure 2.2) using the relationship between the sound power level and sound pressure level to predict attenuation over distance.

Operational noise

Impacts from noise during operation have been assessed in accordance with the NPI. Assessment under the NPI has two components:

- controlling intrusive noise impacts in the short term for dwellings
- maintaining noise level amenity for particular land uses for dwellings and other land uses.

Noise criteria

The intrusiveness criterion for residential noise receptors as set out in the NPI is:

$$L_{Aeq, 15 \text{ minute}} \leq RBL \text{ (dB(A) } L_{A90}) + 5 \text{ dB(A)}$$

The NSRs are dwellings located in a rural area. Accordingly, the amenity criteria (L_{Aeq}) for rural residential properties have been applied.

Under the NPI, the lower of the two (intrusiveness or amenity) is adopted as the project specific noise level (PSNL). Table 8.6 shows that the intrusiveness criteria are lower for day, evening and night periods and have therefore been adopted as the PSNLs.

Table 8.6 Project specific noise levels (PSNLs) based on NSW NPI

Period	RBL dB(A)	Intrusiveness criteria L _{Aeq} dB(A)	Acceptable amenity criteria L _{Aeq} dB(A)	Adopted PSNL L _{Aeq} dB(A)
Day	35	40	50	40
Evening	30	35	45	35
Night	30	35	40	35

The NPI provides guidance on applying adjustments where the noise may be considered annoying (e.g. due to tonality, intermittency, irregularity or dominant low-frequency content). For each aspect an adjustment of 5 dB(A) can be added to the predicted value, up to a total of 10 dB(A) to penalise the noise for its potential increase in annoyance.

Noise sources

The main operational noise generating activities on site will include:

- approximately 4,000 NexTrack motors that allow the solar panels on the horizontal mounting structure to track the sun across the sky, evenly spread across the arrays of PV modules
- approximately 30 central inverters that are located in containers at the end of each block of PV modules
- the main step-up transformer in the switchyard.

The equipment will operate continuously during daylight hours only.

Sound power totals used in the noise calculations are shown in Table 8.7.

Table 8.7 Sound power levels for operational noise sources

Plant	Sound power (Lw) (dB(A))
NexTracker (each)	58
SC2200 Inverter (each)	94
Transformer	75

Noise calculation

Expected noise levels at the NSRs were calculated using the same method as for construction noise.

Noise from road traffic

Noise from road traffic was assessed taking into consideration the NSW Road Noise Policy (DECCW 2011), that sets out noise assessment criteria for existing dwellings affected by land use development.

The policy sets different noise limits dependent upon the road category and type of project and land use. Based on the road categories in the traffic impact assessment (Appendix F), Sturt Highway falls within the category of 'existing freeways/arterial/sub-arterial roads' and Kywong Boree Creek Road, Kywong Faithfull Road and Mitchells Road are 'local roads'.

8.7.3 Impact assessment

Construction noise

Table 8.8 shows the resultant maximum noise levels predicted at the NSRs during project construction compared with the relevant noise management levels for activities undertaken during standard hours.

Table 8.8 Predicted maximum construction noise levels at NSRs, $L_{Aeq,15min}$ dB(A)

Receiver (dwelling)	Noise affected management level dB(A)	Predicted construction noise levels* $L_{Aeq,(15min)}$ dB(A)	Exceed noise management level
D2	45	45	No
D3	45	43	No

* Note: Predicted noise levels have been rounded up to the nearest integer

The predicted construction noise levels at the development site would attenuate to a level of 45 dB(A) at the nearest sensitive receptor (D2) located at a distance of 1.4 km.

The predicted maximum construction noise levels are conservative:

- All plant and equipment are assumed to be operating together and at the closest point of the development site to each sensitive receptor.
- They do not take into account the implementation of noise attenuation measures, such as barriers, use of topographical features for shielding, or possible noise control treatments on plant and equipment.
- They do not take into account the potential shielding effects of topography and vegetation, such as the vegetation that lines Sturt Highway and Sandy Creek between the development site and D2.

It is therefore predicted that noise affected management levels will not be exceeded during construction even when works are conducted at the closest point to the NSRs. Predicted noise levels are well below the highly noise affected management level of 75 dB(A).

Note however, the applicant is also proposing the use of a mulcher on site to assist with removing scattered paddock trees. Depending upon model, design and noise mitigation measures, mulchers can potentially emit sound power levels of up to 120 dB(A). The use of a mulcher on site is therefore likely to require management to avoid exceeding noise management levels.

Operational noise

Table 8.9 shows the resultant noise levels predicted at the NSRs during project operation compared with the relevant PSNLs.

Table 8.9 Predicted $L_{Aeq,15min}$ noise levels at NSRs during operation dB(A)

Receiver	PSNL (intrusiveness criteria) L_{Aeq} dB(A)			Predicted operational noise levels $L_{Aeq,(15min)2}$ dB(A)		Exceed intrusive criteria
	Day	Evening	Night	Neutral conditions	Modifying Factor*	
D2	40	35	35	<30	33	No (all)
D3	40	35	35	<30	31	No (all)

* Modifying factor conservatively set at maximum +10 dB(A)

The predicted noise levels at all NSRs comply with all the nominated criteria under neutral conditions and assuming a conservative modifying factor. The prediction does not factor in noise attenuation measures, such as shielding or other treatments on plant and equipment that would reduce noise levels further, and assumes the equipment is operating at the point closest to the receiver.

Decommissioning noise

It is expected that noise levels and associated impacts during decommissioning would be comparable to those during operation, assuming that sensitive receivers are still in the same locations.

Noise from road traffic

Construction traffic will comprise a combination of light vehicle and heavy movements as equipment, materials and personnel are transported to site. Peak traffic movements are expected to be 30 movements (round trips) per day comprising 14 heavy vehicle movements and 16 light vehicle movements (see Section 3.8).

As an average of 1,200 vehicles per day currently use the Sturt Highway, the 30 additional daily movements (60 uses of the highway) during the peak construction phase corresponds to an increase of only 5%. Accordingly, the associated increase in traffic noise from the Stuart Highway during this period is also expected to be minor.

Increases to traffic volumes on local roads during construction will be proportionately more significant, and traffic-related noise impacts are expected to increase accordingly. Dwelling D3 is located within 130 m of the site access route and is expected to be subject to intermittent nuisance traffic noise levels during daytime hours for the eight-month construction period.

The construction traffic on local roads will not pass within 1 km of any other dwelling, so no other noise-related impacts on dwellings due to construction traffic are anticipated.

During the operational phase, only four full-time and eight part-time staff will be typically based at the facility and additional maintenance traffic will be sporadic. Operational activities are therefore anticipated to have a negligible impact upon traffic volumes and associated noise impacts on the Sturt Highway and only a minor impact on the local road network.

Potential cumulative road noise impacts may result should project construction overlap with extraction of materials from Wrights Pit and Mimosa Pit. However, due to the likely low numbers of combined project and extractive vehicles compared with background traffic on the Sturt Highway, it is expected that the cumulative impact will be negligible.

8.7.4 Management and mitigation

The noise assessment undertaken for the project was conservative. However, it is proposed that noise monitoring be undertaken during construction to confirm predictions and determine any need for noise management measures. In particular, the short term use of a mulcher on site will be subject to noise monitoring and, if noise management levels are exceeded at the two NSRs, management measures such as the following will be implemented to achieve compliance:

- locating the mulcher within the site so as to maintain a specified minimum distance to the NSRs
- operating the mulcher within designated time periods rather than in an ad hoc manner to minimise the frequency of intrusion
- positioning the mulcher to make use of any natural shielding
- application of noise shielding or noise suppression measures at the mulcher
- consultation with the landholders at D2 and D3 to agree on measures.

If management measures such as the above are required and implemented, noise levels during construction are not predicted to exceed applicable criteria. The preparation of a noise management plan to address construction noise is therefore not considered necessary.

Any measures to manage nuisance traffic noise at D3 during the construction period, if required, will be agreed in consultation with the landholder or tenant.

8.8 Visual amenity

The project has potential to create impacts to visual amenity, as a result of the construction works and development of infrastructure associated with solar farms. This section provides an assessment of the potential visual impacts as a result of the project. Further detail regarding visual assessment is contained in the visual impact assessment in Appendix H.

8.8.1 Existing conditions

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

The surrounding properties are generally partitioned and have varying types of rural infrastructure, such as generally unsealed roads, tree plantings and fencing. At various locations in the vicinity of the development site, farm sheds, silos and other structures are present.

Topography

There is a minimal degree of topographic relief across the local and regional area, resulting in a largely flat landscape aesthetic. However, some gentle relief is present, as follows:

- a low ridgeline runs in an east to west direction across most of the development site
- a low ridgeline is located approximately 1.3 km to the south of the development site
- ephemeral waterways are located immediately to the south and southeast of the development site
- Sandy Creek is located approximately 500 m to the north of the development site
- Galore Hill (a prominent local lookout) is located 13.4 km southeast of the development site.

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.

Adjacent roads

The roads in the vicinity of the development site are sensitive receivers and selected points (termed viewpoints (VPs)) on this network have been chosen to assess the visual impacts to those receivers. The selected viewpoints are shown in Figure 8.9. The roads nearest the site from which the project is expected to be visible include:

- Sturt Highway (VP3, VP5) located approximately 300 m northeast of the site
- Mitchells Road (VP1) bounding the west of the site
- Kywong-Faithfull Road (VP2, VP6) located approximately 600 m to the south.

The project is also expected to be partially visible from a number of other local roads located further away from the site include Kywong Boree Creek Road (VP6) to the southeast, Mimosa Road (Bankdale Road) to the south, and Faithfull Road to the northwest.

Surrounding dwellings

Dwellings in the vicinity of the development site are also sensitive receivers and several have been selected as viewpoints to assess the visual impacts to those receivers.

Eight scattered dwellings (D1-D8) are located on rural properties within 4 km of the development site. These residences are located between 980 m and 3.9 km from the site, as listed in Table 8.10 and shown in Figure 8.9. One of the dwellings (D8) is located on a ridgeline 3.9 km south of the site.



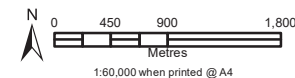
Figure 8.9

Viewpoint Locations Sandigo Solar Farm

Client: Esco Pacific
Project: Sandigo Solar Farm
Project No: AE1078
Mapping by GeoEccentric 27/02/2018

Legend

- | | | | | | | | |
|--|--------------------|--|-------------------------|--|---------------------|--|---------------------------------|
| | Development Site | | Watercourse | | Host Landholder | | Viewpoint Location |
| | Subdivision Lot | | Contours - 1m Intervals | | Sensitive Receivers | | Viewpoint/Photomontage Location |
| | 1 km Offset Buffer | | Highway | | Other Dwellings | | |
| | 2 km Offset Buffer | | Main Road | | | | |
| | Native Vegetation | | Local Road | | | | |



Three dwellings (D1, D3 and D8) form part of the visual receptors and were chosen as viewpoints (VP4, VP6 and VP7 respectively). The remaining seven dwellings are not considered visual receptors, either because the site is not visible or because the visual impacts are expected to be negligible due to distance from the site and/or topography and/or vegetation screening.

Table 8.10 Location summary of dwellings near the site

Dwelling no.	Location	Distance and direction from development site
D1	Site landholder (VP4)	980 m northwest of site
D2	"The Oaks" Paintings Bridge Road	1.4 km northeast of site
D3	Kywong-Boree Creek Road (cnr Kywong Faithfull Road) (VP6)	1.7 km southeast of site
D4	Unnamed road (off Paintings Bridge)	2.5 km north of site
D5	Bankdale Road	3.4 km south of site
D6	Faithfull Road	3.1 km northeast of site
D7	Faithfull Road	3.2 km west of site
D8	Unnamed road (west end of Bankdale Road) (VP7)	3.9 km south of site

Recreational features

The main recreational features of the region are as follows (see Figure 1.1):

- Galore Hill Scenic Reserve, located approximately 13.4 km southeast of the development site. This prominent reserve contains a lookout, from which the development will likely be visible [VP8].
- Buckingbong State Forest, located approximately 16 km west of the development site, but beyond the development site view shed.
- Sandy Creek, located approximately 500 m to the north of the development site and potentially also used for recreation. It is separated from the development site by the Sturt Highway, topography and vegetation and is not a viewpoint.

