Environmental Impact Statement

COLEAMBALLY SOLAR FARM

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Certification

I certify that I have prepared the contents of this Environmental Impact Statement in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulations 2000.* To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the project and that information is neither false nor misleading.

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TERMS AND DEFINITIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AGO	Australian Greenhouse Office
ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AWS	Automatic weather station
BCC	Biobanking Credit Calculator
BOM	Australian Bureau of Meteorology
BLM	Bureau of Land Management
BREE	Bureau of Resources and Energy Economics
BFRMP	Bush Fire Risk Management Plan
CEMP	Construction environmental management plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
dB(A)	A measure of A-weighted *(c.f.)* sound levels.
DEC	Department of Environment and Conservation
DECC	Department of Climate Change (now OEH)
DECCW	Department of Climate Change and Water (now OEH)
DOE	Department of the Environment (Commonwealth)
DPE	Department of Planning and Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPA	(NSW) Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
ESD	Ecologically sustainable development

GA	Geoscience Australia
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
Hz	Hertz
ICNG	Interim Construction Noise Guideline
INP	*NSW Industrial Noise Policy*
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
km	kilometres
kV	kilovolts
L_{A90} (15 minutes)	The A-weighted sound pressure level that is exceeded for 90% of a 15-minute measurement period, when measured in the absence of the construction works under consideration and excluding extraneous noise. This is considered to represent the background noise.
L_{Aeq}(15 minutes)	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period that excludes other noise sources such as from industry, road, rail and the community.
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LCU	Landscape Character Unit
LEP	Local Environment Plan
LGA	Local Government Area
LMZ	Landscape Management Zone
LRET	Large scale Renewable Energy Target
m	metres
mm	millimetres
MIA	Murrumbidgee Irrigation Area
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MRET	Mandatory Renewable Energy Target
MVA	Megavolt-ampere
MW	Megawatt
MWh	Megawatt hours
NHMRC	National Health and Medical Research Council
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NW Act	*Noxious Weeds Act 1993* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PCT	Plant Community Type

POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PMF	Probable Maximum Flood
PV	Photovoltaic
RBL	Rating Background Level - the level of background noise
RDA	Regional Development Australia
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
REAP	Renewable Energy Action Plan (NSW)
RFS	NSW Rural Fire Service
RNP	NSW *Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
SEARs	Secretary's Environmental Assessment Requirements
Sensitive Receiver	A place or object that is sensitive to a particular environmental impact. eg school, place of worship, residence, heritage building/structure, pipeline (for vibration/blasting). These may be separately defined by government and industry policies and guidelines
SEPP	State Environmental Planning Policy (NSW)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
Sound pressure level	The noise at a given distance from plant or equipment
sp/spp	Species/multiple species
SPRAT	EPBC Act Species Profiles and Threats Database
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State Significant Development, as defined by section 89C of the EP&A Act *(c.f.)*
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
µT	Microtesla , multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WMP	Waste Management Plan
WSP	Water Sharing Plan
ZVI	Zone of Visual Influence

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction and operation of a proposed 150 Megawatt (MW) photovoltaic (PV) solar farm at Coleambally (the 'proposal'). NGH Environmental has prepared the EIS on behalf of the proponent, Neoen Australia (Neoen).

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs) provided by NSW Department of Planning and Environment (DPE) on 13 February 2017.

PROPOSAL DESCRIPTION

The Coleambally Solar Farm proposal area covers approximately 570 hectares (ha) of land. Key development and infrastructure components would include:

- Solar arrays, PV boxes and skids.
- Potential battery storage.
- Delivery station and solar sub-station.
- Associated above and/or underground cabling.
- Underground connection to TransGrid substation and extension to substation.
- Ancillary facilities.
- New access point from Ercildoune Road and associated road upgrades.
- Possible new access point from Kook Road for solar substation maintenance purposes only.
- Construction of bridges across Tubbo irrigation channel and the central irrigation channel.
- Construction of internal gravel access tracks.
- Possible irrigation drainage channel relocation, subject to final design.
- Subdivision of land.
- Landscaping.

Detailed design would allow for avoidance of sensitive features on the site. The native vegetation buffer would be established post-construction, to minimise visual impacts in specific locations.

The capital investment is estimated to be $210 Million.

PROJECT NEEDS AND BENEFITS

Human activity is resulting in the release of large amounts of greenhouse gasses (GHGs) which trap the sun's heat in our atmosphere and upset the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the historic global agreement to tackle climate change. Australia has committed to reducing its emissions to 26-28% below 2005 levels by 2030. Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

There have been a number of government policies in place in Australia influencing the development of renewable energy. The Federal Government's Large-scale Renewable Energy Target (LRET) aims to ensure that adequate incentives are provided for large scale grid connected renewable energy. The current LRET is 33,000 GWh by 2020.

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013). The Government's vision is for a secure, affordable and clean energy future for NSW. The Plan positions the state to increase energy from renewable sources by attracting investment, building community support, and grow expertise in renewable energy, at least cost to the energy customer and with maximum benefits to NSW. Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors.

The Coleambally Solar Farm would produce an estimated 380,000 MWh/year of renewable electricity and supply over 11,000 GWh over its life. This would assist to meet the LRET targets. The solar farm would also help implement the NSW Government's Renewable Energy Action Plan

Key benefits of the solar farm include:

- Generation of approximately 380,000 megawatt hours (MWh) of renewable electricity per year.
- Based on an emission factor of 0.87 kg CO_2-e/kWh (for NSW and ACT) (DIICCSRTE 2013) the proposed solar energy facility would displace more than 300,000 tonnes of carbon dioxide (CO_2) or greenhouse gas emissions per year.
- Supply of enough power each year to service over 52,000 average New South Wales households (ACIL Allen Consulting, 2015).

A solar energy facility that displaces over 300,000 tonnes of CO_2per annum is the equivalent of taking approximately 90,000 cars off the road each year, based on an average car in NSW travelling 14,100 km per year (DIT 2011).

Local social and economic benefits that would be associated with the construction and operation of the Coleambally Solar Farm include:

- Direct and indirect employment opportunities during construction and operation of the solar farm; this includes up to 300 employees at the peak of construction and seven operational staff for the life of the project.
- Direct business volume benefits for local services, materials and contracting businesses.
- Assistance in meeting the future national electricity demands.

Additionally, the proposal would address the environmental constraints of the site appropriately. It would be designed to:

- Preserve biodiversity features, through minimising tree removal.
- Minimise impacts to soil and water, through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Minimise visual impacts to neighbours, incorporating vegetation screens located in consultation with neighbours.
- Preserve agricultural production values, being highly reversible at the end of the project's life.

KEY ENVIRONMENTAL ASSESSMENT ISSUES

The detailed investigation of risks and impacts was undertaken for the construction, operation and decommissioning phases of the Coleambally Solar Farm. Additional to addressing the project-specific SEARs, a risk assessment was carried out to identify key environmental risks of the proposal, to guide the depth of investigation that would be undertaken in this EIS. The risk assessment identified five

environmental aspects as key risks, and detailed investigations were subsequently undertaken in these areas:

- Biodiversity
- Aboriginal cultural heritage
- Visual impacts
- Land use
- Noise impacts

Biodiversity

The proposal area is located within the NSW Riverina Bioregion and the Murrumbidgee Subregion (IBRA v.7 2012). Cleared and highly modified agricultural land occupies approximately 95% of the proposal area within cropping and pastoral areas. Two distinct native Plant Community Types (PCTs) were observed in the proposal area:

1. Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (PCT 26) in the northeast corner of the proposal area. Weeping Myall Open Woodland forms part of the listed EEC - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion*. The development envelope has been designed to minimise impact to this community.
2. Black Box Grassy open woodland wetland of rarely flooded depressions in south western NSW (Mainly Riverina Bioregion and Murray Darling Depression Bioregion) (PCT 16). This community occurs along the irrigation drain in the south of the proposal area and near Ercildourne Road. The development envelope has been designed to minimise impact to this community.

The following threatened species were identified as potentially being present:

- A Burr Daisy, *Calotis moorei*
- Bindweed, *Convolvulus tedmoorei*
- Lanky Buttions, *Leptorhynchos orientalis*
- Squirrel Glider, *Petaurus norfolcensis*

No threatened flora or fauna species were detected during the surveys. Targeted surveys in spring are required to determine whether the plant species listed above are present in the proposal area. No additional surveys are considered necessary for the Squirrel Glider.

The development envelope has been selected to avoid or minimise impacts to biodiversity where possible. Most areas of EEC in the proposal area have been avoided through the design process. The following potential direct and indirect impacts to biodiversity values of the site that could result from the proposal:

- Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, compound sites, stockpile sites, access tracks).
- Accidental spills and contamination from construction activities (including compound sites).
- Earthworks.
- Noise.
- Dust generation.
- Light spills during night works.
- Increased vehicle traffic.

- General construction activities.
- Existence of new and permanent solar infrastructure.
- Inappropriate landscaping.
- Weed encroachment.
- Increased vehicle traffic risking collision with fauna.
- Perimeter fencing preventing fauna movement.

A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction phase are avoided where possible, and minimised where they cannot be avoided.

Aboriginal heritage

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. Consultation with Aboriginal stakeholders was undertaken.

Coleambally is within an area identified as part of the Wiradjuri language group. The proposal area is entirely within the broad scalded plains of the Murrumbidgee that have been laser levelled and divided into irrigation bays. There are no micro features such as sand ridges or palaeochannels within the proposal area. Soils are heavily disturbed and there is unlikely to be any remnant intact profile within at least the upper 20-30 cm. There is a single once natural water course adjacent to the proposal area that bisects the assessment area. Although now a modified channel the design is believed to follow the natural course of an unnamed creek.

18 known Aboriginal sites have been recorded in the general locality. None of these occur within the proposal area.

A series of pedestrian survey transects were undertaken across the proposal area. The survey was undertaken by an archaeologist from NGH Environmental. Whilst members of the local Aboriginal community were invited to participate in the survey, none took up this invitation.

Despite the variable visibility encountered during the survey, no Aboriginal cultural material or objects were found across the proposal area. The assessment concluded that it is unlikely that *in situ* stone artefacts occur within the proposed development envelope. Based on the land use history of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the broader proposal area.

Visual amenity

NGH Environmental completed a Visual Impact Assessment (VIA) of the proposed Coleambally Solar Farm.

There are six residences located within two kilometres of the proposal area, with the closest being about 920 metres to the east. None are proposal-involved. Four Landscape Character Units (LCU) were identified within 16 kilometres of the proposal area:

- Agricultural.
- Reserve.
- Rural village.
- Industrial.

Representative viewpoints within each LCU were identified and modelled. The predicted sensitivity of each viewpoint were assessed. The residential viewpoints were found to have 'High' sensitivity. Road viewpoints were generally found to have 'Moderate' sensitivity, with industrial viewpoints found to have 'Low' sensitivity. The form of the infrastructure is not incongruous with the existing low lying rectangular forms in this agricultural area.

The visual impact assessment was undertaken considering the:

- Infrastructure components proposed.
- Their potential impact on landscape character units and representative viewpoints.
- The degree of contrast the development would have and if these are considered acceptable.

No view points were assessed to have a high impact.

Medium impacts are seen for road viewpoints within the foreground and one residential viewpoint within the middle ground. Screening as a mitigation strategy has been considered and an agreement has been reached with the landholder for the residential viewpoint.

The Kidman Way is considered a high use area, however view durations would be short of the proposal. Along the Kidman Way existing vegetation screening is minimal and there would be dominant views of the infrastructure. Screening as a mitigation strategy could soften views of infrastructure from these viewpoints.

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

Some of the other onsite infrastructure may cause glare or reflections depending on the sun angle. This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to motorists or aircraft.