Existing vegetation

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

- remnant native vegetation along a section of Mitchells Road which offers intermittent screening from the west for the northern half of the site
- native trees along most of the eastern boundary of the site, offering intermittent screening from the east
- scattered native trees lining Sturt Highway which offer some breakup of the view of the site.

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

8.8.2 Methodology

The visual impact assessment was based on a combination of professional qualitative judgment and commonly accepted industry criteria and guidelines, as outlined below:

- Landscape Institute and Institute of Environmental Management & Assessment (LIIEMA) (2013). *Guidelines for Landscape and Visual Impact Assessment*. Third edition.
- Roads and Maritime Services (RMS) (2014). *Beyond the Pavement: Urban Design Policy Procedures and Design Principles*.

- RMS (2009). *Environmental Impact Assessment Guidance Note. Guidelines for landscape character and visual impact assessment*. 24 March 2009.

The assessment was undertaken to:

- assess the existing visual character within the development site as well as the surrounding landscape
- determine the extent and nature of the potential visual impact of the project on the surrounding areas
- identify measures to mitigate and minimise any potential visual impacts.

The assessment was based on the following visual elements and assumptions in the proposed project design and layout:

- Solar panels will be installed in regular arrays.
- Each solar panel will be fixed to a metal mounting structure, piled or screwed into the ground without the need for any concrete.
- The mounting structure will slowly and silently track (in a single axis) the horizontal movement of the sun.
- The solar panels will 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 will be located in 40 foot containers or container skid pads.
- A substation will be installed, located adjacent to the existing 132 kV transmission line.
- Internal vehicle access tracks will be constructed from the entrance point of the site to each PCU and to the solar substation to allow for maintenance of the site.
- Perimeter safety fencing will be installed around the site.
- A site office and maintenance building will be installed.
- Temporary infrastructure will be put in place during site construction including site compounds and storage areas.
- Battery storage to be installed on site (in shipping container-like buildings).
- The approximately eight-month construction process will involve the following civil works: limited grading, compaction, stormwater drainage and sediment controls and dust suppression.
- Construction activities will be undertaken during standard hours for construction works. Any construction or commissioning activities outside of standard working hours will require approval from relevant authorities.

The assessment involved the following methodology:

- a desktop review of aerial photography review to identify landscape character and potential visual receptors.
- ground-truthing of desktop research by Accent representatives on 10 January 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
- preparation of photomontages showing the completed development site from 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
- 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 design, construction and operational management and mitigation 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.

8.8.3 Potential impacts

Potential impacts assessed included:

- impacts during construction
- impacts during decommissioning
- operational impacts:
 - on residential dwellings
 - on landscape character
 - on roads
 - on other sensitive locations
- potential impact for glare or glint, from proposed infrastructure on nearby receivers
- cumulative impacts.

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 access points
- construction facilities, including portable structures and laydown areas
- various construction and directional signage
- vegetation clearing, excavations and earthworks
- various construction activities including erection of solar panels with associated electrical infrastructure works, including power conversion blocks.

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.

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

Decommissioning

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

8.8.4 Impact assessment

For the project, visual receivers fall into two main categories:

- people passing through by road (such as road users on the Sturt Highway, Kywong Boree Creek Road, Kywong Faithfull Road and Mitchells Road)
- people living at residential dwellings near the development site.

Based on the LIIEMA guidance, people living at dwellings 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 likely to be used frequently by people engaged in activities which may cause their awareness of views to be particularly high as they pass the development site. Road users are therefore not considered sensitive receivers of visual impacts in this assessment.

The nearest dwelling to the development site (D1, VP4) is located 980 m away and occupied by the site landholder, who is part of the commercial venture of the project and therefore not a sensitive receiver. There are only two other dwellings within 2 km of the site, and the project will only be visible (behind a distant treeline) from one of these (D3, VP6). D3 is therefore considered as the only sensitive receiver of visual impacts in this assessment.

Construction phase

Pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact due to their relatively short duration (8 months) and temporary nature.

Operation phase

In assessing the visual impacts proposed development, the following were 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 of materials proposed to be used
- lighting required.

In summary, eight viewpoints in the vicinity of the project have been considered (see Table 8.11 and Figure 8.9). Three of these viewpoints coincide with dwelling receptors (as seen in Table 8.12 and Figure 8.9), five coincide with road viewing receptors and one coincides with a scenic lookout.

Table 8.11 Viewpoint visual impact assessment summary

Viewpoint	Location viewed from	Sensitivity	Magnitude	Resultant impact
VP1	Sturt Highway directly north of development site	Moderate	High	High - moderate
VP2	South of site on Kywong Road	Low	Moderate	Moderate - Low
VP3	330 m north of site on Sturt Highway	Moderate	Moderate	Moderate
VP4 [D1]	Residence of site landholder from front gate of dwelling	High	Negligible	Negligible

Viewpoint	Location viewed from	Sensitivity	Magnitude	Resultant impact
VP5	Roadside rest area on Sturt Highway 1.1 km east of site	Moderate	Negligible	Negligible
VP6 [D3]	Junction of Boree Creek Road and Kywong Road	High	Negligible	Negligible
VP7 [D8]	North of residence	High	Negligible	Negligible
VP8	Galore Hill, east of Lockhart-Kywong Road	High	Negligible	Negligible

Table 8.12 Receiver visual impact assessment summary

Receiver	Location	Sensitivity	Magnitude	Resultant impact
Dwellings				
D1 [VP4]	Residence of site landholder from front gate of dwelling	High	Negligible	Negligible
D2	"The Oaks" Paintings Bridge Road	High	Negligible	Negligible
D3 [VP6] – sensitive receiver	Kywong-Boree Creek Road (cnr Kywong-Faithfull Road)	High	Negligible	Negligible
D4	Unnamed road (off Paintings Bridge)	High	Negligible	Negligible
D5	Bankdale Road	High	Negligible	Negligible
D6	Faithfull Road	High	Negligible	Negligible
D7	Faithfull Road	High	Negligible	Negligible
D8 [VP7]	Unnamed road (west end of Bankdale Road)	High	Negligible	Negligible
D9	Unnamed road (off Kywong-Faithfull Road)	High	Negligible	Negligible
D10	Unnamed road (off Kywong-Faithfull Road)	High	Negligible	Negligible
Roads				
Sturt Highway [VP3, VP5]	Between 290 m and 1.1 km north and northeast of site	Moderate	Moderate	Moderate
Mitchells Road [VP1]	15 m west of site	Moderate	High	High - moderate
Kywong Road [VP2, VP6]	570 m south to 1.6 km southeast of site	Low	Moderate	Moderate - Low
Boree Creek Road [VP6]	1.6 km southeast of site	High	Negligible	Negligible

Receiver	Location	Sensitivity	Magnitude	Resultant impact
Mimosa Road	3 km south of site	Low	Negligible	Negligible
Faithfull Road	2.2 km northwest of site	Low	Negligible	Negligible
Recreational features				
Buckingbong State Forest	16 km west of site	High	Negligible (beyond viewshed)	Negligible
Galore Hill Scenic Reserve and lookout [VP8]	13.4 km south-east of site	High	Negligible (due to distance)	Negligible
Sandy Creek	500 m north of site	High	Negligible (separated by Highway, topography and vegetation)	Negligible

Receiver with the highest visual impact rating

The receiver with the highest visual impact rating is VP1, which is Mitchells Road west of and adjacent to the site. Although existing vegetation (trees and shrubs) intermittently screen approximately half the road's adjacent length, the remaining length is not screened and the site would be highly visible from this part of the road. However, as described above, local road users are not considered to be sensitive receivers. In addition, this road is used predominantly by local landholders and has low traffic volumes.

Other receivers with visual impact ratings of greater than negligible

Two other receivers have visual impact ratings of greater than negligible, those being Sturt Highway and Kywong Faithfull Road. However, roads users at these locations are not considered to be sensitive receivers.

Traffic along Sturt Highway at the locality is generally travelling at high speed and there are no particular existing scenic aspects to draw attention. A brief view of the project from passing vehicles is likely to be considered more of a point of interest than an adverse visual impact.

Kywong Faithfull Road is used predominantly by local landholders and has low traffic volumes.

Receivers with a visual impact rating of negligible

None of the viewpoints that coincide with dwellings have a visual impact rating of greater than negligible and all of the other dwellings within 4 km of the development site (of which there are five) are either outside the viewshed or also have a visual impact rating of negligible.

The dwellings with negligible ratings include the only site identified as a sensitive receiver, dwelling D3.

Glare and reflectivity

The potential for sun reflecting off the photovoltaic solar panels to cause visual nuisance or glare is expected to be minimal as they are designed to absorb not reflect light. The risk of glare is discussed further in Appendix H. Other components of the project, such as the site office and PCUs, are not expected

to cause any more glare than normal farm buildings and will be largely obscured from view by the solar arrays.

Reducing the visual impact

As the majority of the sensitive receivers have a visual impact rating of negligible, measures taken to mitigate the project's impact on them are not considered necessary. For the three locations with greater than negligible impact ratings, mitigation measures may reduce the visual impacts on those receivers. Additionally, engaging with the local community may ameliorate the impact on the sensitive receivers.

Community and stakeholder consultation

The process of community consultation implemented by the applicant (see Section 6) will provide a forum for project issues, including visual impacts, to be discussed.

The only dwelling (excluding the site landholder) from which the project is expected to be visible is D3 (VP6) and visual impacts at this location are predicted to be negligible. ESCO Pacific has attempted to contact the D3 landholder over during the course of the project feasibility and EIS investigations. Attempted contact has included traditional mail and voicemail. To date, the landholder has not responded. The applicant will make continued efforts to contact the landholder to inform them about the project and to discuss potential issues including visual impact.

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

8.8.5 Management and mitigation

Design phase

Based on the visual impact assessment and the results of community consultation, the site will not be visually intrusive from the nearest sensitive receptors (the closest dwellings and roads to the solar farm infrastructure). This is shown from VP4 and VP6 which show the site fading into the existing tree line, with the development site only being readily visible from the roads. Accordingly, landscaping and visual screening treatments are not considered to be required.

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
- minimise reflective surfaces with a preferred use of muted colours for ancillary structures.

Construction phase

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, as outlined in Section 8.1.3.
- Limiting disturbance and rehabilitating disturbed areas, as outlined in Section 8.5.3.
- 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

Operation

Visual impacts during the operational phase of the project are expected to be minimal. However, an OEMP will be prepared, including measures to mitigate any potential visual impacts, including:

- Keeping the site tidy and well maintained, including removal of all rubbish at regular intervals.
- Restricting 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.

Decommissioning

A DMP will be implemented to return the site to its pre-existing condition.

8.9 Air quality

The project has the potential to create air quality impacts through dust from soil disturbance and emissions from vehicles and machinery. However, these impacts will be temporary and primarily during the construction phase. This section provides an assessment of the potential air quality impacts as a result of the project.

8.9.1 Existing conditions

The air quality within the Narrandera LGA is generally expected to be good and typical of a rural setting in NSW. Potential sources of air pollution near the development site include:

- agricultural practices, including cropping and earth moving
- spray-drift from pesticide and herbicide application
- vehicle and agricultural machinery emissions
- dust from unsealed roads
- nearby sand mining at Mimosa Pit
- burning-off of green waste and wood-fuelled fires.

Wind speeds average between 7.2 and 16.3 km per hour at 9 am, with the strongest winds during the summer months (see Section 2.6). During January through to April, winds from the east and northeast are most prevalent. During May to August, winds are generally from the east or northwest. From September to December, the prevailing wind direction is from the southwest.

In 2015/2016 there were seven facilities in the Narrandera LGA (two in Narrandera and five in Grong Grong) required to report their emissions to the Department of the Environment and Energy (DoEE), as part of the National Pollution Inventory. The closest facility, Downer ETI Works Pty Ltd, is located approximately 29.5 km northwest of the development site. The facility's primary business is asphalt production and spray seal operations.