The operational view of the solar farm may generate a cumulative impact with the existing substation and powerlines. The array site requires security fencing and steel dominated infrastructure. Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

Noise

Land uses surrounding the proposal area are generally limited to sheep and cattle grazing on improved irrigated pastures and irrigated agriculture. Noise generating equipment would include irrigation systems such as pumps as well as tractors, quad bikes and 4WD vehicles. These land uses would not create substantial background noise within the area. Noise levels are likely to be concentrated at peak times during a given season determined by farm activities (sowing, spraying and harvest etc).

The surrounding road network would also be a source of noise.

The nearest residential dwelling is approximately 920m east of the solar farm boundary.

The construction work is likely to generate a small amount of short-term local noise pollution from the operation of machinery and plant and truck movements. The construction work would be undertaken

during normal working hours (connection to substation an exception) and are not likely to cause undue concern to sensitive noise receivers. Modelling predicts that that noise from the construction of the solar farm would not exceed guideline levels at any of the sensitive noise receivers.

The connection of the powerlines to the existing substation would occur over three days with work being undertaken between 12am and 5am. Any noise impacts from this activity would be short term. The predicted noise levels from the proposed powerline works were found unlikely to exceed guidelines levels at any of the sensitive noise receivers.

During operation, sources of noise from the solar farm would be from the electrical substation, on-site transformers, tracking actuators and occasional maintenance activities.

The existing substation is located more than 2750 metres from the nearest residence. Noise from the substation is therefore considered to be inaudible. The upgrade on the existing substation does not involve the addition of transformer or any equipment that would increase the existing noise level of the substation.

The new solar substation would contain 1 or 2 transformers. The predicted noise level at the closest property was found to be below the ambient background noise levels.

During operations, about 7 staff will be required on-site to operate and maintain the solar plant. Road noise from maintenance vehicle access will be infrequent with up to 7 vehicles accessing the proposal area per day (14 vehicle movements). Noise from the maintenance works would mostly be due to infrequent maintenance activities conducted inside a maintenance building. As such, noise from any maintenance works will be intermittent and occur during the day only. Given the large distance to the surrounding receivers, noise from maintenance work is expected to be well below guideline levels.

The solar panels may be installed on single-axis trackers which involves the panels being driven by motors to track the arc of the sun to maximise the solar effect. The tracking motors would be evenly distributed across the proposal area. The tracking motors would turn no more than five degrees every 15 minutes and would operate no more than one minute out of every 15-minute period. The predicted noise output from this at the nearest sensitive receiver was found to be below guideline levels.

No noise impacts from the operation of the transmission line are expected given the transmission line would be underground.

All vibration impacts from the construction of the solar farm were found to be below any impact level. No ground vibration would occur during operation of the solar farm.

LOWER RISK ISSUES

The following lower risk issues were assessed for the proposed Coleambally Solar Farm:

- Soil
- Water use and quality, including groundwater
- Traffic, transport and road safety
- Climate and air quality
- Electric and magnetic fields
- Socioeconomic and community
- Resource use and waste generation
- Fire and bushfire
- Historic heritage
- Cumulative impacts

No significant impact for any of these aspects is expected from the solar farm.

MANAGEMENT OF IMPACTS

The solar farm has been design to avoid environmental impacts, including:

- Avoidance of the majority of native vegetation, including threatened biota
- Avoidance of Aboriginal heritage through positioning of the solar farm on disturbed irrigated land
- Incorporation of screening and landscaping elements
- Selection of technologies that minimise noise and vibration outputs

A range of additional management and mitigation measures have been developed to further reduce any residual impact. These strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks.

CONCLUSION

Overall, the Coleambally SF would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous agricultural capacity.

The key environmental risks have been investigated through specialist investigations:

- Biodiversity impacts – the BAR concluded that no significant impacts to threatened species and ecological communities would result. No referrals under the EPBC or TSC Act are considered to be required.
- Aboriginal heritage impacts – the Aboriginal Heritage survey and assessment found that no impact to Aboriginal cultural heritage would occur from the proposal.
- Visual impact - the VIA concluded that the construction and operation would have a very low visual impact on the majority of people living in or travelling through the landscape surrounding the proposed solar farm.
- Noise impacts – the noise assessment concluded that noise impacts during construction, operation and decommissioning would be within the accepted noise criterion. Noise exceedances would not occur.
- Land use - While the agricultural output from the existing farmland would be reduced by the operation of the solar farm this would form a very small reduction in the agricultural output of the Coleambally area. The Coleambally Solar Farm is reversible and would not result in the permanent loss of agricultural land.

A suite of management measures have been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Impacts are considered justifiable and acceptable.

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed 150 MegaWatt (MW) Coleambally Solar Farm. NGH Environmental has prepared this EIS on behalf of the proponent, Neoen Australia (Neoen).

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to support a Development Application (DA) to be lodged with NSW Department of Planning and Environment (DPE).

The objective of this EIS is to fulfil the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and Section 79C of the EP&A Act. The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPE on 13 February 2017 (refer Appendix A).

The EIS also addresses the assessment requirements of the *Threatened Species Conservation Act 1995* (TSC Act) and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 PROJECT OVERVIEW

1.2.1 The proponent

Neoen is an Independent Power Producer (IPP) specialising in renewable energy projects including solar, wind and biomass. The company's headquarters are in Paris (France), with an experienced staff of around 100 employees.

Neoen develops, finances, constructs, operates and maintains its projects as a fully integrated renewable energy player, with a genuine long-term approach.

Since its founding in 2008, Neoen has expanded beyond its local market in France and currently has branches in Portugal (2010), Australia (2012), Mexico (2013), Egypt (2013) and El Salvador (2014). It is also actively developing projects in other African areas, Central America, Pan-Caribbean region, Middle East and in the Asia-Pacific region.

Within Australia Neoen has offices in Sydney and Canberra. They have launched the construction of 131MWp of NSW solar PV projects in Parkes, Grifith, Dubbo and Narromine. Neoen are currently operating the largest off-grid hybrid solar and storage project in Australia at the DeGrussa mine in Western Australia (10.6MWp solar PV + 6MW storage) and have commenced operation at the 309MW Hornsdale Wind Farm in South Australia.

Neoen has now reached an industrial maturity with 1GW of assets either in operation or construction. The company is scaling up its portfolio of projects, both inside and outside France, with the goal of reaching a capacity of 3,000 MW by 2020. They have a target of 1 GW of projects in the construction phase in Australia by 2020.

1.2.2 Proposal area location

The proposed Coleambally Solar Farm is located about five kilometres north east of Coleambally in NSW within the Murrumbidgee Local Government Area (LGA) as shown in Figure 1-1. It is proposed to access the site from the north of the proposal area by Ercildoune Road. The proposed solar farm would connect to the existing 132 kilovolt (kV) TransGrid substation located directly across Ercildoune Road immediately north of the proposal area. A minor extension to the substation would also be needed to accommodate infrastructure for the solar farm connection.

1.2.3 Terms used in this document

- **Proposal area** - Location of the proposed solar farm and the TransGrid Substation allotment.
- **Development envelope** - The area of land which will experience works related to the solar farm and any additional infrastructure required for the operation of the proposed solar farm (e.g. Perimeter fence, solar array design, transmission line footprint, access from Ercildoune Road).

1.2.4 Key components of the Coleambally Solar Farm

The Coleambally Solar Farm proposal area covers approximately 570 hectares (ha) of land. Key development and infrastructure components would include:

- Solar arrays, PV boxes or skids.
- Potential battery storage.
- Delivery station and solar substation.
- Associated above or underground cabling.
- Underground connection to TransGrid substation and extension to substation.
- Ancillary facilities.
- New proposal area access point from Ercildoune Road and associated road upgrades.
- Possible new access point from Kook Road for solar substation maintenance purposes only.
- Construction of bridges across Tubbo irrigation channel and central drainage channel.
- Construction of internal gravel access tracks.
- Possible irrigation drainage channel relocation, subject to final design.
- Subdivision of land.
- Perimeter security fencing.

The Proposed Infrastructure map in Appendix B illustrates the indicative layout, including a concept development envelope for proposed solar arrays. Detailed design would allow for avoidance of sensitive features on the site. The native vegetation buffer would be established post-construction, to minimise visual impacts in specific locations.

1.2.5 Capital investment

The proposed Coleambally Solar Farm would have a capital investment of approximately $210 million.

1.2.6 Land ownership

The proposal area is under the four following land ownerships:

- Lot 78 DP 750896 is owned by a private landholder.
- Lots 81, 82, 83 are owned by a private landholder.
- Part of Lots 100 and 101 DP 750896 are owned by a private landholder. Lot 1 DP 821577 is owned by Coleambally Irrigation.
- Lot 3 DP 1055725 is owned by Essential Energy with TransGrid having a Licence to Occupy.

Neoen propose to lease land for the purposes of constructing and operating the solar farm.

1.2.7 Development history

Part of the proposal area, being Lot 78 DP 750896, has been involved in state significant development applications for an ethanol plant. These applications are summarised in Table 1-1.

Table 1-1 Summary of development applications subject to Lot 78 DP 750896

DA number	Proposal	Status	Determination date
P 06_0020	Ethanol Plant	Approved	21/12/2007
P 06_0020 MOD1	Ethanol Plant: - Change in subject land - Reduction in site area - Change to access point and site layout	Withdrawn	n/a
P 06_0020 MOD2	Ethanol Plant: - Extension of lapse date - Changes to reflect staging of development	Approved	7/03/2017

It is noted that application number P 06_0020 stated Lot 78 is the subject of an agreement to purchase by Four Arrows from the land holder. The second modification application (P 06_0020 MOD2) included a letter dated 27 September 2016 from the land holder stating that they had no objection to the lodgement of the application to modify the consent.

Lot 78 has not been involved in the construction of any work related to the ethanol plant to date.

Neoen has a signed Option Deed with the owner of Lot 78, to lease the land for the purpose of a solar farm. This Option Deed was signed on 14 December 2016.

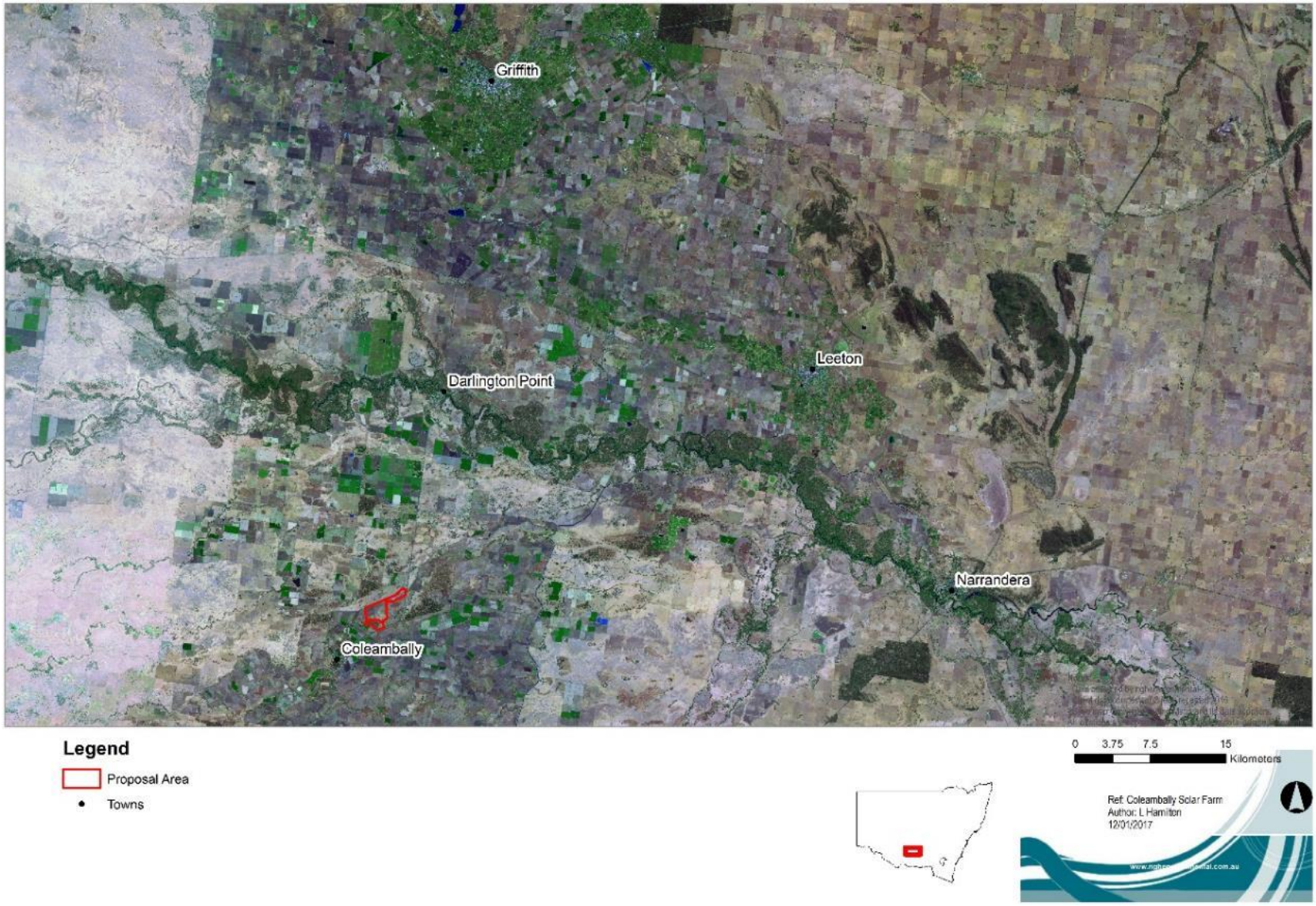


Figure 1-1 General location of the proposal area and TransGrid substation

2 STRATEGIC JUSTIFICATION AND ALTERNATIVES CONSIDERED

2.1 STRATEGIC NEED

2.1.1 Global warming

Human activity is resulting in the release of large amounts of greenhouse gasses (GHGs) which trap the sun's heat in our atmosphere and upset the balance of the Earth's climate. This threat is acknowledged by scientists and politicians around the world, as illustrated by the historic global agreement to tackle climate change in November 2015 at the COP21 conference in Paris. At the Paris COP21 conference, Australia committed to reducing its emissions to 26-28% below 2005 levels by 2030. Renewable energy helps to reduce emissions of GHGs associated with electricity generation.

2.1.2 National renewable energy targets

The Kyoto Protocol is an international agreement created under the United Nations Framework Convention on Climate Change in Kyoto, Japan in 1997. The Australian Prime Minister signed Australia's instrument of ratification of the Kyoto Protocol in 2007, thereby committing Australia to reduce its collective GHG emissions.

There have been a number of government policies in place in Australia influencing the development of renewable energy. In 2001, the Commonwealth Government introduced the Mandatory Renewable Energy Target (MRET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The initial MRET was for Australian to provide 9,500 gigawatt hours (GWh) of new renewable energy generation by 2010.

This target was revised and from January 2011 an expanded the target to 45,000 GWh of additional renewable energy between 2001 and 2020. The MRET was split into a Small-scale Renewable Energy Scheme and Large-scale Renewable Energy Target (LRET) components to ensure that adequate incentives were provided for large scale grid connected renewable energy. The LRET aims to create a financial incentive for the establishment and growth of renewable energy power stations, such as wind and solar farms, or hydro-electric power stations through the creation of large-scale generation certificates.

In June 2015, the Australian parliament passed the *Renewable Energy (Electricity) Amendment Bill 2015.* As part of the amendment bill the LRET was reduced from 41,000 GWh to 33,000 GWh by 2020 with interim and post 2020 targets adjusted accordingly. The current projection is that about 23.5% of Australia's electricity generation in 2020 will be from renewable sources.

The Coleambally Solar Farm would produce an estimated 380,000 MWh/year of renewable electricity and supply over 11,000 GWh over its life. This would assist to meet the LRET targets.

2.1.3 NSW Renewable Energy Action Plan

In 2013, the NSW Government released the NSW Renewable Energy Action Plan to guide NSW's renewable energy development (NSW Government 2013). The Government's vision is for a secure, affordable and clean energy future for NSW.

The Plan positions the state to increase energy from renewable sources, at least cost to the energy customer and with maximum benefits to NSW. The strategy is to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in NSW.

The Plan details 3 goals and 24 actions to efficiently grow renewable energy generation in NSW:

1. Attract renewable energy investment and projects.
2. Build community support for renewable energy.
3. Attract and grow expertise in renewable energy.

Furthermore, the Plan recognises that energy storage can increase the value of renewable energy to individuals, network operators and investors. Storage allows renewable energy investors to increase revenue by selling power at times of peak market prices as opposed to when the electricity is generated. This in turn places downward pressure on electricity prices by encouraging more supply at times of peak demand and reducing the need for additional distribution and transmission infrastructure.

Storage technology (including rechargeable batteries and thermal energy storage) is a global market, with many other countries currently grappling with ways to integrate increasing amounts of renewable energy into their networks. NSW can leverage the work being done overseas as well as develop storage expertise within NSW to create a long-term export industry.

2.1.4 State and Federal support for renewable energy

At present, Australia has one of the world's highest GHG emissions per unit of electricity produced in the world, with the vast majority of its power generated by aging coal-fired power plants. The REAP and LRET incentives are supported at the federal level by grant programs from the Australian Renewable Energy Agency (ARENA), and financing programs from the Clean Energy Finance Corporation.

2.1.5 Climate Change Fund Draft Strategic Plan 2017 to 2022

This strategic plan sets out priority investment areas and potential actions using $500 million of new funding from the $1.4 billion Climate Change Fund over the next five years. Investment in these areas will help New South Wales make the transition to a net zero emissions by 2050, and adapt to a changing climate.

This strategic plan is an important first step to implementing the policy framework. The strategic plan organises potential actions into three priority investment areas that will form the basis of future action plans:

- Accelerating advanced energy (up to $200m)
- National leadership in energy efficiency (up to $200m)
- Preparing for a changing climate (up to $100m).

The advanced energy priority area focuses on supporting the transition to a net-zero emissions economy by providing greater investment certainty for the private sector, accelerating new technology to reduce future costs, and helping the community and industry make informed decisions about a net-zero emissions future.

2.1.6 NSW 2021: A Plan to Make NSW Number One

This plan was released in 2011, replacing the State Plan as the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation. Goal 22 of this plan seeks to protect our natural environment, and includes a specific target to increase renewable energy.

A commitment is made to:

> *Contribute to the national renewable energy target [i.e. 20% renewable energy supply] by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources (NSW Government 2011).*

Specific initiatives under this target that directly support building solar power plants included the Solar Flagships Program, in partnership with the Commonwealth Government, established in 2009 (now closed). Additionally, a strategic move towards renewable energy generation is supported through the establishment of a Joint Industry Government Taskforce to develop a Renewable Energy Action Plan for NSW, which would identify opportunities for investment in renewable energy sources.

2.1.7 Greenhouse gas emissions - life cycle analysis and benefits of solar technology

Life cycle emissions take into account emissions produced during the manufacture, construction, operation and decommissioning of, in this case, electricity generation technologies. When compared with existing conventional fossil-fuel based electricity generation, solar PV technology generates far less life-cycle GHG emissions per GWh than conventional fossil-fuel-based electricity generation technologies (Fthenakis *et al* 2008, NREL 2012).

Unlike fossil fuel systems, most of the GHG emissions for solar technology occur upstream of the lifecycle, with the majority of the emissions (50-80%) arising during the production of the module (Weisser n.d). Other lifecycle emissions relate to construction and decommissioning activities. During plant operation, the production of electricity with photovoltaic modules emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources. Support activities, such as maintenance works, may however generate emissions but the amount would be regarded as being very low. End of life and associated transport activities do not result in meaningful cumulative GHG emissions (Weisser n.d).

Emissions from conventional fossil fuel based energy generation can therefore be avoided by replacing conventional methods of fossil fuel energy generation with solar PV energy generation.

2.2 PROPOSAL BENEFITS

2.2.1 Key benefits

Key benefits include:

- The Coleambally Solar Farm would generate approximately 380,000 megawatt hours (MWh) of renewable electricity per year.
- Based on an emission factor of 0.87 kg CO_2-e/kWh (for NSW and ACT) (DIICCSRTE 2013) the proposed solar energy facility would displace more than 300,000 tonnes of carbon dioxide (CO_2) or greenhouse gas emissions per year.
- The proposed solar energy facility could supply enough power each year to service over 52,000 average New South Wales households (ACIL Allen Consulting, 2015).
- A solar energy facility that displaces over 300,000 tonnes of CO_2per annum is the equivalent of taking approximately 90,000 cars off the road each year, based on an average car in NSW travelling 14,100 km per year (DIT 2011).

2.2.2 Broad benefits

Broad benefits that would be associated with the operation of the Coleambally Solar Farm include:

- Reduced GHG emissions, assisting the transition towards cleaner electricity generation.

- Provision of a renewable energy supply that would assist the Commonwealth and NSW Governments to reach Australia's LRET and other energy and carbon mitigation goals.
- Embed electricity generation supply into the Australian grid, closer to the main consumption centres.

2.2.3 Local benefits

Local social and economic benefits that would be associated with the construction and operation of the Coleambally Solar Farm include:

- Direct and indirect employment opportunities during construction and operation of the solar farm; this includes up to 300 employees at the peak of construction and 7 operational staff for the life of the project.
- Direct business volume benefits for local services, materials and contracting businesses.
- Assistance in meeting the future national electricity demands.

Additionally, the proposal would address the environmental constraints of the site appropriately. It would be designed to:

- Preserve biodiversity features, through minimising tree removal.
- Minimise impacts to soil and water, through pile driven panel mounts rather than extensive soil disturbance and excavation.
- Minimise visual impacts to neighbours, incorporating vegetation screens located in consultation with neighbours.
- Preserve agricultural production values, being highly reversible at the end of the project's life.

2.3 PROPOSAL OBJECTIVES

The objectives of the Coleambally Solar Farm proposal are to:

- Select and develop a site which is suitable for commercial scale solar electricity generation.
- Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals.
- Develop a project which is acceptable to the local community.
- Provide local and regional employment opportunities and other social benefits during construction and operation.
- Provide a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions.
- Construct a project with minimal adverse environmental impacts.
- Provide electricity generation close to a consumption centre.

2.4 ALTERNATIVES CONSIDERED

During the development of the proposal, a number of alternatives were considered. These include the 'do nothing option' (not developing the solar farm), alternative proposal area locations and developing different renewable technologies.

2.4.1 The 'do nothing' option

The consequences of not proceeding with the proposal would be to forgo the identified benefits. This would result in the **loss** of:

- Opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- A renewable energy supply that would assist in reaching the LRET.
- Additional electricity generation and supply into the Australian grid.
- Social and economic benefits, created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.

Doing nothing would avoid the environmental impacts associated with the development and operation of the proposed solar farm, which include vegetation impacts, construction noise, traffic and dust, visual impacts and a temporary reduction in agricultural production at the site. However, these impacts are considered to be manageable and would not result in a significant impact to the environment. Given the benefits of the proposal, the do nothing option is not considered to be a preferred option. In light of the benefits of the proposal and the low level of environmental impact (assessed within this EIS), the proposal is considered to be ecologically sustainable and justifiable.

2.4.2 Technology alternatives

The LRET and REAP outline the commitment by both Australia and NSW more specifically, to reducing GHG emissions and have set targets for increasing the supply of renewable energy. Other forms of largescale renewable energy accounted for in the LRET include wind, hydro, biomass, and tidal energy. The feasibility of wind, solar, biomass, hydro and tidal projects depend on the availability of energy resources and grid capacity.