There are two dwellings (D2 and D3) within 2 km of the development site (in addition to the site landholder), which could be impacted as a result of dust or exhaust emissions resulting from the project (see Figure 2.2). As described in Section 8.7, D2 and D3 have been identified as NSRs for the project.

The development site is relatively flat to gently undulating and is located at an elevation between 156 and 172 m ASL. The site has been largely cleared of native vegetation due to its history of agriculture. However

sections of the perimeter of the development site are lined with trees (which are to be retained), creating a potential barrier between project-related air emissions and nearby residences.

8.9.2 Methodology

Due to the temporary nature of construction works and the low risk of significant air quality impacts, a qualitative assessment of air quality has been undertaken (without air quality modelling).

8.9.3 Impact assessment

Construction and decommissioning

Dust generation as a result of surface disturbance works, including earthworks and vehicle movements on unsealed roads will be expected to occur as a result of the project. Surface disturbance works are relatively minor for solar farm projects. However, works will include:

- installation of piles to support the mounting framework
- installation of underground cabling between PV solar panels and inverters
- preparation foundations for the inverter blocks
- development of hardstands, access tracks and boundary fencing
- construction of transmission infrastructure
- installation of permanent fencing and security
- construction of support buildings including a site office, maintenance shed and switchyard.

Air emissions will be generated from vehicle, plant and equipment, including:

- earthmoving machinery and equipment, including excavators, scrapers and loaders
- material handling equipment, including forklifts and cranes
- vehicles travelling to and from the site, including light vehicles transporting construction personnel and heavy vehicles delivering construction materials
- water trucks for dust suppression.

The dwelling at D2 is located 1.4 km northeast of the development site across the Sturt Highway and Sandy Creek. Winds blowing from the southwest, particularly during September to December (see Section 2.6) could carry project-related dust from the development site. However, the trees and other vegetation that line the highway and the creek will help reduce the quantity of dust. Due to the presence of shielding vegetation and the distance between D2 and the development site, dust impacts are expected to be minimal.

The dwelling at D3 is located 1.7 km southeast of the development site and approximately 130 m southeast of the site access route. Due to the distance between D3 and the development site, dust impacts associated with construction activities are expected to be minimal, even during May to August when winds from the northwest may be prevalent (see Section 2.6).

D3 may be impacted by dust and exhaust emissions generated by vehicles turning onto the unsealed Kywong Faithfull Road from the sealed Boree Creek Kywong Road. The risk of dust impacts will be greatest under dry conditions when the wind is blowing from the west or northwest. Northwestly winds mainly occur between May and August (along with easterlies). At other times of the year, including over summer, prevailing winds would carry any dust away from the dwelling (see Section 2.6). In addition, the northern and western boundary of the residential property is lined with trees, helping reduce the potential of air quality impacts. Air quality impacts as a result of construction will be temporary in nature (expected to last for eight months).

Decommissioning impacts are expected to be the same as for construction, assuming that there are no dwellings located closer to the development site at that time.

Notwithstanding the low inherent risk of dust and air quality impacts, management and mitigation measures are outlined in Section 8.9.4 to further reduce the risk.

Operation

Daily traffic to and from the site during operation will be minimal as only four full-time and eight part-time staff members will be located on-site. Traffic generation during operation is not expected to exceed 19 movements (38 trips) per week (see Section 8.6). This is expected to result in minor, infrequent dust generation from vehicles travelling on unsealed roads. Air quality impacts on NSRs during operation are expected to be negligible.

In addition, the operation of the project will produce minimal greenhouse gas emissions compared to conventional coal and gas-fired power stations, and will make a positive contribution to the reduction of greenhouse gas emissions from NSW (see Chapter 4).

8.9.4 Management and mitigation

The following standard management and mitigation measures are proposed for the construction, operation and decommissioning of the project:

- Preparing a CEMP, OEMP and DMP which includes procedures to prevent and control dust, including:
 - grading and ongoing maintenance of internal access roads to increase stabilisation of soil, where possible
 - wetting down the internal access roads and other exposed surfaces, particularly during dry and windy conditions
 - minimising vehicle movements on unsealed roads
 - limiting the extent of vegetation clearance and excavation
 - minimising the number of stockpiles on site
 - enforcing on-site speed limits
 - clearly defining access and travel routes
- The CEMP, OEMP and DMP will also include procedures to prevent and control vehicle, plant and equipment emissions, including:
 - regularly inspecting and maintaining vehicles, plant and equipment to ensure they are operating efficiently, and in accordance with the manufacturer's requirements
 - ensuring that vehicles, plant and equipment meet relevant standards for emissions
 - switching off vehicles, plant and equipment when not in use.
- A TMP will be developed which will outline requirements for the management of vehicle generated dust and emissions (see Section 8.6).
- A complaints register and procedure will be developed to respond to any issues raised by the local community regarding air quality impacts.

8.10 Bushfire and electrical fire

Bushfires and electrical fires can present a significant risk to human health, life, biodiversity, and infrastructure. Environmental hazards such as hot, dry climatic conditions and the presence of dense vegetation can increase the risk or severity of a fire occurring. Activities such as the operation of construction machinery or the use of tools such as angle grinders can increase combustion or ignition risks. This section provides an assessment of the potential hazards associated with bushfires and electrical fires.

8.10.1 Existing conditions

The development site, covering approximately 231 ha of rural land, is highly modified due to its history of agriculture and grazing, and is comprised largely of pasture grasses and environmental weeds. Native vegetation is largely absent, with scattered paddock trees occurring throughout the site (to be cleared during project construction) and more intact native vegetation is located outside of the development boundary along road verges, within windrows, in occasional clumps, and to the north along Sandy Creek.

The existing 132kV transmission line (Yanco to Wagga 330) transects the northern end of the development site, running northeast to southwest. A second 132 kV transmission line and a 330 kV transmission line are located further to the south of the development site. TransGrid is responsible for managing the potential fire impacts of these transmission lines.

The site is subject to hot and dry summers and has an annual rainfall of only 437.3 mm (see Section 2.6). The bush fire danger period typically occurs from the start of November to the end of March. However, this period can vary depending on local environmental conditions (MIABFMC, 2008).

The Murrumbidgee Irrigation Area Bush Fire Risk Management Plan 2008 (MIA BFRMP) indicates that one bushfire has occurred at the development site since 1972 (in 1991). The development site is not located in any of the Bush Fire Management Zones set out in the MIA BFRMP.

The site is not located on land mapped as Bushfire Prone Land, according to the NSW Rural Fire Service Bush Fire Prone Land Tool (NSW RFS 2017a).

The nearest NSW Rural Fire Service (NSW RFS) fire stations are located at Narrandera and Grong Grong, approximately 29 km northwest and 27 km north of the development site, respectively. The development site is to be serviced by a graded road, offering direct access to the centre of the site.

8.10.2 Methodology

As the project is an SSD, a bush fire safety authority under section 100B of the *Rural Fires Act 1997* (Rural Fires Act) is not required. However, Section 63 of the Rural Fires Act imposes a duty of care on land managers and landowners to:

....take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land.

Section 64 requires that during the bush fire danger period, land managers and landowners must:

(a) immediately on becoming aware of the fire and whether the occupier has lit or caused the fire to be lit or not, take all possible steps to extinguish the fire, and

(b) if the occupier is unable without assistance to extinguish the fire and any practicable means of communication are available, inform or cause to be informed an appropriate officer of the existence and locality of the fire if it is practicable to do so without leaving the fire unattended.

The MIA BFRMP has been prepared in accordance with the Rural Fires Act. The plan sets out methods for assessing and managing bush fire risk within the Murrumbidgee Irrigation Area, which are applicable to the project (MIABFMC 2008).

The SEARs for the project also include the requirement from Fire and Rescue NSW for the preparation of a comprehensive Emergency Response Plan (ERP) detailing requirements for bushfire preparation and response.

This section has been prepared taking the above requirements into account.

8.10.3 Impact assessment

The existing vegetation on the development site, including pasture grasses, environmental weeds and scattered paddock trees remaining after construction, could be susceptible to fires in hot, dry or windy

conditions. Fire could cause damage to project infrastructure and adversely impact the health and safety of site personnel.

Sources of ignition at the site could include:

- operation of machinery, including construction machinery, hot tools (angle grinders, welders etc.) and motor vehicles
- solar panels subject to faulty wiring or incorrect installation
- battery storage facility (containing lithium-ion batteries), if installed at the site
- electrical faults in inverters and/or the substation
- overhead transmission lines
- nearby bushfires
- lightning strikes
- smoking and careless disposal of cigarette butts.

The risk of a bushfire may also be increased by the presence of combustible materials including chemicals and hazardous materials, petrol-powered tools and machinery, or stockpiled vegetation.

Given the low cover of vegetation within the development site, it is unlikely the project will present a significant bushfire risk. The fire hazards within the site are readily manageable and will be minimised through the implementation of mitigation measures outlined in Section 8.10.4 below. The risk assessment in Section 7 identified a medium risk of bush fire and electrical fire associated with the project in the absence of appropriate management and mitigation measures. However, with appropriate controls in place, the risk was assessed as low.

8.10.4 Management and mitigation

The following management and mitigation measures will be implemented to reduce bush fire and electrical fire risk:

- Preparing a Bush Fire Management Plan (BFMP) prior to construction, in accordance with the NSW RFS Planning for *Bush Fire Protection – a guide for councils, planners, fire authorities and developers 2017* (NSW RFS 2017b), and in consultation with the NSW RFS District Office. The BFMP will include the following:
 - on-site firefighting equipment required
 - management of asset protection zones
 - measures for reducing fuel loads on the site (e.g. grazing regime, slashing, ploughing and weed control etc.)
 - location of hazards and procedures to manage the hazards prior to and during firefighting operations
 - site access and internal road plan
 - management arrangements for the development of an ERP (see below)
 - procedures to update and review the BFMP
 - contact details during and outside office hours.
- Preparing an ERP in accordance with FRNSW requirements as outlined in the SEARs, which ESCO Pacific accepts as a condition of Development Consent. The ERP will detail:
 - foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity or potential hazmat incidents)
 - risk control measures that will need to be implemented to safely mitigate potential risks to health and safety of firefighters and other first responders (including electrical hazards)

- other risk control measures that may need to be implemented in a fire emergency due to any unique hazard specific to the site.
- The ERP will also be prepared in accordance with the NSW RFS Planning for *Bush Fire Protection – a guide for councils, planners, fire authorities and developers 2017*, and in consultation with the NSW RFS District Office, addressing on-site and off-site fire events. The ERP will detail appropriate risk control measures to mitigate potential risks to health and safety of firefighters and other first responders, including:
 - appropriate personal protective clothing required to be worn
 - minimum level of respiratory protection required
 - decontamination procedures
 - minimum evacuation zone distances and site muster point
 - a safe method of shutting down and isolating the photovoltaic system.
 - emergency evacuation procedures.
- Two copies of the ERP will be stored in a prominent ‘Emergency Information Cabinet’, to be located directly adjacent to the site’s main entry point/s.
- The fire stations at Narrandera and Grong Grong, the RFS, Fire and Rescue NSW will be provided with the BFMP and ERP, including plans of the development site.
- Electrical components, including solar panels, will be designed and maintained to minimise the risk of ignition, in accordance with relevant Australian Standards.
- Buildings will be designed in accordance with relevant NSW RFS standards (NSW RFS 2017b).
- Access site and internal roads will be designed and constructed in compliance with RFS standards (NSW RFS 2017b). Emergency access to vehicles will be provided across the entire development site.
- Chemicals will be stored in accordance with MSDS requirements.
- The battery storage facility, if constructed, would be monitored and maintained regularly to avoid leaks from the lithium-ion batteries or overheating.
- The interior of any buildings will contain the necessary fire safety provisions, in accordance with the relevant Australian Standards and legislation (e.g. fire extinguishers, smoke alarms, sprinklers).
- A non-combustible dedicated water tank with a Storz outlet will be located adjacent to the site office. Water from this tank will only be used for fire-fighting. A petrol, diesel or solar powered fire-fighting pump and 30 m hose reel with a steel nozzle will be available onsite, suitable for mounting on a 4WD with water tank, and used for grass fire / ember attacks by the applicant in the event of a fire.
- The CEMP and OEMP will provide safety protocols including:
 - storage of storage of hazardous and flammable chemicals
 - daily monitoring of the Fire Danger Rating for the area, during the Fire Danger Period
 - smoking on-site
 - basic fire-fighting by on-site staff and use of fire-fighting equipment.
- Project staff and contractors will be informed of fire risks and evacuation procedures. Staff will be trained in emergency response procedures.