Neoen has interests in both wind and solar projects. Wind projects were considered to be more suitable to world-class wind resources in South Australia's and other parts of the country. Superior solar resources were identified in New South Wales, providing excellent opportunities for solar projects. This led Neoen to initiate several solar developments in NSW, bearing in mind that this technology can generally be deployed faster than any other type of renewable energy infrastructure.

Available grid capacity at a suitable voltage at the nearby TransGrid substation was instrumental in making Coleambally an ideal choice for a renewable energy development.

2.4.3 Alternative site locations

During the site selection process for the Coleambally Solar Farm, a number of alternative locations were considered. Minimising environmental and social impacts and maximising efficiency were major considerations in the evaluation of alternatives.

The current site was identified as the preferred location, based on the following features:

- Availability of abundant solar resource.
- Proximity to an electricity substation with good connection capacity.
- Availability of appropriate land with appropriate topography (flat or predominantly north-facing).
- Suitability in terms of environmental constraints (the site has a long disturbance history under agricultural cultivation, minimising potential for biodiversity and heritage constraints).
- Absence of flood risk.

The Coleambally site was identified by Neoen as a high-potential location for a solar farm in 2016. An initial feasibility assessment was undertaken which determined the site to be a suitable area to accommodate a solar farm. Subsequent environmental investigations have confirmed its suitability.

2.4.4 Alternative PV technologies

Neoen is considering several different solar PV mounting technology options for the proposal, as shown in Figure 2-1, Figure 2-2 and Figure 2-3. These include:

- Single-axis tracking panels (a lower density but higher energy yield can be achieved).
- North facing fixed tilt panels.
- East-west facing fixed tilt panels (a lower cost of installation and better density of panels can be achieved).

The final decision may be one or a combination of these technologies. Each option would have relatively comparable constructed footprints, visual impacts and environmental impacts, as the varying structures would be of similar height with similar support mountings (installed by driving or screwing into the ground, rather than excavations for footings).

In terms of module technology, Neoen is considering both multicrystalline and monocrystalline modules, which are the most common technology globally, and thin-film technologies which were used in the recently constructed Nyngan and Broken Hills solar farm projects in NSW.

All of these PV technology options are assessed in this EIS, to provide design flexibility. The final decision would be determined at the detailed design phase.

Figure 2-1 Example of single-axis tracking systems with multicrystalline modules

Figure 2-2 Example of south-facing fixed-tilt mounting system with thin-film technology in Europe (installation in Australia would face the north)

Figure 2-3 Example of east-west facing fixed-tilt mounting system with multicrystalline modules

2.4.5 Site suitability and justification

The Coleambally Solar Farm would meet the proposal objectives, principally the development of a commercial scale solar electricity power station. It is justified in terms of reducing Australia's GHG emissions and meeting future energy demands. It will contribute to Australia's renewable energy targets

and support a global reduction in GHG emissions. Finally, it will contribute to economic development in Coleambally and surrounding region.

The proposal area is considered to be suitable for the proposal given:

- It is located within close proximity to existing electricity infrastructure, being the Coleambally Substation.
- The land has been heavily disturbed from past and current agricultural activities.
- Given the location, site attributes and the heavy disturbance of the land, the proposal would have low impacts on the environment.
- The proposal area is not subject to land hazards such as flooding, bush fire and is not known to hold land contamination.
- The proposal is not likely to generate land use conflicts with surrounding land uses.
- The community have provided support for the proposal.

3 PROJECT DESCRIPTION

3.1 PROPOSAL AREA DESCRIPTION

The Coleambally Solar Farm proposal comprises about 570 ha of freehold land, identified as Lots 78, 81, 82, 83, part of Lot 100 and 101 of DP 750896, and Lot 3 DP 1055725 (TransGrid substation). An irrigation channel (Tubbo Channel) identified as Lot 1 DP 821577 borders the north of the proposal area. A smaller channel also identified as Lot 1 DP 821577 passes through the southern portion of the proposal area. The Kidman Way (B87) is located directly to the south and north east of the proposal area where it intersects with Ercildoune Road. Immediately to the north of the proposal area is Kook Road. (Figure 3-1).

The majority of the proposal area has been cleared of native vegetation, laser levelled and cultivated for agriculture, which is the dominant land use in the area. A rural industrial complex called The Welsh Rice Sheds is located directly to the north of the proposal area. Figure 3-2 to Figure 3-4 depict the cleared and heavily modified agriculture nature of the land.

The proposal area has been heavily modified for the purposes of irrigation. This has included:

1. Extensive clearing of native vegetation.
2. Paddocks sown with wheat, soy beans and pasture.
3. Wide spread earth moving to flatten and level the paddocks (Laser Levelling).
4. Modification of a natural drainage line into a drainage channel.
5. Construction of irrigation supply channels.

Paddocks within the proposal area are lined with irrigation channels (Figure 3-4) which are fed from a major irrigation channel (Tubbo Channel) along the northern boundary of the property. The proposal area holds one farm dam. The nearest natural water course is Cooinbil Creek, approximately 16 kilometres to the north west. The Murrumbidgee River is located about 21 kilometres to the north east.

There are patches of remnant native vegetation within the proposal area. These are located:

1. Along the northeast boundary.
2. Near the proposed access in the north of the proposal area.
3. Along the drainage channel in the centre of the proposal area.

Scattered roadside vegetation extends along the boundary of the proposal area along the Kidman Way, Ercildoune Road and Kook Road.

The existing TransGrid substation and site of the substation extension is located on Lot 3 DP 1055725 immediately north of the proposal area, across Ercildoune Road (Figure 3-5). The vegetation surrounding the substation has been cleared and is managed using hazard reduction burns.

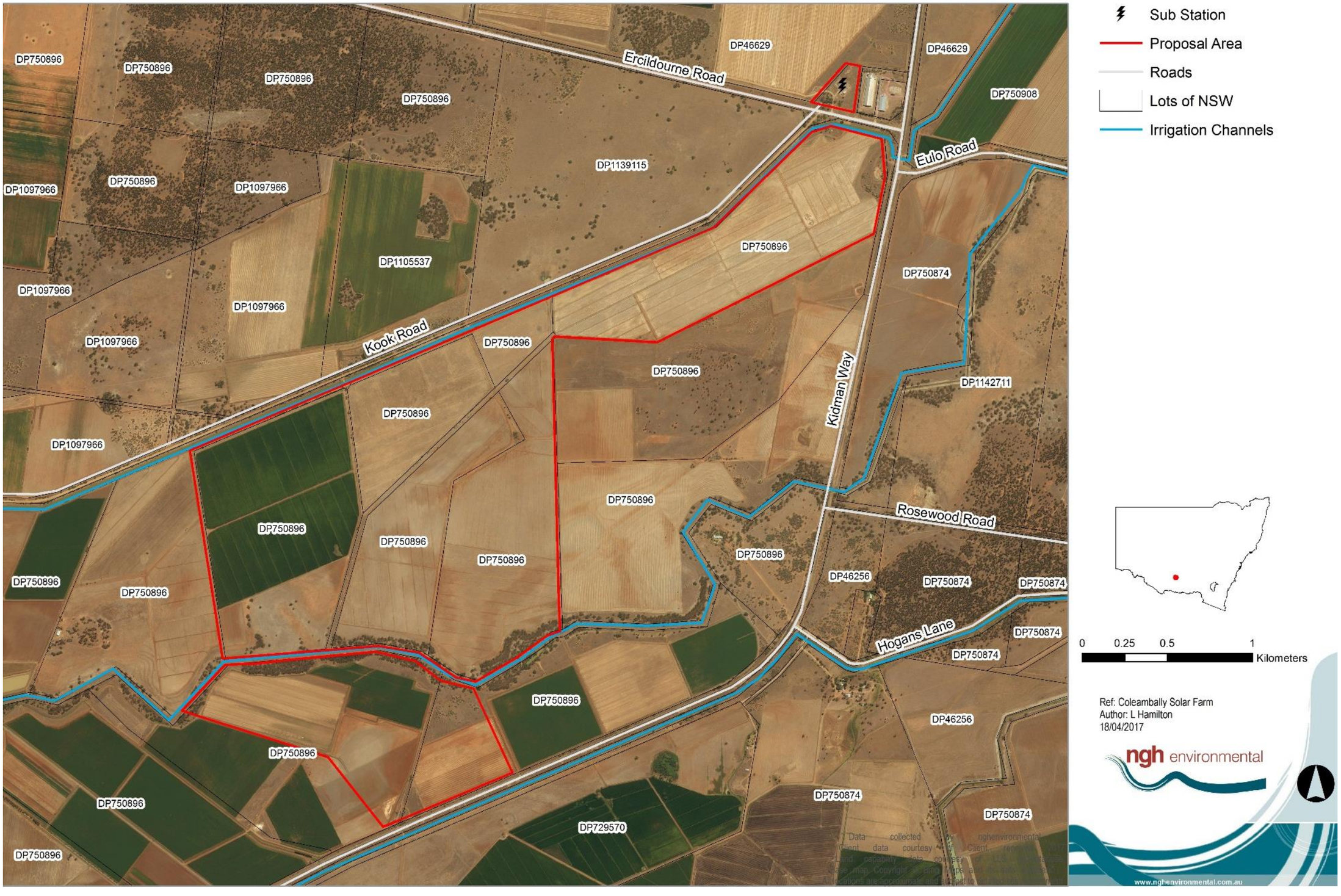


Figure 3-1 Location of the Coleambally Solar Farm and TransGrid substation

Figure 3-2 Cultivated paddock and minor irrigation channel in the north of the proposal area, accessed from Kook Road looking south.

Figure 3-3 Laser levelled paddock in the north-east of the proposal area looking east.

Figure 3-4 Irrigation drainage channel from the central paddock looking north.

Figure 3-5 Existing substation accessed from Ercildoune Road.

The nearest sensitive receivers are the six residences located within two kilometres of the proposal area (Appendix B). The closest receiver is located about 920 metres away. This receiver would have broken views of the proposed Coleambally Solar Farm through existing vegetation.

Access to the Coleambally Solar Farm would be off Ercildoune Road, which is a local road under the jurisdiction of the Murrumbidgee Council. Ercildoune Road is expected to experience a low level of traffic predominantly used by local traffic and agricultural machinery. Details of the site access are discussed in section 3.2.12.

3.2 THE PROPOSED COLEAMBALLY SOLAR FARM

The proposal includes the following components:

- Solar arrays: approximately 560,000 solar panels supported by approximately 75,000 piles, driven or screwed into the ground in order to support the solar array's mounting system. The panels to be installed would be either:
    - single-axis tracking panels (which would have approximately 7,900 tracker units)
    - north-oriented fixed-tilt panels
    - east-west facing fixed-tilt panels
    - or a combination of these alternatives.
- Up to 80 PV boxes skids, each of them containing at least one inverter and one transformer.
- One containerised or skid-mounted medium voltage delivery station.
- One containerised or skid-mounted high voltage solar substation including at least one 132 kV transformer.
- Onsite cabling and electrical connections between solar arrays and panel inverters.
- Trenches for underground cabling.
- New site access point from Ercildoune Road.
- Gravel access road and parking for staff and visitors.
- Internal gravel access tracks to allow for site maintenance.
- Upgrade of Ercildoune Road and its intersection with Kidman Way in accordance with NSW Roads and Maritime Services and Murrumbidgee Council requirements.
- Construction of access bridge over Tubbo irrigation channel from Ercildoune Road.
- Construction of bridge across central irrigation drainage channel.
- Construction of a new access from Kook Road including a new bridge over Tubbo irrigation channel.
- Permanent staff amenities and office building (approximately 12 metres long and 7 metres wide).
- Perimeter security fencing, approximately 2.3 m high.
- A 132kV underground transmission line to connect the solar substation to the existing Coleambally TransGrid substation, located immediately north of the proposal area.
- Potential battery storage. The inclusion of batteries would be considered during the detailed design stage.
- Possible irrigation drainage channel relocation, subject to final design.
- Extension of the existing bench of the substation on Lot 3 DP 1055725 to accommodate the new connection infrastructure. The proposed bench would be built to the same level as the existing substation, and the height of HV equipment would be similar to the adjacent switch bays.