8.11 Electromagnetic interference

Electromagnetic fields (EMFs) are a combination of electric and magnetic fields generated from electrically charged objects such as transmission lines. They are produced whenever electricity is used and are present wherever energy flows, and therefore humans are exposed to some level of EMF in their daily lives.

Voltage produces the electric fields and currents that produce the magnetic fields, therefore the stronger the voltage and current, the stronger the EMF will be. Electric fields exist in any live wire, whether

electricity is being consumed or not, however magnetic fields only exist when an appliance is operating (ARPANSA 2016).

With distance from the source, the strength of EMFs reduces rapidly. However, although electric fields can be insulated by surrounding materials such as air, buildings and the earth, magnetic fields are not. The strength of magnetic fields, at a given location, is dependent on the number and kinds of sources and the distance from the sources (ARPANSA 2016).

Naturally occurring EMFs are associated with thunderstorms, lightning and ionospheric currents (ARPANSA 2018a).

This section considers the potential impacts of EMFs associated with the project.

8.11.1 Existing conditions

Existing potential sources of EMFs in the vicinity of the development site include three power transmission lines: one adjacent to the site to the northeast (Essential Energy: 66kV), one transecting the development site (TransGrid: 132kV), and one located approx. 600 m south (TransGrid: 132 kV). The site will connect to one or more of the TransGrid transmission lines by a centrally-constructed substation.

As part of the project, DC cabling will run from the combiner boxes to the central inverters and AC cabling will carry 33 kV from the switchgear to the solar substation. The cabling, inverters and substation will produce some electromagnetic emissions.

The following project infrastructure have the potential to generate EMFs:

- PV units
- DC cabling (above ground and underground)
- AC cabling (underground)
- lithium-ion batteries
- central inverters
- set up transformers
- PCUs
- main step-up transformer and associated equipment.

8.11.2 Methodology

Transmission lines and other electrical devices and infrastructure in Australia operate at a frequency of 50 Hz and fall within the Extremely Low Frequency (ELF) range of 0-300 Hz (ARPANZA 2016). Fields of different frequencies can interact with the human body in various ways. However, ELF EMFs have not been shown to have significant impacts on health (ARPANSA 2014).

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) advises that exposure to ELF EMF at high levels can affect nervous system functioning. Some population studies have reported a possible association between prolonged exposure to ELF magnetic fields (below exposure limits but above what is typically encountered) and childhood leukaemia, although scientific evidence of this is not strong (ARPANSA 2014). However, based largely on these population studies, the International Agency for Research on Cancer has classified EFL magnetic fields as possibly carcinogenic to humans (ARPANSA 2015).

ARPANSA states that:

- *The scientific evidence does not establish that exposure to the electric and magnetic fields found around the home, the office or near powerlines causes health effects (ARPANSA 2016).*
- *There is no established evidence that the exposure to magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of the proximity, causes any health effects (ARPANSA 2015).*

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) establishes guidelines for limiting EMF exposure to humans, with the aim of preventing adverse impacts to health and wellbeing. The exposure limits outside the body, referred to as reference levels, were developed using worst-case assumptions so that basic restrictions (i.e. exposure limits related to adverse effects within the body) can be met (ICNIRP 2010). ICNIRP reference levels for the general public and occupational exposure are shown in Table 8.13

Table 8.13 ICNIRP reference levels (ICNIRP 2010)

Receiver	Electric field strength (kv/m)	Magnetic field strength (mG)
General public	5	2000
Occupational	10	10,000

Electric fields

The World Health Organization (WHO) states that strength of electric fields directly underneath powerlines can reach up to 10 kV/m, and reduces significantly with distance – at 50 m to 100 m they are reduced to levels that are negligible (WHO 2018). The electric field values at different distances from transmission lines is shown in Figure 8.10 (note that the units on the vertical axis are V/m whereas the ICNIRP reference levels are kV/m).

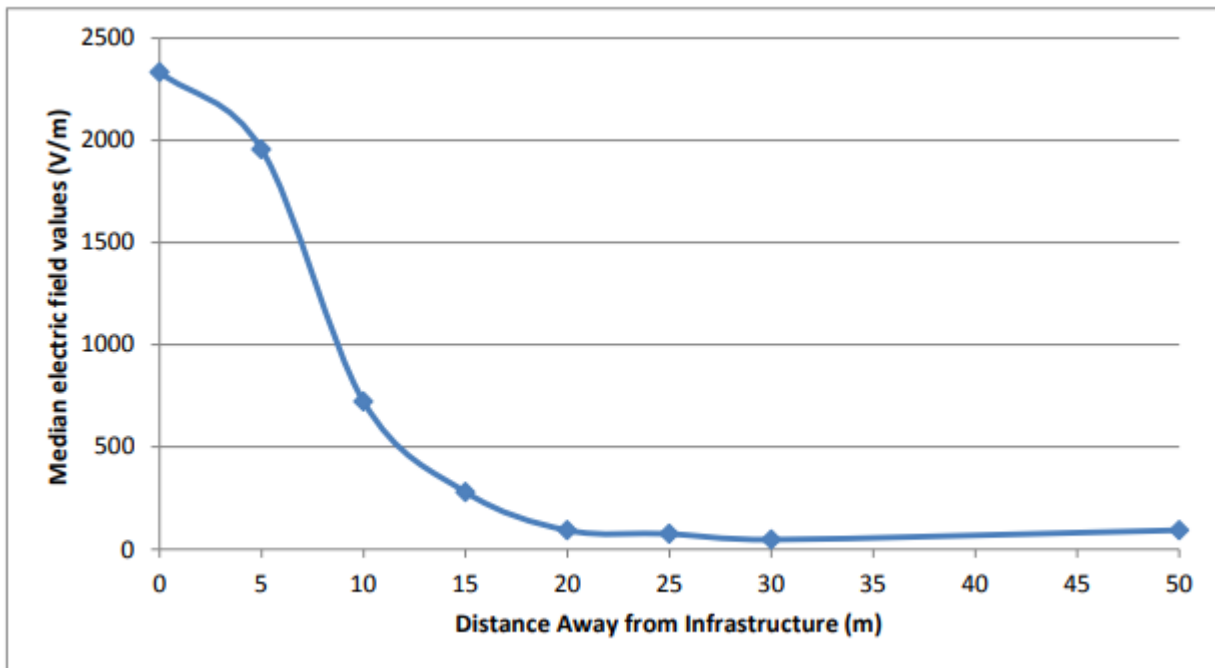


Figure 8.10 Median electric field values at different distances from transmission lines (sourced from APRANSA 2014)

The typical electrical field strengths of household equipment, for comparison, is shown in Table 8.14 (sourced from WHO 2018).

Table 8.14 Typical electric field strengths of household appliances, measured at a distance of 30 cm

Appliance	Electric field strength (kV/m)	Electric field strength (V/m)
Stereo	0.18	180
Iron	0.12	120
Refrigerator	0.12	120
Mixer	0.1	100
Toaster	0.08	80
Hair dryer	0.08	80

Magnetic fields

The values of magnetic fields that are typical for powerlines and substations are listed in Table 8.15, and are well below ICNIRP reference levels of 2,000 mG for the general public and 10,000 mG for occupational exposure (ARPANSA 2016; ICNIRP 2010).

Table 8.15 Typical values of magnetic fields measured near powerlines and substations (ARPANSA 2016)

Source	Location of measurement	Range of measurements (mG)
Distribution line	Directly underneath	2-30
Distribution line	10 m away	0.5-10
Substation	At substation fence	1-8
Transmission line	Directly underneath	10-200
Transmission line	At edge of easement	2-50

Typical values of magnetic fields measured at normal user distance are shown in Table 8.16, as a comparison to Table 8.15.

Table 8.16 Typical values of magnetic fields measured at normal user distance (ARPANSA 2016)

Appliance	Range of measurement (mG)	Range of measurement (μT)
Electric stove	2-30	0.2-3
Personal computer	2-20	0.2-2
Electric blanket	5-30	0.5-3
Hair dryer	10-70	1-7
Toaster	2-10	0.2-1
Electric kettle	2-10	0.2-1

Homes located more than 50 m from high voltage powerlines, including transmission lines, are not expected to have higher than typical levels of magnetic fields. Levels of magnetic fields measured 5 to 10 m from substations and transformers are generally indistinguishable from typical background levels that occur in a home (ARPANSA 2015). The magnetic field values (in Microtesla, μT) at different distances from transmission lines is shown in Figure 8.11.

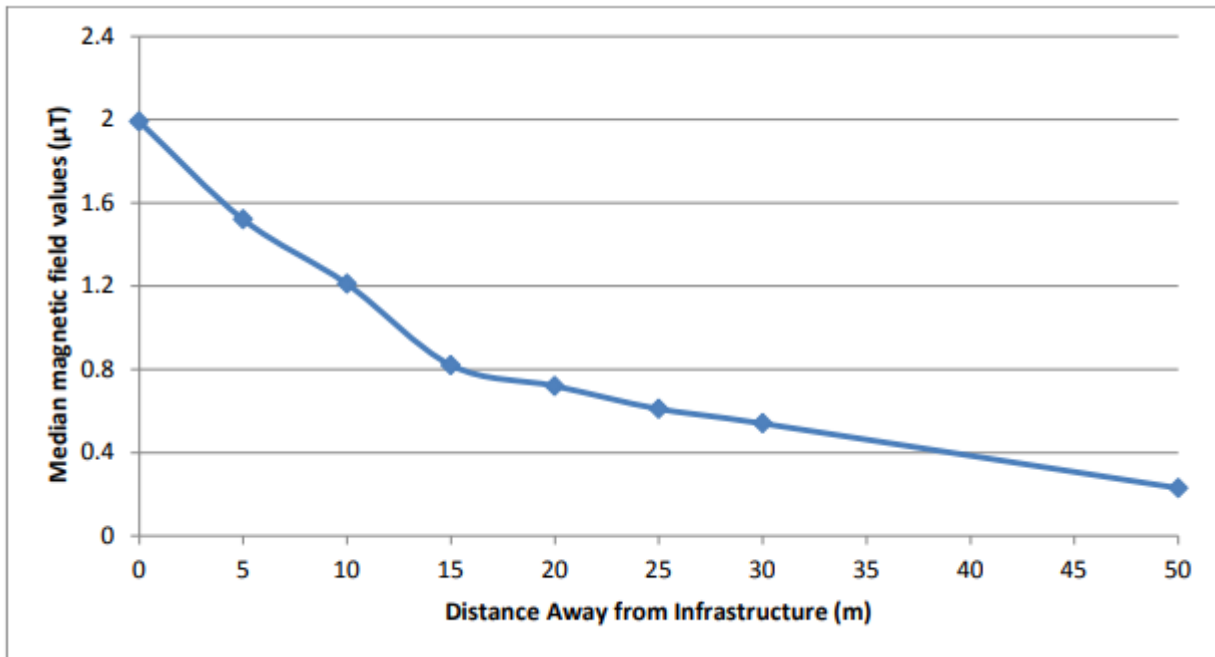


Figure 8.11 Median magnetic field values at different distances from transmission lines (sourced from APRANSA 2014)

8.11.3 Impact assessment

Exposure to ELF fields depends on factors including proximity to electricity equipment and infrastructure and also the number of electrical components comprising the infrastructure (ARPANSA 2014).

Construction and decommissioning

Exposure to EMFs during construction and decommissioning would be limited to staff working in and around the 66 kV (adjacent to the development site to the north) and 132 kV transmission lines traversing the site. However, this will be for a short duration and therefore the potential impacts of EMFs on the health of staff are likely to be insignificant. Magnetic fields produced from the PV units would be less than those of household appliances, and risk of EMFs from the PV units would be insignificant (Chang and Jennings 1994).