Within the 570 ha proposal area, ground disturbance would be limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground.
- Construction of internal gravel access tracks and access bridges.
- Establishment of PV skids or boxes, delivery station and solar substation.
- Trenching and possible boring for the installation of cables.
- Establishment of staff amenities and offices.
- Construction of parking area.
- Construction of perimeter security fencing.
- Trenching and boring of underground transmission line.
- Substation extension.
- Establishment of battery storage if carried out.
- Modification or relocation of irrigation drainage channel if carried out.
- Source of soil material for substation extension from existing borrow pit located within the Coleambally substation site. The location of the existing borrow pit is shown in Appendix B.

As illustrated on the Proposed Infrastructure map in Appendix B, the development envelope which will include the solar arrays covers the majority of the site, however the ground disturbance from pile installation would disturb only about 0.2% of the total site area. Panels within the solar array area would sit above the ground and ground cover vegetation would be maintained under the panels. The area of the site which would be affected by shading from the solar panels would be approximately 70%. Additional ground disturbance outside the solar arrays would result from construction of the internal access tracks, trenches for cabling and footings for other equipment.

Construction ancillary facilities would be located within the ancillary facilities option areas as shown on the Proposed Infrastructure map in Appendix B. Further detail is provided in Section 3.2.10.

It is noted that the exact location of solar farm infrastructure, including the ancillary facilities, would be determined at the detailed design phase. All work and infrastructure would be located within the proposed development envelope.

The annual output of the proposal would be approximately 380,000 MWh. The construction phase of the project is expected to take between 9 to 12 months with a capital cost of approximately $210 million. The proposal is expected to have approximately 30 year operating life at which point the solar farm would either:

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

3.2.1 Solar arrays

The solar arrays would be comprised of approximately 560,000 solar panels, which would be either multicrystalline, monocrystalline or thin-film technology.

The panels to be installed would be either single-axis trackers (which would have approximately 7900 tracker units), north-oriented fixed-tilt, east-west facing fixed-tilt or a combination of these technologies.

Approximately 75,000 piles would be driven or screwed into the ground in order to support the solar array's mounting system and solar panels, with racking systems to allow the installation of solar panels. This minimises ground disturbance.

The panel structures would be 1.5 m to 2.3 m high. The mounting system to be installed on the poles would be dependent on the final project technology. Panel technology options are illustrated in Figures 2-1, 2-2 and 2-3. Figures 3-6, 3-7 and 3-8 illustrate the construction and assembly stages of a solar PV array (for a single-axis tracking system).

Figure 3-6 Example of poles driven into the ground on a Neoen solar project in Western Australia

Figure 3-7 Example of a single-axis mounting system before panel installation

Figure 3-8 Example of a single-axis mounting system after panel installation

The multicrystalline, monocrystalline or thin-film solar PV panels installed on the mounting system would be interconnected. These module interconnections would be as short as possible and would shorten the cabling loops. Long cabling loops pose a higher risk for lightning strikes.

3.2.2 PV boxes or skids

Up to 80 PV boxes or PV skids would be installed and evenly distributed across the site. Each of them would contain an inverter and a transformer. The PV boxes (containerised) or PV skids (on skid platforms) would measure up to 13.0 metres long x 3.5 metres high x 2.5 metres wide.

The containerised PV boxes would contain inverter and transformer stations in containers, with an example illustrated in Figure 3-9.

Figure 3-9 Example of a containerised PV box

The PV skids could contain two inverters and two transformers installed on a platform, and could be similar to those illustrated in Figure 3-10 and Figure 3-11.

Figure 3-10 Example of a PV skid

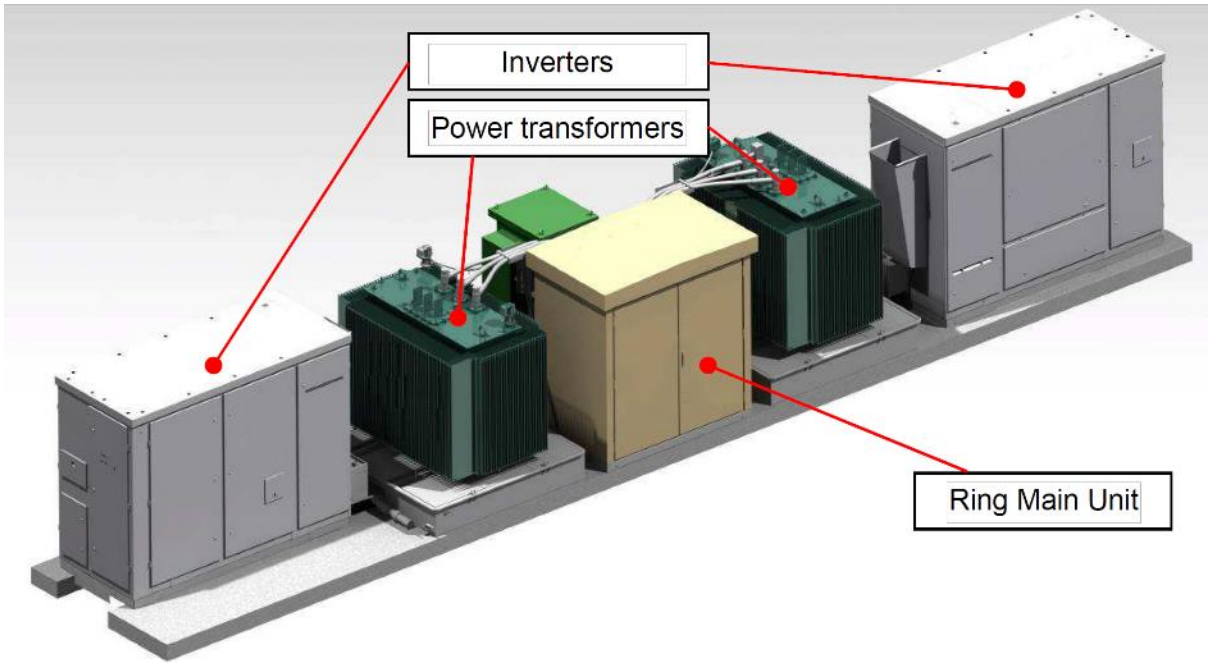


Figure 3-11 Example of a PV skid

3.2.3 Delivery station

The medium voltage delivery station would have a similar appearance to the PV skid described above, or may be delivered in two containers with the following dimensions (~13 m long x ~ 2.5 m wide x ~ 3m high). The delivery station would be located within one of the ancillary facilities option areas within the proposal area.

3.2.4 Solar substation

The high voltage solar substation accompanies the medium voltage delivery station with dimensions of approximately 60 metres long x 60 metres wide by 3.4 metres high. The solar substation would contain one or two transformers. The solar substation would be located within one of the ancillary facilities option areas within the proposal area.

3.2.5 Underground cabling

Underground cabling on site would be designed in accordance with Australian and international standards, taking into account the temperature of the ambient environment in which the cables and ancillaries shall operate, the allowable currents compatible with an acceptable warming-up as stated in the standards and as per manufacturers' recommendations. Underground cables and pipes will be buried at a depth of at least 500mm to ensure agricultural land capabilities are not reduced if underground infrastructure is left in situ after decommissioning.

Trenches would accommodate and protect the power and would be comprised of the following:

- Power ducts to export the production from the solar arrays to the Array Boxes (AB's).
- Power ducts to export the production from the ABs to the PV boxes or PV skids.
- One 25mm² copper wire for equipotentiality.
- The medium voltage cable for the two antennae from the PV boxes or PV skids to the delivery station.
- A fibre optic connection.
- A low current duct for communication.

Figure 3-12 illustrates an example of a trench design which may be used.

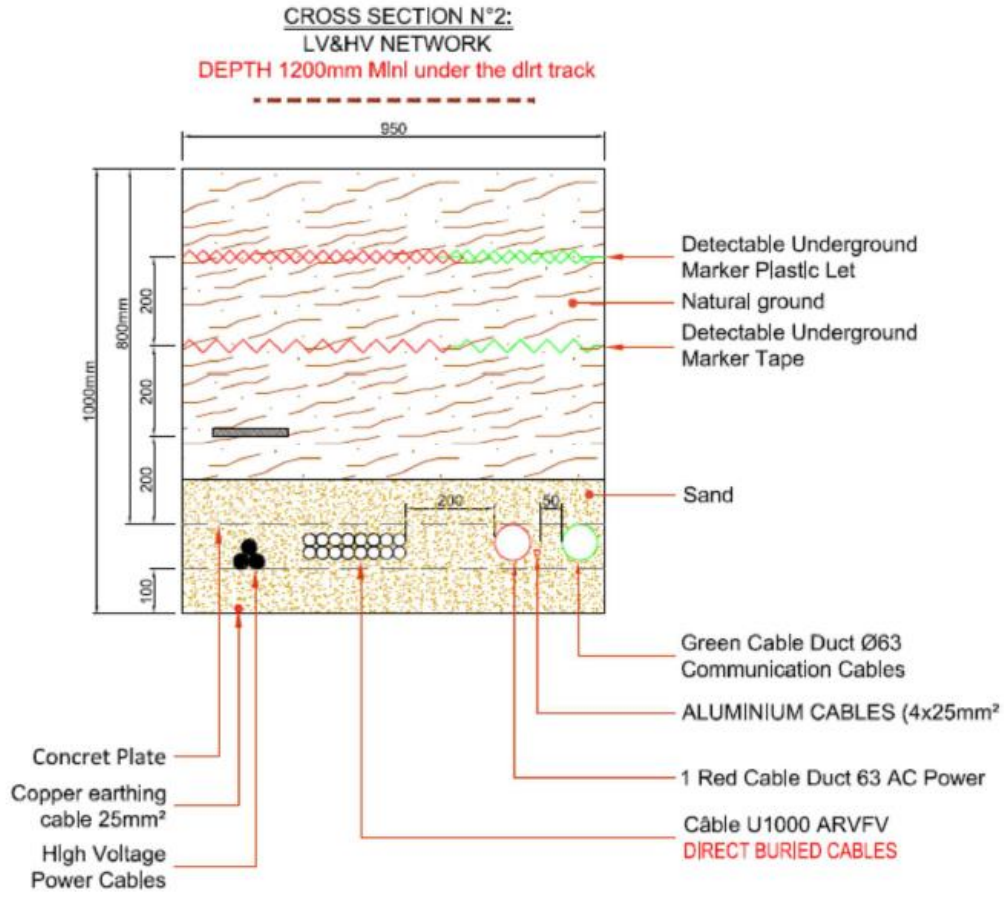


Figure 3-12 Typical trench design

3.2.6 Transmission line and substation extension

The electrical connection from the solar substation to the existing Coleambally TransGrid substation would be via a 132 kV underground line. Should the solar substation be constructed within ancillary Area A, the transmission line to the TransGrid substation would be about 410 metres in length. Should the solar farm substation be constructed within ancillary Area B, the transmission line to the TransGrid substation would be about 2,200 metres in length.

The proposed underground transmission line and extension of the substation would avoid the woodland which occurs along the roadside. The proposed infrastructure map in Appendix B illustrates the transmission line route from the solar farm boundary to the substation.

The actual route of the underground powerline across Ercildoune Road would be determined at the detailed design phase in consultation with Murrumbidgee Council. Construction would involve trenching through areas of vegetation and under-boring across Tubbo Irrigation channel and the smaller irrigation channel north of the road. The Ercildoune Road crossing would either be under-bored or trenched.

Modifications to the existing TransGrid substation, including a bench extension, is required to facilitate connection to the solar farm. The bench extension would be built to the same height as the existing bench. The height of HV equipment would be similar to the adjacent switch bays.