Exposure of the public to EMFs during construction and decommissioning would be no greater than is currently the case, as the main sources of EMFs in the area are the existing transmission lines.

Operation

Project-related sources of exposure during operation will be limited to the existing 132 kV transmission line and the cabling, inverters, lithium-ion batteries and PV units of the solar farm.

Exposure to EMFs during operation would be limited to maintenance staff and on-site staff. Public access will be restricted by site fencing around the site. EMFs from underground AC cabling will be shielded by the soil. EMFs from lithium-ion batteries (in the event that a battery storage facility is constructed) would be expected to be partially shielded by the units they would be contained in.

Only one dwelling (owned by the site landholder) is located within 1 km of the development site (see D1 on Figure 2.2). D1 is located 980 m from the site boundary and approximately 1 km from the substation. Given the distance of D1 and other dwellings to the development site and substation, EMF levels at the dwellings are not expected to increase significantly.

Exposure to both staff and the general public is expected to be well below ICNIRP reference levels and therefore EMF exposure as a result of the project is unlikely to present a health risk.

8.11.4 Management and mitigation

The following management and mitigation measures will be implemented to minimise the risk of EMFs from the project:

- Electrical equipment and infrastructure will be designed and maintained in accordance with relevant Australian standards, codes of practice and guidelines such as Primefact 1063: Infrastructure Proposals on Rural Land (DPI 2013).
- Design of electrical equipment and infrastructure will be undertaken by qualified personnel, with support from specialists where required.
- Electrical equipment will be accessed only by qualified staff.
- To ensure public safety, the project will be fenced around the perimeter of the developable area.
- The general public will not be allowed to enter the development site, unless with supervised by onsite staff and with prior permission.
- The landholder and general public will not, under any circumstances, have access to the substation or inverters.

8.12 Socio-economic

Socio-economic impacts on local communities, both positive and negative, have the potential to occur as a result of large-scale developments. As required by the SEARs, this section provides an assessment of the social and economic impacts of the project, including a summary of the existing socio-economic profile of the surrounding area and the wider Narrandera LGA. It also addresses Narrandera Shire Council's comment in the SEARs regarding impacts on accommodation for workers during the construction phase.

8.12.1 Existing conditions

The proposed Sandigo Solar Farm is located approximately 28 km southeast of the Narrandera Township, and 114 km north of Albury, within the Narrandera LGA. The LGA is located in the Riverina region of southwestern New South Wales and is crossed by the Sturt and Newell Highways. It has an area of 4,116 km², with the Narrandera Township having an area of 8.4 km² (NSC 2010).

The Narrandera LGA has a population of 5,853 people, a 0.8% decrease since 2011, with a median age of 44 years (significantly higher than the national average of 38 years) (ABS 2017; ABS 2013). Of this, 49.6% are female and 50.4% are male. Aboriginal and Torres Strait Islander people make up 9.7% of the population, which is high compared to the national average of 2.8%. Approximately 83.1% of people were born in Australia. According to the Narrandera Shire Council Land Use Strategy 2010, the population of the LGA is forecast to decline over the next decade (NSC 2010).

The LGAs main land use is rural and consists predominantly of irrigated land. Agriculture, forestry and fishing are the main employers in the LGA, with 4.6% of people working in grain-sheep or grain-beef cattle farming and 4.5% in other grain growing. Other important sectors include public administration and healthcare. The unemployment rate for the Narrandera LGA based on the 2016 census was 6.1%, which was lower than the then national rate of 6.9% (ABS 2017).

The Murrumbidgee Irrigation Area forms part of the Riverina region, in which the development site is located, and is recognised as one of Australia's major food bowls, providing over one-quarter of all the fruit and vegetable production in NSW and being one of Australia's largest exporters of bulk wines (RDA 2014).

A number of educational facilities are located within the LGA, including the Riverina Institute of TAFE, which could potentially be used for training of construction and operation staff. The LGA also provides services in community support and aged and disability care and contains one of the premier sporting facilities in the Riverina region (AFL 2017). An airport is also located in Narrandera, providing flights to Griffith and Sydney (NSC 2010).

Narrandera Shire Economic Development Strategy 2017-2020

The Narrandera Shire Economic Development Strategy 2017-2020 was developed in 2016 by the council with the key objective of sustainably facilitating business growth (NSC 2016). Eco-efficiency and sustainability have been identified in the strategy as a macro trend that has the potential to influence economic growth in the shire. The compatibility of the project with the strategy is outlined in Section 8.12.2.

Riverina Murray Regional Plan 2036

The RMRP provides a 20-year blueprint for the region, setting out the NSW Government's vision for the Riverina Murray which is to create a diversified economy founded on Australia's food bowl, iconic waterways and a strong network of vibrant and connected communities (DPE 2017). The compatibility of the project with the regional plan is outlined in Section 8.12.2.

Local community attitudes

The community information sessions facilitated by the applicant (see Chapter 6) did not identify any issues that are likely to prove difficult to address. Members of the local community asked questions in regard to the number of jobs created, noise from inverters, access routes and potential ecological impacts, and appeared to be supportive of solar projects in the area.

8.12.2 Impact assessment

Construction and decommissioning

The project is expected to have a generally positive impact on the local and wider economy during construction, with any adverse impacts being minimal given the temporary nature of the construction phase and implementation of management measures listed in Section 8.12.3. The key potential social and economic impacts that may result from construction of the project include:

- Increase in local employment, as the project will create direct employment for up to 150 staff and contractors during construction, with many of these drawn from the local area.
- Increase in local workforce skills from the training and experience gained working on the project.
- Additional workers from outside the area will stimulate the local economy through demand for accommodation, hospitality and retail services.
- Short-term pressure on accommodation and local services such as health facilities. However, occupancy rates of private dwellings are 84.9% (ABS 2017), and there are a number of short-term accommodation options within the Narrandera LGA including hotels, motels, motor inns and caravan parks, indicating that additional workers could be easily accommodated.
- Pressure on accommodation and retail services, as well as the increases in traffic, could adversely affect local tourism, especially if construction coincides with local events such as festivals.

Impacts during decommissioning are expected to be similar to those outlined above for construction. In addition, local re-use or recycling of infrastructure (such as used solar panels) may be a further community and economic benefit.

Operation

The key potential social and economic impacts that may result from operation of the project include:

- Increase in local employment as the project will directly employ up to four full-time and eight part-time staff to manage the site during operation, including maintenance staff and site managers, and require additional operational and maintenance support by contractors, many of them likely to be sourced locally.

- Temporary loss of agricultural land, however this loss for the site landholder will be offset from income generated from lease arrangements. In addition, the size of the project (231 ha) will not significantly reduce the availability to agriculture of land in the Narrandera LGA. Following decommissioning, agricultural activities could recommence as the project is not expected to cause any long-term impacts on land capability.
- Change in visual character of the development site and the rural landscape until operation has ceased and decommissioning has been carried out.
- Potential creation of a local tourist attraction.

Compatibility with Narrandera Shire Economic Development Strategy

The Sandigo Solar Farm project supports the following objectives outlined in the Narrandera Shire Economic Development Strategy 2017-2020 (NSC 2016):

- Attract new investment that is sustainable and compatible with community aspirations and the Shire's environment: the project will generate clean and sustainable energy that will diversify the income base of the region and assist in the reduction of atmospheric pollution and carbon emissions associated with climate change, benefiting the wellbeing of the community. Renewable energy has also been nominated by the council as a priority growth sector in the Riverina Region.
- Support the creation of employment opportunities and a skilled workforce, as outlined above.

The project also supports the following eco-efficiency and sustainability opportunities identified in the strategy:

- opportunities for new industries and businesses in energy and water efficient technologies; waste management, reduction and reuse; and alternative energy
- shift to investment in renewable energy and demand for land and/or materials for alternative energy production (e.g. solar and wind farms, bio-fuel production etc.)
- increased demand for 'green skills' within the workforce
- heightened community awareness and interest in 'clean – green' and locally produced products, creating opportunities for value-adding, niche marketing and premium pricing.

Compatibility with Riverina Murray Regional Plan

The Sandigo Solar Farm project supports the following goals set out in the RMRP (NSC 2016):

- a growing and diverse economy – by developing and diversifying the rural economy through the development of renewable energy generation
- a healthy environment with pristine waterways – by undertaking a development that has minimal environmental impact on land and waterways and which reduces GHG emissions by producing renewable energy
- efficient transport and infrastructure networks – by maximising the use of existing transmission lines and infrastructure
- strong, connected and healthy communities – by providing a diversified income base, employment opportunities and flow-on economic impacts within the region.

8.12.3 Management and mitigation

A Consultation and Stakeholder Engagement Plan outlining measures to reduce adverse impacts on the Narrandera community will be prepared and implemented by the applicant. The plan will provide procedures for:

- managing community expectations
- informing stakeholders of potential impacts
- providing project-related updates

- registering and responding to complaints and feedback.

The applicant will liaise with the appropriate local community representatives to reduce the potential for adverse impacts on local services or events due to the accommodation of the construction workforce. Where possible, local contractors, manufacturing facilities, materials and services will be used.

Ongoing engagement with Narrandera Shire Council will be undertaken to discuss and resolve any concerns.

8.13 Waste management and resource use

The potential impacts of resource consumption and the production and disposal of waste is assessed in this section.

8.13.1 Existing conditions

Construction

The key resources to be used for the project during construction will include:

- glass and silicon for PV modules
- metal components for site buildings, DC boxes
- components of cabling and junction boxes
- electrical conduit materials
- timber for building fit-out
- lithium-ion batteries (if a battery storage facility is constructed)
- steel for posts, and for shipping containers to house inverters, aggregates, road base and concrete
- steel fencing materials
- steel piles and ground screws
- steel mounts and bolts
- plastic and masonry products, for slabs and footings
- sand for burying cables
- water for cleaning, dust suppression and sanitary facilities
- fuel and lubricants for machinery and motor vehicles.

Wastes as a result of construction will include:

- excess building materials, offcuts, scrap metals and cabling
- packaging materials such as cardboard, plastic, and timber pallets
- topsoil from excavations
- green waste from vegetation clearance
- bio-wastes from on-site septic systems.

Operation

Resource use associated with project operation is likely to be limited to maintenance activities (e.g. replacement of some materials), presence of onsite personnel (e.g. use of office-related products including stationary), the use of machinery and motor vehicles.

Water use will be minimal and restricted to cleaning and sanitary facilities. Water use is discussed further in Section 8.4.

Waste may include replaced materials, green waste from vegetation clearance, bio-waste from onsite septic systems, minor waste chemicals, and packaging materials such as cardboard, plastic, and timber pallets.

Decommissioning

Above ground infrastructure would be removed during decommissioning. Resources are likely to include fuels and lubricants used for machinery and motor vehicles that are used to remove the infrastructure. Water use would be similar to that used in construction.

Recycle and reuse (including sale) of the following materials will be possible during decommissioning of the site:

- metals from piles, steel mounts fencing and cables
- PV modules
- lithium-ion battery (potentially recycled through Tesla's Closed Loop Battery Recycling Program³ or other appropriate lithium-ion battery recycling program)
- electrical conduits
- timber from buildings
- equipment including DC boxes and junction boxes.

Where a material cannot be recycled or reused, it will be disposed of in accordance with the EPA Waste Classification Guidelines 2014 to appropriately licensed facilities.

8.13.2 Methodology

Guidelines and policies

The POEO Act provides a framework for the management of waste in NSW. Under the Act, a license is required to carry out certain scheduled waste activities, and it is an offence to:

- wilfully or negligently dispose of waste likely to cause harm to the environment
- litter.

The Protection of the Environment Operations (Waste) Regulation 2005 (POEO Regulation) prescribes management requirements for certain wastes and provides thresholds for environment protection licences. The regulations also outline the waste levy system, including EPAs requirements for records, surveys and reports.

The POEO Act and POEO Regulation assist in meeting the objectives of the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The WARR Act promotes waste avoidance and resource recovery for the reduction in waste generation, in accordance with principles of ecologically sustainable development, and sets out resource management hierarchy principles.

To ensure resources are used efficiently and adverse impacts to the environment as a result of waste are minimised, this chapter has been prepared in accordance with the following guidelines and strategies:

- EPAs Waste Avoidance and Resource Recovery (WARR) Strategy 2014-2012 (EPA 2014a)
- EPAs Waste Classification Guidelines 2014 (EPA 2014b)
- EPAs Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities 2012 (EPA 2012).

³ https://www.tesla.com/en_AU/blog/teslas-closed-loop-battery-recycling-program

Waste classification

The EPA Waste Classification Guidelines 2014 provide detail on how wastes should be assessed and classified and provides management options for their disposal. The guidelines classify waste as follows:

- special waste (e.g. asbestos and tyres)
- liquid waste (e.g. fuels, oils and pesticides)
- hazardous waste (e.g. lead-acid or nickel-cadmium batteries and lead paint)
- restricted solid waste (currently no wastes have been pre-classified by the EPA as 'restricted solid waste')
- general solid waste (putrescible) (e.g. general litter, food waste, green waste, sanitary waste and animal waste)
- general solid waste (non-putrescible) (e.g. building and demolition waste, synthetic fibre waste, and wood waste).

The majority of the waste resulting from construction would be classified under the POEO Act as 'general solid waste (non-putrescibles)'. Other wastes such as bio-wastes would be classed as 'general solid waste (putrescibles)'.

Lithium ion batteries have not been pre-classified by EPA NSW, however they are classified as a Dangerous Good under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) (EPA 2014b; ABRI 2015) (see Section 7.6). The EPA recommends the Australian Battery Recycling Initiative be contacted regarding recycling of lithium-ion batteries (EPA 2012).

Waste hierarchy

The project will be consistent with the waste management hierarchy set out in the WARR Act and shown in Figure 8.12.

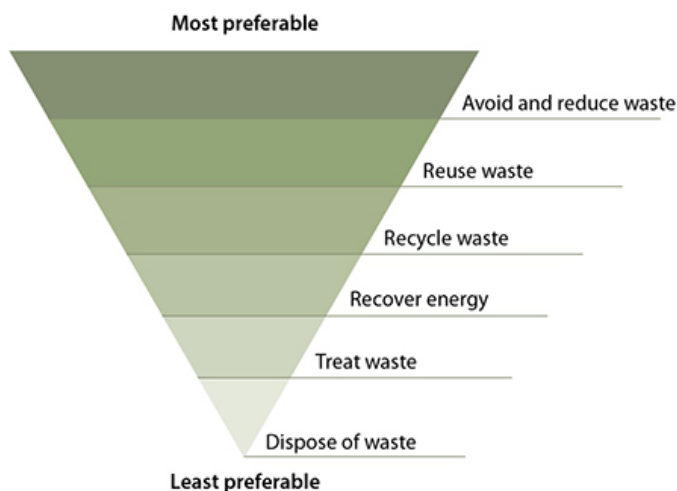


Figure 8.12 Waste management hierarchy (EPA 2017)

A description of the waste management hierarchy is as follows:

- Avoid and reduce waste: reduce the quantity of waste being generated.
- Reuse waste: reusing a product more than once in its original form for the same or similar use, avoiding the need for reprocessing.
- Recycle waste: processing waste into a similar non-waste product. This consumes less energy than the production of the non-waste product from raw materials.
- Recover energy: convert non-recyclable waste to energy such as heat, electricity or fuel.

- Treat waste: use chemical, biological or mechanical processes (e.g. composting) to stabilise wastes, reducing their health and environmental impacts.
- Disposal of waste: disposing of waste at appropriately licensed facilities.

8.13.3 Impact assessment

Construction and decommissioning

The majority of the waste resulting from construction will be building and demolition waste, classified under the POEO Act as 'general solid waste (non-putrescibles)'. Many of these wastes, including infrastructure components such as steel or electrical components, are highly recyclable or reusable and would not be expected to require disposal during either construction or decommissioning.

At decommissioning, the Australian Battery Recycling Initiative would be consulted in regard to recycling of lithium-ion batteries (EPA 2012).

Operation

During operation, replacement of some materials may occur as part of maintenance activities, however these wastes will be recycled or reused where possible.

Other wastes generated by the project such as general solid waste (putrescibles) (e.g. food, animal carcasses, and green waste from vegetation clearance) and liquid waste (fuel) will be minimal and will be managed in accordance with the EPA Waste Classification Guidelines 2014.

Where materials cannot be reused or recycled, they will be disposed of at an appropriately licensed facility.

Resource use impacts

Demand for materials as part of the project is unlikely to place significant pressure on local or regional resource availability or suppliers. The energy used by the project as a result of the key resources consumed during construction, operation and decommissioning activities will be offset through the generation of renewable energy.

Relatively small quantities of water will be consumed by the project during construction, operation and decommissioning. It is anticipated that 500 kL of water will be used during operation each year for cleaning, maintenance, and staff amenities. During operation, water use will be offset by the collection of rainwater from building roofs and storage in on-site water storage tanks (e.g. 2 x 35 kL tanks).

8.13.4 Management and mitigation

A Waste Management Plan (WMP) will be prepared to meet the waste management classification and hierarchy outlined in Section 8.13.2, and will form part of the CEMP, OEMP and DMP. The plan will set out waste management responsibilities to be communicated to staff and contractors. The WMP will include:

- waste transportation protocols
- procedures for ordering materials
- classification of waste to be generated during construction
- procedures for identifying opportunities to avoid, reuse, recycle, recover, or treat waste
- method of tracking all waste entering and leaving the site
- procedures for managing waste generated during maintenance of plant and equipment
- procedures for waste monitoring, inspection and reporting
- location of dedicated waste management areas onsite (e.g. skips and recycling bins)
- commercial reuse opportunities.

8.14 Cumulative impacts

8.14.1 Existing conditions

For the purpose of this EIS, cumulative impacts are the combined effects of:

- various impact types (such as air quality and noise) which may occur as a result of a project
- the project with other activities (such as nearby developments) and other environmental trends in the area.

The DPE Major Projects Register (MPR), accessed on 19 February 2018, was used to undertake a search on any major projects within Narrandera Shire. Three projects were identified:

- Avonlie Solar Project – Renewable Energy Systems Australia Pty Ltd propose to develop a solar farm at Avonlie, approximately 20 km southeast of Narrandera and 10 km northwest of the Sandigo development site. The solar farm will generate up to a combined total of 200 MW of renewable energy and occupy around 608 ha of rural land currently used for agriculture.
- Euroley Poultry Production Complex, located approximately 48 km northwest of the development site

A review of the RMS website did not identify any major works proposed in the vicinity of the development site. The Narrandera Shire Council website identified that construction works to improve the Narrandera town centre, as part of implementation of the Narrandera Business Centre Master Plan, were scheduled to begin in 2016/2017. These works are to include the improvement of footpaths, parking, landscaping, and road safety.

As outlined in Section 8.5.1, a search of DPEs MinView tool and consultation with Narrandera Shire Council identified there are no minerals, petroleum, or coal exploration titles or applications over the development site (see Figure 8.8) (DPE 2018). The nearest mining or exploration title area to the development site is located approximately 36 km to the north.

8.14.2 Impact assessment

The view of the project infrastructure may compound the visual impact already associated with the existing transmission lines, however this impact is considered to be negligible.

The Sandigo Solar Farm project is unlikely to generate a cumulative impact with the Euroley Poultry Production Complex, due to the significant distance between the projects.

Due to the relatively minor works that will be undertaken as part of the implementation of the Narrandera Business Centre Master Plan and the distance of the Narrandera town centre (located approximately 28 km northwest of the development site), it is unlikely the project will generate a cumulative impact with the works associated with the implementation of the plan.

The proposed Avonlie Solar Farm is located within 10 km of the project. Construction of the Avonlie Solar Farm is estimated to take 18 months, commencing in March-May 2019 (NGH 2018). The Sandigo Solar Farm project is estimated to take eight months, commencing in September-November 2018. If these indicative dates are adhered to, the construction periods will partially coincide. Both projects will require similar support and create similar types of impacts on the local region. The proposed Avonlie Solar Farm is closer to Narrandera and approximately double the size of the Sandigo development, therefore it will have greater exposure to the community and potentially have more significant impacts. The potential cumulative impacts associated with the two solar developments are discussed below.

Construction

The timing of the proposed Avonlie Solar Farm development may partially overlap with the final stages of construction of the Sandigo Solar Farm. Key cumulative impacts may include community impacts such as combined demand that may strain local resources (e.g. accommodation and local services). However,

construction of the two projects may also be sequential, depending on actual timing, and in this case will provide an extended period of sustainable income and business for the local region (NGH 2018).

Land clearance during construction of the two projects is likely to result in cumulative impacts on native vegetation and species habitat (minor if managed appropriately and offset) and the loss of Aboriginal cultural values and archaeological sites within the local area. Other potential cumulative impacts of construction resulting from the two projects are traffic and amenity (including noise and visual) impacts.

The increase of traffic on Sturt Highway and local roads could generate potential cumulative impacts with traffic generated from local events and activities. However, in such a case, appropriate measures to reduce the potential impacts will be addressed in the Sandigo TMP. In addition, potential traffic impacts may occur if construction of the development site coincides with extraction of materials from Wrights Pit and Mimosa Pit. However, as discussed in Section 8.6, any cumulative impacts on the use of these pits are expected to be minimal.

In terms of visual amenity, the increase in construction traffic on Sturt Highway, which is used regularly by heavy vehicles, local roads and the development site has the potential to contribute to cumulative visual amenity impacts to surrounding receivers, including road users and nearby residents. However, the increase in traffic as a result of the project will be temporary and for a short duration during the construction period.

Cumulative impacts from decommissioning will be similar to construction and will depend on the timing of decommissioning of the two projects. However infrastructure removal (rather than construction) would result in a shorter duration of works, and therefore a reduced impact.

Operation

The two solar farm projects would potentially be sharing some of the same power transmission infrastructure, such as the TransGrid transmission lines. This will reduce or remove existing excess capacity in the local network.

The benefits of renewable energy generation in the region as outlined in Section 4.3 may be further enhanced by having two solar farms and the negative cumulative operational impacts resulting from the Sandigo Solar Farm and Avonlie Solar Farm would be minimal.

8.14.3 Management and mitigation

Implementing the management and mitigation measures discussed for each environmental aspect in Chapter 8 is expected to acceptably minimise the risk of cumulative impacts occurring as a result of the project. No additional management and mitigation measures are proposed.

9 Environmental management

9.1 Environmental framework

ESCO Pacific proposes to manage the environmental risks associated with the proposed Sandigo Solar Farm by implementing a suite of project-specific mitigation measures detailed in Chapter 8 and summarised in the statement of commitments below.

It is intended to manage all commitments and environmental mitigation measures by implementing a Project Environmental Management Plan, consisting of a CEMP, OEMP and DMP. ESCO Pacific will prepare these plans prior to each stage of works. Each of these plans will describe project aspects, including:

- Staff and contractor roles and responsibilities
- approval and licencing requirements
- monitoring and reporting requirements
- environmental targets and objectives
- auditing and review processes and timetables
- emergency response procedures
- induction and training
- stakeholder engagement and complaint response procedures
- adaptive management mechanisms to encourage continuous improvement.

9.2 Statement of commitments

The mitigation measures, monitoring activities and management strategies outlined in Chapter 8 will be implemented for all activities associated with each stage of the project. Table 9.1 details the key commitments proposed in this EIS that will enable ESCO Pacific and its contractors to effectively mitigate and manage the potential environmental impacts of the project.