Soil for the proposed bench extension foundation would be sourced from an existing borrow pit within the substation site. The location of the existing borrow pit is shown in Appendix B.

3.2.7 Battery

Various energy storage solutions are being considered for the proposal to compliment large scale renewable energy generation and to prepare the network for more renewables in the future.

The inclusion of battery energy storage would be investigated and considered closer to the time of implementation. Once more information is available about the works, Neoen would consult with the Department of Planning and Environment to determine whether the consent would need to be modified to enable batteries to be installed.

Proposed Technologies

Various energy storage technologies would be further investigated as part of the detailed design phase. The proposal is currently considering different types of energy storage technologies. The current technologies available include:

- Electrochemical (eg lithium ion, vanadium and salt-based batteries, lead acid and supercapacitors).
- Chemical (Hydrogen Fuel Cell).
- Mechanical.

The final technology would be selected based on the following criteria:

- Ability to support the network to increase renewable energy penetration
- Ability to provide energy during periods of peak demands
- Minimal environmental impact
- Safety and ease of integration
- Demonstration and maturity of technology
- Value for money

Energy storage devices have potential to impact on the environment if they are not implemented and disposed of in the correct way. The proposed energy storage devices would be accompanied with MSDS (Material Safety Data Sheets) which details the exact chemical compounds of the technology and how best to use/dispose of it. In certain cases, and depending on the toxicity of the chemical, a recycling program may be accompanied by the technology manufacturer to reduce environmental impact. Energy storage devices which involve chemicals (or electrochemicals) would be designed to contain leaks or spillage with similar bunding protection as oil transformers.

Footprint

The need for and viability of battery storage would be determined during the detailed design phase. Energy storage devices may be installed across the site (in a decentralised way), or at a central location within one of the ancillary facility option areas.

3.2.8 Internal access tracks

The on-site tracks would be made of compacted gravel. If required, geotextile would be laid between the soil and the gravel. Internal access tracks would be up to five metres wide to allow for the safe delivery, unloading and installation of key components such as the PV boxes or skids and various oversized substation equipment. The total length of the access track would be determined during the detailed design phase and would be subject to the type of solar PV technology used. Internal access tracks are private roads designed and constructed only for the construction, operation and maintenance of the solar farm, and not

necessarily suitable for any other purpose. Access roads would be maintained over the life of the solar farm. Figure 3-13 illustrates a typical internal track design.

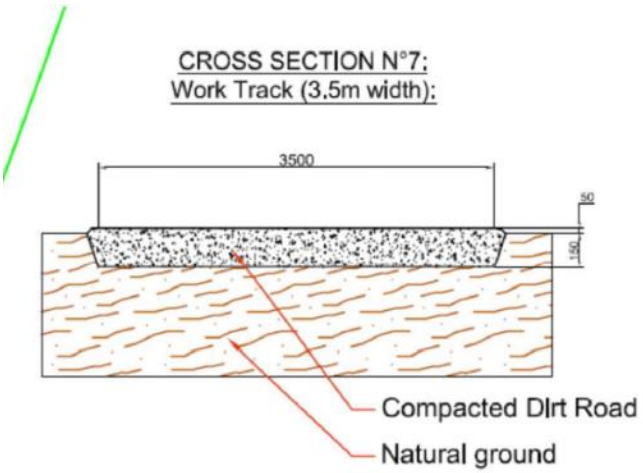


Figure 3-13 Typical internal track design, width is not indicative of the actual tracks

3.2.9 Possible drainage channel relocation

Final detailed design of the proposed solar farm may require the closing or modification of the internal drainage channel that transverses Lots 81 and 82 and borders Lot 83 DP 750896. This would be undertaken in consultation with Coleambally Irrigation and the adjoining landowners.

If the drainage channel is modified, the width and depth of the channel would be reduced by using soil on-site.

If the drainage channel is closed, it would be filled in using soil on-site and a new drainage channel may be constructed along the eastern boundary of the proposal area as shown in the Proposed infrastructure map (Appendix B), if required. The new channel would be up to two metres deep with a bed width of up to 3.5 metres. The total width of the channel infrastructure would be up to 30 metres wide including the banks, bed and berm widths.

3.2.10 Construction ancillary facilities

The following construction ancillary facilities would be located within the proposal area:

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

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

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

- Car park.
- Sanitary modules with septic tank.

- Changing rooms.
- Administrative office.
- Undercover storage area.
- Muster point in case of emergency.
- Genset for electrical supply.

3.2.11 Perimeter security fencing

The perimeter of the site would be fenced with 2.3 m high security fencing along the site boundaries. It is expected to be cyclone fencing with a strand of barbed wire at the top.

3.2.12 Site access

Main access

The site is proposed to be accessed from north of the proposal area along Ercildoune Road. The proposed access point, as shown in Figure 3-17, has been designed and located in accordance with advice from NSW Roads and Maritime Services (RMS) and Murrumbidgee Council. Ercildoune Road and its intersection with Kidman Way will be upgraded in accordance with RMS and Murrumbidgee Council requirements (Refer to Appendix G). A vehicle tracking plan for the Kidman Way and Ercildoune Road intersection and the site access point is shown in Figure 3-18.

This option requires the construction of a bridge and access road over the Tubbo Channel from Ercildoune Road to the proposal area. Consultation with Murrumbidgee Council and Coleambally Irrigation Cooperative Limited has been undertaken as part of the detailed design phase of the road.

Existing farm access points, one along Kook Road and one along Kidman Way, as shown in Appendix B, would be retained for emergency access.

Figure 3-14 Kidman Way looking south from near Ercildoune Road intersection

Figure 3-15 Kidman Way intersection with Ercildoune Road

Figure 3-16 Ercildoune Road looking East from near Kook Road

Figure 3-17 Access concept design

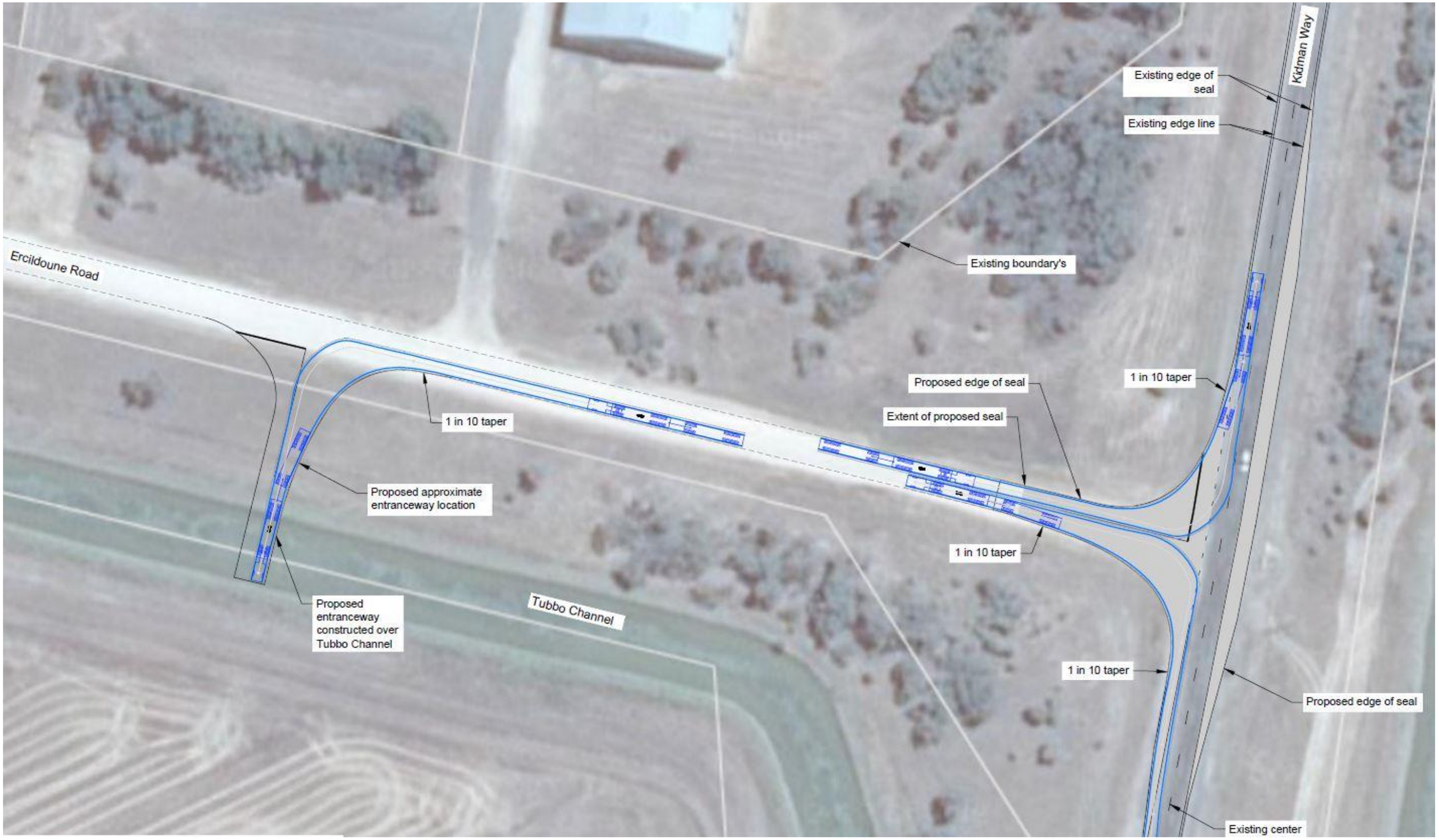


Figure 3-18 Vehicle tracking plan

Maintenance access

It is possible that once commissioned, TransGrid would carry out maintenance on the proposed solar substation. Should the solar substation be constructed within ancillary Area B, a direct access point from Kook Road would be required. It is anticipated that this access point would only be used by TransGrid for maintenance purposes. Two options for the location of the proposed access point are shown in Appendix B.

Emergency access

Two existing farm access points will be retained for emergency purposes, as shown in Appendix B. It is anticipated that the gates will remain locked, however will be accessible by the NSW Rural Fire Service.

3.2.13 Staff amenities and office building

A permanent staff amenities and office building would be constructed or installed on site. Its dimensions would be approximately 12 metres long and 7metres wide. The building would be located within one of the ancillary facilities option areas within the proposal area.

3.2.14 Landscaping

Landscaping would be undertaken on site to minimise visual impacts. Based on the result of a visual impact assessment undertaken for the proposal and avoiding areas of biodiversity significance as discussed in section 6.2, landscaping is recommended along proposal area boundaries as shown in Appendix B. Proposed landscaping for visual screening purposes would involve the planting of five metre wide vegetation strips using local native species along the proposal area boundaries where shown.