Table 9.1 Summary of environmental management commitments

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
9.1	Biodiversity			
B.1	Site access for construction and operation will be selected to minimise vegetation removal and impacts to threatened fauna species	x	x	x
B.2	Use of ecosystem credit offsets to minimise impacts to flora and fauna	x	x	
B.3	EMPs will be developed to mitigate potential impacts to biodiversity, including:	x	x	x
B.3.1	<ul style="list-style-type: none"> unless otherwise agreed by the Responsible Authority, the removal of hollow-bearing trees will be undertaken outside of the spring to early summer period to avoid the main breeding period for hollow-dependent fauna 	x	x	x
B.3.2	<ul style="list-style-type: none"> pre-clearance surveys will be undertaken to ensure that nests and hollows identified in paddock trees are inactive 	x		
B.3.3	<ul style="list-style-type: none"> where an active hollow is identified, a licensed wildlife salvage 	x		

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
	team will be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered in vegetation or hollow-bearing trees			
B.3.4	<ul style="list-style-type: none"> demarcation and exclusion fencing should be installed around trees and vegetation to be retained in, or directly adjacent to (within the radius of an applicable tree protection zone (TPZ)), the development site, as follows: 	x	x	x
B.3.4.1	<ul style="list-style-type: none"> TPZs should be clearly defined 	x	x	x
B.3.4.2	<ul style="list-style-type: none"> the radius of the TPZ should be calculated for each tree by multiplying its diameter at breast height (DBH) by 12 (i.e. TPZ = DBH x 12) in accordance with the Australian Standard – Protection of trees on development sites 	x	x	x
B.3.4.3	<ul style="list-style-type: none"> a TPZ should not be less than 2 m or greater than 15 m, except where crown protection is required 	x	x	x
B.3.4.4	<ul style="list-style-type: none"> appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' should be installed around retained trees and vegetation 	x	x	x
B.3.4.5	<ul style="list-style-type: none"> the location of any 'No Go Zones' should be identified in site inductions 	x	x	x
B.3.4.6	<ul style="list-style-type: none"> fencing should comprise star pickets with high visibility bunting 	x	x	x
B.3.5	<ul style="list-style-type: none"> all material stockpiles, vehicle parking and machinery storage will be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation 	x	x	x
B.3.6	<ul style="list-style-type: none"> where practical, all paddock and hollow-bearing trees to be removed should be placed in areas of retained vegetation to provide additional fauna habitat 	x		
B.3.7	<ul style="list-style-type: none"> where appropriate, native vegetation cleared from the development site should be mulched for re-use on the site, to stabilise bare ground 	x		
B.3.8	<ul style="list-style-type: none"> sediment and erosion control measures should be implemented prior to construction works commencing, to protect drainage channels and any downgradient habitat. These should be in accordance with the measures outlined in the <i>Soil, land use and agriculture</i> section 	x	x	x
B.3.9	<ul style="list-style-type: none"> standard noise controls should be implemented during construction as outlined in the <i>Noise</i> section to minimise disturbance to fauna 	x		x
B.3.10	<ul style="list-style-type: none"> the site rehabilitation plan will be implemented to progressively rehabilitate disturbed areas 	x	x	x
B.3.11	<ul style="list-style-type: none"> a Weed and Pest Management Plan will be prepared prior to construction as outlined in the <i>Soil, land use and agriculture</i> section. This should include: 	x	x	x
B.3.11.1	<ul style="list-style-type: none"> identification of areas on the development site which have environmental weeds 	x		
B.3.11.2	<ul style="list-style-type: none"> methods for controlling weeds e.g. herbicides, physical removal, grazing, etc. 	x	x	x
B.3.11.3	<ul style="list-style-type: none"> ongoing monitoring of weeds 	x	x	x
9.2	Aboriginal cultural heritage			
AH.1	Undertaking controlled surface collection of archaeological materials from within the development site by qualified archaeologists in consultation and cooperation with the RAP	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
AH.2	Following the surface collection, a detailed salvage report will be written by a qualified archaeologist. The report will discuss the context of the finds, as well as the nature and extent of the assemblages within a local and regional context	x	x	x
AH.3	The artefacts recovered during the salvage will be held by AHM for analysis and reporting purposes. After construction works, the artefacts recovered during the surface salvage will be relocated to a location in agreement with the applicant and the RAP	x	x	x
AH.4	If any Aboriginal object is discovered and/or harmed (in, or under the land), while undertaking the proposed development activities, ESCO will:	x	x	x
AH.4.1	• not further harm the object	x	x	x
AH.4.2	• immediately cease all work at the particular location	x	x	x
AH.4.3	• secure the area so as to avoid further harm to the Aboriginal object	x	x	x
AH.4.4	• notify OEH as soon as practical on 131 555, providing any details of the Aboriginal object and its location	x	x	x
AH.4.5	• not recommence any work at the particular location unless authorised in writing by OEH	x	x	x
AH.5	In the event that skeletal remains are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and OEH contacted	x	x	x
9.3	Historic heritage			
HH.1	No management and mitigation measures are required to be undertaken as the project is highly unlikely to impact historic heritage	x	x	x
9.4	Hydrology and water resources			
H.1	The following management and mitigation measures will be implemented during construction to limit the impacts of the project on hydrology and water resources:	x	x	x
H.1.1	• ensuring any high-risk site facilities (such as the substation) are located away from areas of potential flood risk	x		
H.1.2	• implementing erosion and sediment control measures during construction as outlined in <i>soil, land use and agriculture</i> section, including minimising areas of disturbance and rehabilitating disturbed areas as soon as possible	x	x	x
H.1.3	• designing and installing effective stormwater management and control measures during construction, in accordance with the erosion and sediment control plans for the site	x		x
H.1.4	• developing and implementing procedures for the testing and management of construction wastewater if disposal is required	x		x
H.1.5	• refuelling plant and machinery in an impervious bunded area at least 50 m away from water bodies and drainage lines	x	x	x
H.1.6	• storing fuel and chemicals in an impervious bunded area at least 50 m away from water bodies and drainage lines as outlined in <i>soil, land use and agriculture</i> section	x	x	x
H.1.7	• implementing a spill response plan (to be prepared as part of the CEMP) which will include containment and remediation procedures, placement of spill kits and material safety data	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
	sheets, and training requirements for staff as outlined in <i>soil, land use and agriculture</i> section			
H.1.8	<ul style="list-style-type: none"> disposing of all hazardous chemicals and waste offsite in accordance with relevant NSW government regulations and guidelines as outlined in <i>soil, land use and agriculture</i> section 	x	x	x
H.1.9	<ul style="list-style-type: none"> daily inspection of all machinery, plant, equipment and facilities to ensure no leakage of fuels, lubricants or other liquids 	x	x	x
H.2	Maintaining vegetation cover under all solar panel arrays to maximise water infiltration		x	
H.3	Treating sewage by an onsite bio-cycle system installed to comply with Building Code of Australia requirements		x	
H.4	Ensuring the Emergency Response Plan for the project includes procedures to be followed in the event of flooding within the development site or surrounding area, including information on safe evacuation routes	x	x	x
9.5	Soil and land use			
S.1	Development of EMPs to mitigate potential impacts to soils, land use and agricultural land. The plans will be developed with the following guidelines to address potential erosion and sedimentation impacts, including:	x	x	x
S.1.1	<ul style="list-style-type: none"> Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition (also known as the Blue Book) 	x	x	x
S.1.2	<ul style="list-style-type: none"> Volume 2A Installation of Services 	x	x	x
S.1.3	<ul style="list-style-type: none"> Volume 2C Unsealed Roads 	x	x	x
S.2	Environmental management plans s will include measures such as:	x	x	x
S.2.1	<ul style="list-style-type: none"> designing internal access roads, tracks and the site carpark with adequate runoff controls to prevent erosion from concentrated flows 	x		x
S.2.2	<ul style="list-style-type: none"> constructing and/or installing erosion and sediment control structures, and regular inspection of them, particularly following rainfall events 	x	x	x
S.2.3	<ul style="list-style-type: none"> lining drains with geotextile or plastic, to reduce erosion 	x		x
S.2.4	<ul style="list-style-type: none"> maintaining a register of erosion and sediment control activities, including records of inspection and maintenance 	x	x	x
S.2.5	<ul style="list-style-type: none"> minimising areas of disturbance and rehabilitating disturbed areas as soon as possible with appropriate plant species 	x		x
S.2.6	<ul style="list-style-type: none"> separating topsoil and subsoil and ensuring that soils are reinstated in the correct order 	x		x
S.2.7	<ul style="list-style-type: none"> filling trenches progressively after placement or removal of underground cabling 	x		x
S.2.8	<ul style="list-style-type: none"> implementing a WPMP to be developed prior to construction, to reduce the spread of weeds and pathogens and control pest animals. This should include: 	x	x	x
S.2.8.1	<ul style="list-style-type: none"> – identification of areas on the development site which have environmental weeds 	x		
S.2.8.2	<ul style="list-style-type: none"> – methods for controlling weeds e.g. herbicides, physical removal, grazing, etc. 	x	x	x
S.2.8.3	<ul style="list-style-type: none"> – ongoing monitoring of weeds 	x	x	x
S.2.9	<ul style="list-style-type: none"> implementing a vehicle hygiene protocol when entering and 	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
	leaving the site to ensure vehicles and earthmoving machinery are free of debris, sediment and weeds			
S.2.10	• ensuring any fill brought to site is weed and pathogen free	x		x
S.2.11	• implementing a TMP to ensure vehicles adhere to speed limits and keep to designated roads, to reduce generation of dust	x		x
S.2.12	• ensuring appropriate stockpile management to reduce dust, erosive runoff and potential contamination (where relevant)	x		x
S.2.13	• implementing a contamination procedure (to be developed as part of the CEMP) outlining appropriate steps and authorities to be notified in the event buried contamination is uncovered	x	x	x
S.2.14	• refuelling plant and machinery in an impervious bunded area at least 50 m away from water bodies and drainage lines	x	x	x
S.2.15	• storing fuel and chemicals in an impervious bunded area at least 50 m away from water bodies and drainage lines	x	x	x
S.2.16	• implementing a spill response plan (to be prepared as part of the CEMP) which will include containment and remediation procedures, placement of spill kits and SDSs, and training requirements for staff	x	x	x
S.2.17	• disposing of all hazardous chemicals and waste offsite in accordance with relevant NSW government regulations and guidelines	x	x	x
S.2.18	• revegetating any residual areas still disturbed following construction (where no longer active) with appropriate plant species		x	
S.2.19	• maintaining vegetation cover across the development site to reduce potential erosion impacts		x	
9.6	Traffic and transport			
T.1	Development of EMPs, including traffic management measures, will be put in place to mitigate any potential impacts	x	x	x
T.2	Development of a traffic management plan (in consultation with Narrandera Shire Council, RMS and any other relevant stakeholders), which will include:	x		x
T.2.1	• confirmation of the project construction timeframe and work stages	x		
T.2.2	• confirmation of expected traffic volumes generated by the project for all work stages	x		
T.2.3	• identification of all heavy vehicle and over-dimensional vehicle haulage routes for all work stages	x		
T.2.4	• a mechanism to review identified haulage route road conditions prior to the commencement of works	x		
T.2.5	• mechanisms/agreements (if deemed necessary) to maintain haulage route roads and road infrastructure, including local public roads used by site traffic, during construction works and to reinstate roads to at least pre-construction conditions	x		
T.2.6	• any additional requirements for specific work stage construction traffic management plans	x		
T.2.7	• any additional relevant mechanisms for over-dimensional vehicle permits and traffic management requirements	x		
T.3	Supplementary 'trucks crossing' signs could be used to provide advanced warning for vehicles travelling along Sturt Highway, Kywong-Boree Creek Road and Kywong-Faithfull Road if required	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
T.4	Traffic-related impacts to amenity during construction (such as noise and dust) will be addressed in the EMP with management measures proposed to mitigate these	x		x
T.5	Traffic-related impacts to during operation (such as risks to road safety from operational traffic) are expected to be minimal but will be addressed in the EMP with management measures proposed to mitigate these		x	
9.7	Noise			
N.1	The noise assessment undertaken for the Sandigo Solar Farm was conservative. However, it is proposed that noise monitoring be undertaken during construction to confirm predictions and determine any need for noise management measures. In particular, the use of a mulcher on site will be subject to noise monitoring and, if noise management levels are exceeded at the two nearest sensitive receivers (NSRs), management measures such as the following will be implemented to achieve compliance:	x	x	
N.1.1	<ul style="list-style-type: none"> locating the mulcher within the site so as to maintain a specified minimum distance to the nearest sensitive receivers 	x	x	
N.1.2	<ul style="list-style-type: none"> operating the mulcher within designated time periods rather than in an ad hoc manner to minimise the frequency of intrusion 	x	x	
N.1.3	<ul style="list-style-type: none"> positioning the mulcher to make use of any natural shielding 	x	x	
N.1.4	<ul style="list-style-type: none"> application of noise shielding or noise suppression measures at the mulcher 	x	x	
N.1.5	<ul style="list-style-type: none"> consultation with the landholders at D2 and D3 to agree on measures 	x	x	
N.2	Any measures to manage nuisance traffic noise at D3 during the construction period, if required, will be agreed in consultation with the landholder or tenant	x	x	x
9.8	Visual amenity			
V.1	Apply urban design principles and objectives during detailed design phase	x		
V.2	Investigate colour combinations for infrastructure items to aid visual obscurity	x	x	
V.3	Minimise reflective surfaces with a preferred use of muted colours for ancillary structures	x	x	
V.4	Development of EMPs, including visual amenity management measures, will be put in place to mitigate any potential impacts. These measures will include:	x	x	x
V.4.1	<ul style="list-style-type: none"> demarcation and exclusion fencing will be installed around trees and vegetation to be retained as described in the <i>Soil, land use and agriculture</i> section 	x		x
V.4.2	<ul style="list-style-type: none"> limiting disturbance and rehabilitating disturbed areas, as described in the <i>Soil, land use and agriculture</i> section 	x	x	x
V.4.3	<ul style="list-style-type: none"> minimise 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 	x	x	x
V.4.4	<ul style="list-style-type: none"> temporary hoardings, barriers, traffic management and signage 			x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
	should be removed when no longer required			
V.4.5	<ul style="list-style-type: none"> keeping the site tidy and well maintained, including removal of all rubbish at regular intervals. There should be no storage of materials beyond the construction boundaries 	x	x	x
V.5	Restricting 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		x	
9.9	Air quality and dust			
AQ.1	Development of EMPs which will contain procedures to prevent and control dust and will include:	x	x	x
AQ.1.1	<ul style="list-style-type: none"> grading and ongoing maintenance of internal access roads to increase stabilisation of soil, where possible 	x	x	x
AQ.1.2	<ul style="list-style-type: none"> wetting down the internal access roads and other exposed surfaces, particularly during dry and windy conditions 	x	x	x
AQ.1.3	<ul style="list-style-type: none"> minimising vehicle movements on unsealed roads 	x	x	x
AQ.1.4	<ul style="list-style-type: none"> limiting the extent of vegetation clearance and excavation 	x	x	x
AQ.1.5	<ul style="list-style-type: none"> minimising the number of stockpiles on site 	x	x	x
AQ.1.6	<ul style="list-style-type: none"> enforcing on-site speed limits 	x	x	x
AQ.1.7	<ul style="list-style-type: none"> clearly defining access and travel routes 	x	x	x
AQ.2	Implementation of an EMP with procedures to prevent and control vehicle, plant and equipment emissions and will include:	x	x	x
AQ.2.1	<ul style="list-style-type: none"> regularly inspecting and maintaining vehicles, plant and equipment to ensure they are operating efficiently, and in accordance with the manufacturer's requirements 	x	x	x
AQ.2.2	<ul style="list-style-type: none"> ensuring that vehicles, plant and equipment meet relevant standards for emissions 	x	x	x
AQ.2.3	<ul style="list-style-type: none"> switching off vehicles, plant and equipment when not in use 	x	x	x
AQ.3	Development of a TMP to assist with management of vehicle generated dust and emissions	x	x	x
AQ.4	Development of a complaints procedure to respond to issues raised by project staff and the local community regarding air quality impacts	x	x	x
9.10	Bushfire and electrical fire			
F.1	Development of a BFMP prior to construction, to include the following:	x	x	x
F.1.1	<ul style="list-style-type: none"> on-site firefighting equipment required 	x	x	x
F.1.2	<ul style="list-style-type: none"> management of asset protection zones 	x	x	x
F.1.4	<ul style="list-style-type: none"> measures for reducing fuel loads on the site (e.g. grazing regime, slashing, ploughing and weed control etc.) 	x	x	x
F.1.5	<ul style="list-style-type: none"> location of hazards and procedures to manage the hazards prior to and during firefighting operations 	x	x	x
F.1.6	<ul style="list-style-type: none"> site access and internal road plan 	x		x
F.1.7	<ul style="list-style-type: none"> management arrangements for the development of an Emergency Response Plan 	x		x
F.1.8	<ul style="list-style-type: none"> procedures to update and review the BFMP 	x		x
F.1.9	<ul style="list-style-type: none"> 24 hour, 7 days per week contact details 	x		x
F.2	Development of a comprehensive ERP, addressing on-site and off-site fire events and detailing appropriate risk control measures to mitigate potential risks to health and safety of	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
	firefighters and other first responders, including:			
F.2.1	• appropriate personal protective clothing required to be worn	x	x	x
F.2.2	• minimum level of respiratory protection required	x	x	x
F.2.3	• decontamination procedures	x	x	x
F.2.4	• minimum evacuation zone distances	x	x	x
F.2.5	• a safe method of shutting down and isolation the photovoltaic system	x	x	x
F.2.6	• emergency evacuation procedures	x	x	x
F.3	Provide the fire stations at Narrandera and Grong Grong, the RFS, Fire and Rescue NSW with the BFMP and ERP, including plans of the development site	x	x	x
F.4	Electrical components, including solar panels, will be designed to minimise the risk of ignition, in accordance with relevant Australian Standards	x	x	x
F.5	Buildings will be designed in accordance with relevant NSW RFS standards	x	x	x
F.6	Access site and internal roads will be designed and constructed in compliance with RFS standards. Emergency access to vehicles will be provided across the entire development site	x	x	x
F.7	Chemicals will be stored in accordance with SDS requirements	x	x	x
F.8	The interior of any buildings will contain the necessary fire safety provisions, in accordance with the relevant Australian Standards and legislation (e.g. Fire extinguishers, smoke alarms, sprinklers)	x	x	x
F.9	Water sources: a non-combustible dedicated water tank with a Storz outlet will be located on onsite. Water from this tank will only be used for fire-fighting. A petrol, diesel or solar powered fire-fighting pump and 30 m hose reel with a steel nozzle will be available onsite, and can be mounted on a 4WD with water tank, and used for grass fire/ember attacks by the applicant in the event of a fire	x	x	x
F.10	Development of an Environmental Management Plan that will provide safety protocols including:	x	x	x
F.10.1	• storage of storage of hazardous and flammable chemicals	x	x	x
F.10.2	• daily monitoring of the Fire Danger Rating for the area, during the Fire Danger Period	x	x	x
F.10.3	• smoking on-site	x	x	x
F.10.4	• basic fire-fighting by on-site staff and use of fire-fighting equipment	x	x	x
9.11	Electromagnetic interference			
E.1	Electrical equipment and infrastructure will be designed and maintained in accordance with relevant Australian standards and codes of practice	x	x	
E.2	Design of electrical equipment and infrastructure will be undertaken by qualified personnel, with support from specialists where required	x	x	
E.3	Electrical equipment will be accessed only by qualified staff	x	x	x
E.4	The general public will not be allowed to enter the development site, unless with supervised by onsite staff and with prior permission	x	x	x
E.5	The landholder and general public will not, under any circumstances, have access to the substation or inverters	x	x	x