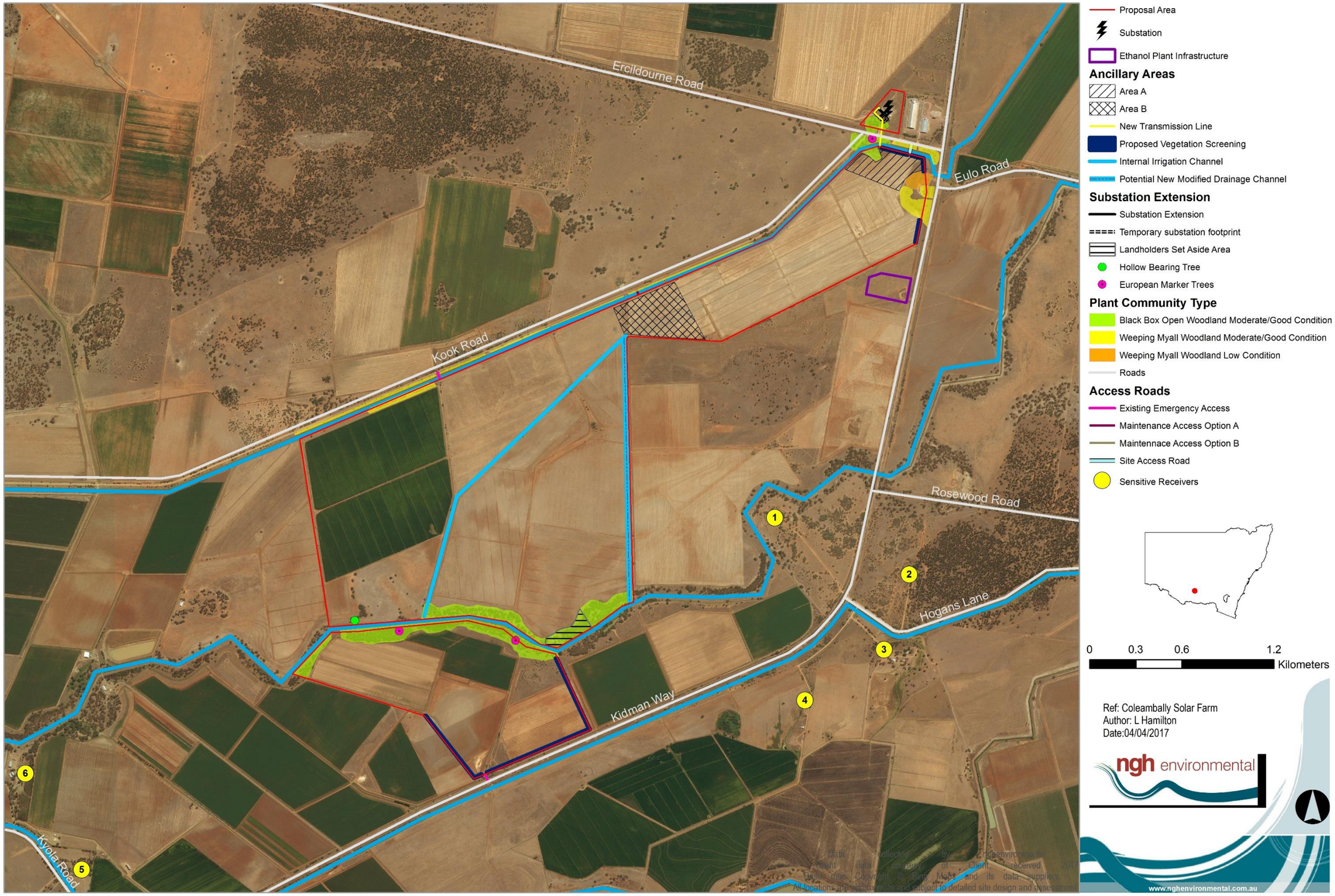


Figure 3-19 Proposed landscaping plan

3.2.15 Subdivision

The proposal involves subdivision of the solar farm proposal area so that it would allow the solar farm to operate separately from the agricultural production land. All excess to agricultural land would be subdivided from the solar farm to maximise the amount of land to remain in agricultural production. The proposed subdivision would result in the creation of two additional allotments as described below:

- Proposed Lot "A": includes the part of Lot 101 DP 750896 to remain as agricultural land.
- Proposed Lot "B": includes the part of Lot 101 DP 750896 to be included in the solar farm.
- Proposed Lot "C": includes the part of Lot 100 DP 750896 to be included in the solar farm.
- Proposed Lot "D": includes the part of Lot 100 DP 750896 to remain as agricultural land.

Should the proposal involve the relocation of the diagonal irrigation drainage channel, the proposed subdivision would include a new 30 m wide allotment over the new drainage channel.

A plan of subdivision would be prepared upon completion of final design of the solar farm.

3.3 CONSTRUCTION AND COMMISSIONING

3.3.1 Indicative timeline

An indicative timeline for the proposal is outlined in Table 3-1.

Table 3-1 Indicative timeline.

Phase	Approximate commencement	Approximate duration
Construction	December 2017 (early works in September 2017)	Nine to 12 months
Commissioning	August 2018	One month
Operation	September 2018	About 30 years
Decommissioning	2047	Six months

Activities specific to each phase of the project are discussed below.

3.3.2 Pre-construction activities

Prior to construction commencing, a number of activities are proposed to enable construction to commence:

- Fencing
- Use of temporary site access points (eg existing farm accesses).
- Survey, geotechnical and other preliminary investigations.
- Slashing and/or removal of areas of non-native vegetation.
- Levelling of minor irrigation canals.
- Establish ancillary facilities including the site compound and laydown areas.

3.3.3 Construction activities

The construction and commissioning phase is expected to last between 9 to 12 months. The main construction activities would include:

- Native vegetation removal.
- Possible relocation of drainage channel.
- Construction of the site access point and road upgrades.
- Construction of access bridge over Tubbo irrigation channel from Ercildoune Road.
- Possible construction of a solar substation maintenance access from Kook Road and new bridge over Tubbo irrigation channel.
- Construction of internal access tracks.
- Construction of bridge across central irrigation drainage channel.
- Installation of steel post foundation system for the solar panels.
- Installation of underground cabling (trenching), installation of PV skids or boxes, solar substation and delivery station, connection of communications equipment.
- Construction of the 132kV underground transmission line, switch gear and equipment.
- Upgrading of the existing TransGrid substation to connect the 132kV transmission line from the solar farm.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.
- Landscaping.

There would be minor ground disturbance to parts of the site where levelling for the solar array construction is required.

Post construction, ground cover would be managed throughout the operational life of the solar farm in consideration of fire control, soil erosion and biodiversity issues.

3.3.4 Hours of operation during construction

Works would be undertaken during standard working hours:

- Monday – Friday 7am to 6pm
- Saturday 8am to 1pm

During the connection of the transmission line to the substation, there would be a temporary power outage for Essential Energy's customers. In order to reduce this impact, the works would be completed between the hours of 12 am and 5 am (night works), in consultation with relevant roads authorities, where required, and in consideration of audible noise impacts to near residents.

3.3.5 Resourcing requirements

Key resourcing requirements for the project would include labour, machinery and equipment, steel, electrical components, water, gravel and landscaping materials.

Labour, machinery and equipment

It is anticipated that approximately 300 construction personnel would be required on site during the peak construction period (approximately three to four months). Construction supervisors and the construction labour force, made up of construction labourers and technicians, are intended to be hired locally where possible.

It is anticipated that most workers would be accommodated at existing accommodation within the local area, including Coleambally, Jerilderie, Narrandera, Leeton and Griffith. It is proposed that bus transfers would be provided to minimise traffic volumes and transit risks during construction.

Equipment used during construction would include earth-moving equipment for civil works, diesel generators, trucks and cranes with similar noise outputs to farm machinery such as tractors.

Pile driving of the solar panel foundations would be undertaken using a machine which screws or hammers poles into the ground, similar to that used for driving farm fence poles into the ground.

Traffic volumes and requirements

Traffic management would be undertaken during the construction phase to manage haulage traffic. Preliminary plans propose parking for approximately 40 vehicles. The proposed timeline for the project indicates that approximately 50 employees would be required during the first month rising to 300 employees during the peak construction period (approximately three to four months). Six or seven piling or drilling machines would also be present on site during the early stages of the works. During construction, up to 25 trucks a day will deliver equipment on site. A special convoy and a 50T mobile crane may be required for the offloading of the PV boxes or PV skids and the delivery station. Traffic volumes and requirements are discussed in detail in Section7.3

Materials

In total, approximately 15,200m^3 of gravel would be required for access tracks. Depending on the types of technology used, PV boxes or skids foundations would require either approximately 600 m^3 of sand or up to 270 m^3 of concrete.

Approximately 1,500m^3 of sand would be required for the burying of cables into about 65 kilometres of trenches. Table 3-2 provides details of the resource quantities required for project construction.

Table 3-2 Resource quantities required for the Coleambally Solar Farm

Resource	Quantity
Gravel	15,200 m^3
Sand (back filling trenches)	1,500m^3
Sand (footings for PV boxes or skids)	600m^3
Concrete - concrete foundation option	270m^3
Concrete for fence footings	180m^3
Metal (components for mounting system, PV boxes or PV skids and delivery system containers, fencing, site buildings, transmission line poles (if any))	30,500 tonnes
Glass for panels	9,000 tonnes
Silicon for crystalline wafers	1,500 tonnes
Water during construction	401,500 kL total

3.3.6 Operation

The operational phase of the proposal is anticipated to commence around August-December 2018. Once operational, activities would include daily operations and maintenance. This would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays, including the use of 'drone' technology to enhance maintenance operations.
- Vegetation management. Ground cover vegetation would be managed to minimise erosion and weed infestation. This may include a maintenance program to address any bare areas that develop, by seeding or armouring (i.e. jute mesh) to avoid erosion.

- Site security if a security event occurs.
- Replacement of equipment and infrastructure, as required.
- In total, approximately 13,500 man-hours of work per year (7 men per year) for preventive maintenance.

Six to 15 cars would be expected during normal operation of the solar farm. Standard work hours would be maintained for standard operational activities.

Additionally, contractors may be engaged to undertake specific tasks from time to time.

Hours of operation during operation

Daily operations and maintenance by site staff would be undertaken during standard working hours:

- Monday – Friday 7am to 6pm
- Saturday 8am to 1pm

Outside of emergencies, night works or work on Sundays or public holidays are not proposed.

During summer months, the solar farm may continue to produce electricity after 6pm and prior to 7am while the days are longer. In the case that the panels installed are single-axis trackers, the tracker units would potentially operate outside standard working hours during summer months.

3.3.7 Decommissioning

At the end of the solar farm's operational life (about 30 years), the proposal area would be either reconditioned or decommissioned. During decommissioning, all above ground infrastructure would be removed. Key elements of project decommissioning would include:

- The solar farm's generator would be disconnected from the TransGrid metering point.
- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse. Much of the solar array panels would be recyclable.
- All site amenities and equipment would be removed and materials recycled or reused, wherever possible.
- Posts and cabling would be removed and recycled (infrastructure at least 500 mm below ground may be left in place).
- Fencing would be removed (some fencing may be retained, if it is requested by the landowner).

Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase.

Towards the operational life of the solar farm, there is potential for the infrastructure to be upgraded to extend the life of the plant. The works would be determined at the time and do not form part of the proposal assessed in the EIS. Further assessment and environmental approvals would be reviewed if the proposal is to be reconditioned.

If closure of the solar farm is determined a rehabilitation and decommissioning/closure management plan would be established prior to the decommissioning date, designed in consultation with the landowner and will be submitted for approval to the NSW Department of Primary Industries. The decommissioning plan will include the following:

- Rehabilitation objectives and strategies.

- Expected timeline for rehabilitation.
- Description of the design criteria.
- Indicators to guide the land back to agricultural production.
- Monitoring and mitigation measures.

Table 3-3 Rehabilitation objectives and strategies

Rehabilitation Objective	Strategies
Return the land capability back to its original state	1. Removal of all above ground infrastructure. 2. Removal of gravel from internal access tracks where required, in consultation with landowner. 3. Reverse any compaction by mechanical ripping. 4. Reinstate irrigation infrastructure in consultation with landowner, including laser levelling and contour/bund reconstruction where required.

4 PLANNING CONTEXT

4.1 PERMISSIBILITY

The proposed development is defined as a ***solar energy system*** and is permissible with consent under clause 34(7) of the *State Environmental Planning Policy (Infrastructure) 2007*. Consent may be granted under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) declares the proposal to be state significant development (SSD) as it is development for the purpose of electricity generating works with a capital cost of greater than $30 million (clause 20, Schedule 1).

Section 78A of the EP&A Act requires a development application for SSD to be accompanied by an EIS prepared in accordance with the EP&A Regulation. This EIS has been prepared in accordance with Part 4 of EP&A Act and Schedule 2 of the EP&A Regulation.