No.	Mitigation Measure	Development Stage*		
		Const.	Op.	Decomm.
9.12	Socio-economic			
SSE.1	Development of a Consultation and Stakeholder Engagement Plan to reduce adverse impacts on the Narrandera community. The plan will include procedures for:	x	x	x
SE.2.1	• managing community expectations	x	x	x
SE.2.2	• informing stakeholders of potential impacts	x	x	x
SE.2.3	• providing project-related updates	x	x	x
SE.2.4	• registering and responding to managing complaints and feedback	x	x	x
SE.3	The applicant will liaise with the appropriate local community representatives to help ensure accommodation of construction workforce does not adversely impact on local services or events. Where possible, local contractors, manufacturing facilities, and materials and services will be used.	x		x
SE.4	Ongoing engagement with Narrandera Shire Council will be undertaken to discuss and resolve any concerns	x	x	x
9.13	Waste management			
WM.1	Preparation of a Waste Management Plan (WMP) that meet the waste management classification as set out in EPA Waste Classification Guidelines and EPA's waste management hierarchy. The WMP will be incorporated into the EMPs and will include:	x	x	x
WM.1.1	• waste transportation protocols	x	x	x
WM.1.2	• procedures for ordering materials	x	x	x
WM.1.3	• classification of waste to be generated during construction	x		x
WM.1.4	• procedures for identifying opportunities to avoid, reuse, recycle, recover, or treat waste	x	x	x
WM.1.5	• method of tracking all waste entering and leaving the site	x	x	x
WM.1.6	• procedures for managing waste generated during maintenance of plant and equipment		x	
WM.1.7	• procedures for waste monitoring, inspection and reporting	x	x	x
WM.1.8	• Use of dedicated waste management areas onsite (e.g. skips and recycling bins)	x	x	x
WM.1.9	• commercial reuse opportunities for generated waste	x	x	x
WM.2	Investigation of opportunities for recycling of the lithium-ion batteries		x	x
9.14	Cumulative impacts			
	Implementing management and mitigation measures for each environmental aspect above.	x	x	x

*Construction, operation, decommissioning

10 Conclusion

This EIS has been prepared to support a Development Application by ESCO Pacific for the construction and operation of the utility-scale Sandigo Solar Farm (the project). This EIS has been prepared in accordance with the Secretary's Environmental Assessment Requirements and agency comments, issued by the Department of Planning and Environment on 30 November 2017, and outcomes of community and stakeholder consultation.

The project will generate up to 100 MW of AC clean and renewable electricity through the conversion of solar radiation to electricity via photovoltaic modules.

The project represents a capital investment value of approximately \$125 million and is expected to create up to 150 jobs during construction and up to four full-time and eight part-time positions when operational. Construction is expected to take approximately eight months and the project is expected to operate for 40 years.

ESCO Pacific has undertaken a constraints and opportunities analysis to identify potential project sites in NSW and other States. Sandigo was chosen as the location of the project due to the high solar irradiance in the region and the capacity of the TransGrid electricity network to transmit the power generated by the farm. In selecting the development site from a range of options within the Sandigo area, ESCO Pacific has followed a process of avoiding, minimising and offsetting impacts to environmental and social values. Once the current site was chosen, this same process was followed to optimise project design, configuration and footprint. The result has been the selection of a site that can be developed with minimal adverse effects on the environment and local landholders.

The project will contribute to Australia's greenhouse gas commitments by reducing emissions associated with energy use and contributing to the achievement of the Renewable Energy Target. The project will also be part of the transition away from fossil fuel reliance to cleaner electricity generation, and the transition to increased energy security through a more diverse energy mix.

At a regional level, the project represents investment in an important rural area of the State and will contribute to a more diversified and sustainable income base. At a local level, project benefits will include employment and training opportunities and local economic stimulation.

The project has been assessed as a permissible development for which consent can be granted as an SSD under the Section 89E of the EP&A Act. The project as proposed in this EIS is also compatible with the surrounding land use and is generally consistent with the requirements of the Narrandera LEP and relevant SEPPs.

ESCO Pacific has placed a strong emphasis on stakeholder and community consultation through the EIS process. Consultation has been undertaken with numerous government agencies and council to clarify requirements, discuss methodologies and seek feedback. The agencies, council and community appear supportive of the project. ESCO Pacific has also been actively engaging with the local Aboriginal community in the region and the Local Aboriginal Land Councils.

Based on the findings of the risk assessment and environmental impact assessment processes undertaken for this EIS, including technical investigations conducted by specialists in key areas of potential concern, and the outcomes of community and stakeholder consultation, the project is considered likely to provide significant local and regional benefit whilst resulting in generally minor, short term and largely reversible environmental impacts. However, this conclusion relies on the effective implementation of the environmental management and mitigation measures outlined in this EIS.

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