4.2 NSW LEGISLATION

4.2.1 Environmental Planning and Assessment Act 1979

Objects

Development in NSW is subject to the requirements of the EP&A Act and the EP&A Regulation. Environmental planning instruments prepared under the Act set the framework for development approval in NSW.

The proposal would be assessed under Part 4 of the EP&A Act. The relevant objects of the EP&A Act are:

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 coordination of the orderly and economic use and development of land.

iii. The protection, provision and coordination 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.

vii. Ecologically sustainable development.

The objects of the EP&A Act have been considered throughout this environmental assessment and natural resources and competing land uses have been taken into account. The proposal aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The proposal has been located and designed so that it would avoid native vegetation as much as possible and minimise the use of natural and artificial resources while considering the social and economic welfare of the local community. For these reasons it is considered that the proposal is consistent with the objects of the EP&A Act.

Matters for Consideration

Section 89H of the EP&A Act provides that section 79C applies to the determination of DAs for SSD. Under Section 79C of the EP&A Act, the consent authority is required to consider a number of matters when determining a DA under Part 4. These matters are listed in Table 5-1 and assessed in terms of their relevance to the proposal.

Table 4-1 Matters of consideration

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant environmental planning instruments (EPIs) are discussed in Section 4.2.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority;	There are no draft instruments relevant to the proposal.
Any development control plan;	Murrumbidgee Council has a number of development control plans, however given the location of the proposal area, these plans do not apply. In addition, clause 11 of the SRD SEPP provides that development control plans do not apply to SSD.
Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F;	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration);	Clause 92 of the EP&A Regulation requires consideration of: • the Government Coastal Policy, for development applications in certain local government areas; and • the provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters are relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates;	Coastal zone management is not applicable to the proposal.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in Sections 5 and 7 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have been avoided or minimized through careful project design. Overall impacts are considered manageable and justifiable.
The suitability of the site for the development;	The suitability of the site for the development is assessed in section 2.4.5. Characteristics that make it suitable for development of a solar farm are identified and justified.
Any submissions made in accordance with this Act or the regulations; and	Public submissions would be sought and responded to as part of the EIS determination process. Neoen would consider and respond to any submissions made in relation to the proposal in a Submissions

Provision	Relevance to the proposal
	Report or Preferred Project Report following the public exhibition period.
The public interest.	A number of public benefits are relevant to the proposal as discussed in Section 2.2. Specifically, these relate to: Reducing fossil fuel emissions that that contribute to climate change. Meeting State and Australian Government policies to increase renewable energy supply. Providing local employment and regional development opportunities.

4.2.2 *Environmental Planning and Assessment Regulation 2000*

Clauses 82 to 85B of the *Environmental Planning and Assessment Regulation 2000* addresses public participation in SSD.

The Coleambally Solar Farm Development Application and accompanying information (including this EIS) will be placed on public exhibition by DP&E for a period not less than 30 days.

4.2.3 *Murrumbidgee Local Environmental Plan 2012*

The proposal area is located within the Murrumbidgee LGA and is subject to the provisions of the *Murrumbidgee Local Environmental Plan 2013* (Murrumbidgee LEP). The Murrumbidgee LEP aims:

(a) to protect, enhance and conserve agricultural and horticultural land through the proper management, development and conservation of natural and man-made resources,

(b) to encourage a range of housing, employment, recreation and community facilities to meet the needs of existing and future residents of Murrumbidgee,

(c) to promote the efficient and equitable provision of public services, infrastructure and amenities,

(d) to conserve the environmental heritage of the land to which this Plan applies.

It is considered that the proposal is compatible with the aims of the Murrumbidgee LEP, especially to promote the efficient and equitable provision of infrastructure.

Land zoning

The LEP states that the consent authority must have regard to the development objectives of planning zones identified in the Murrumbidgee LEP when determining development applications. The proposal area is located on land zoned RU1 Primary Production under the Murrumbidgee LEP.

The objectives of this zone are:

- *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*

For the life of the proposal, the proposal area would harness a renewable natural resource (solar energy). While the activity would impact on land availability for primary production, the land would meet the second and third objects as identified above; it would allow for diversity in land use, appropriate to the area and

it would not fragment resource lands. Being fully reversible and involving limited ground disturbance, it would not remove the potential to use the land for primary production at the end of the life of the proposal.

4.2.4 Development Control Plans and Council policies

There are no Development Control Plans that apply to the proposal area.

4.2.5 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) was introduced to facilitate the effective delivery of infrastructure across the State by improving regulatory efficiency through a consistent planning regime for infrastructure and services across NSW.

Solar energy systems are defined in ISEPP clause 33 as:

> *'**solar energy system** means any of the following systems:*
>
> *a) a photovoltaic electricity generating system,*
> *b) a solar hot water system,*
> *c) a solar air heating system.'*

Part 3 Division 4 of ISEPP relates to electricity generating works and solar energy systems. Clause 34(7) states that '*except as provided by subclause (8), development for the purpose of a solar energy system may be carried out by any person with consent on any land*'. Clause 34(8) excludes certain solar energy systems in residential zones from needing consent. Given the proposal area is not located in a residential zone and would produce more than 100kw, clause 34(7) applies to the proposal.

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

The aims of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) are to identify development that is SSD and to confer functions on joint regional planning panels to determine development applications.

State Significant Development (SDD)

Clause 8 of the SRD SEPP provides that development is declared to be SSD for the purposes of the EP&A Act if:

- *the development is not permissible without consent under Part 4 of the EP&A Act; and*
- *the development is specified in Schedule 1 or 2 of the SRD SEPP.*

Clause 20 of Schedule 1 of the SRD SEPP includes:

> *"Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*
>
> *(a) has a capital investment value of more than $30 million.*

The proposed Coleambally Solar Farm has an estimated capital investment value of $210 million, therefore the proposal is classified as SSD under Part 4 of the EP&A Act.

SSDs are major projects which require approval from the Minister for Planning and Environment. This EIS has been prepared in accordance with the requirements of the Secretary of the Department of Planning and Environment.

4.2.7 State Environmental Planning Policy No. 55 - Remediation of Land

SEPP No. 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. The SEPP applies to the whole of the State.

Clause 7 of SEPP No. 55 requires that the remediation of land be considered by a consent authority in determining a development application.

A search of the NSW EPA contaminated land public record (NSW Government, 2016a) was undertaken for contaminated sites within the Murrumbidgee LGA on 17 March 2017. There were no records returned for the LGA. The online *List of NSW contaminated sites notified to EPA* (NSW Government, 2016b) was also searched on 17 March 2017. There is one site listed in Coleambally, over two kilometres from the proposal area.

The risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site is considered to be low given that a proportion of the land has organic certification and no evidence of contamination was observed during the site assessment.

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

In this Policy, potentially hazardous industry refers to a development 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 industry is a development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact, would emit a polluting discharge in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land.

This EIS investigates risks to human health and the biophysical environment, including risks that may affect existing and future land use. As excavation and soil disturbance activities during construction are limited and as operational infrastructure would not emit any pollutants, these risks are considered low. A series of mitigation measures have been developed to address identified risks. The proposal would be designed, constructed and operated to avoid significant risk to human health, life or property or to the biophysical environment. Therefore, it is considered that the proposal does not constitute a hazardous or offensive industry.

4.2.9 State Environmental Planning Policy (Rural Lands) 2008

The aims of the *State Environmental Planning Policy (Rural Lands) 2008* (Rural Lands SEPP) are:

(a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,

(b) to identify the 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,

(c) to implement measures designed to reduce land use conflicts,

(d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,

(e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The Rural Lands SEPP rural planning principles, listed under clause 7, are:

(a) the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,

(b) recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,

(c) recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,

(d) in planning for rural lands, to balance the social, economic and environmental interests of the community,

(e) the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,

(f) the provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,

(g) the consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,

(h) ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.

It is considered that the proposal is consistent with the aims and planning principles of the Rural Lands SEPP. Part 4 of the Rural Lands SEPP relates to state significant agricultural land. Given the proposal area is not identified in schedule 2, it is not identified as state significant agricultural land and Part 4 does not apply.

4.2.10 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the NSW EPA.

Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works. General electricity works is a scheduled activity and requires an EPL where the activity has the capacity to generate more than 30 MW of electrical power. General electricity generation works is defined as:

> *…the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.*

The works would generate more than 30 MW of electrical power, however electricity generation would be from solar power which is not considered a scheduled activity. Accordingly, an EPL is not required under the POEO Act for the proposal.

It is noted that pollution events resulting from the proposal would still constitute a breach of the Act under section 120. Under section 148 of the Act, the proponent would be required to notify the EPA of any pollution incidents that occur as a consequence of the construction or operation of the proposed development.

4.2.11 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of roads authorities for both classified and unclassified roads. It also regulates the carrying out of various activities in, on and over public roads.

Kidman Way and Ercildoune Road are public roads. Any work within the road reserve, such as upgrades that interfere with the structure of the road, require consent from the roads authority under section 138 of the Roads Act. Murrumbidgee Council is the roads authority for Ercildoune Road and NSW Roads and Maritime Services is the roads authority for Kidman Way.

Given the proposal would involve work within the road reserve for Ercildoune Road and its intersection with Kidman Way, section 138 consent is required. A new access may also be required from Kook Road, work within this road reserve would also require a section 138 consent.

4.2.12 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation. Clearing is defined as cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation including native grasses and herbage.

An authorisation to clear native vegetation is not required for SSD under the provisions of section 89J of the EP&A Act. Impacts to biodiversity as a result of clearing native vegetation are discussed in Section 6.2.

4.2.13 Water Management Act 2000

The *Water Management Act 2000* (WM Act), currently administered by Department of Primary Industries (Office of Water), is progressively being implemented throughout NSW to manage water resources, superseding the *Water Act 1912.* The aim of the WM Act is to ensure that water resources are conserved and properly managed for sustainable use benefiting both the present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses as well as to provide for protection of catchment conditions.

Fresh water sources throughout NSW are managed via water sharing plans (WSPs) under the WM Act. Key rules within the WSPs specify when licence holders can access water and how water can be traded.

The proposal area is covered by the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* (Murrumbidgee Water Management Area) and the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (Murrumbidgee Western Water Source), made under Section 50 of the WM Act.

It is not proposed to modify existing entitlements or seek new entitlements under either of the plans. Water requirements would be satisfied by purchasing water during construction and from rain water collection during operation.

Water use approval is not required for SSD under section 89J (1)(g) of the EP&A Act.

4.2.14 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) sets out to conserve fish stocks and key fish habitats, threatened species, populations and ecological communities of fish and marine vegetation and biological diversity. Further, it aims to promote viable commercial fishing, aquaculture industries and recreational fishing opportunities. Threatened species, populations and ecological communities and key threatening process are listed in the FM Act's Schedules.

A permit under sections 201, 205 or 219 of the Act is not required under the provisions of Section 89J of the EP&A Act.

4.2.15 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. The TSC Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.

The potential to impact threatened species, populations and ecological communities listed under this act has been considered in Appendix D and Section 6.2 of this EIS. The format of the assessment is consistent with the Framework for Biodiversity Assessment, developed for major projects.

4.2.16 National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act 1974* (NPW Act), the Director General of OEH is responsible for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. The Director General of OEH is also responsible under this legislation for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW.

The provisions of the NPW Act have been considered for the proposal. The proposal area is located near part of Murrumbidgee Valley National Park, Boona State Forest and Bretts State Forest, however no impact on these parks and reserves are expected.

An assessment of impacts to Aboriginal Heritage is provided in Section 6-3 and Appendix F. It is noted that under section 89J(d) of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for SSD.

4.2.17 Heritage Act 1977

This Act aims to conserve heritage values. The Act defines 'environmental heritage' as those places, buildings, works, relics, moveable objects and precincts listed in the Local or State Heritage Significance. A property is a heritage item if it is listed in the heritage schedule of the local Council's Local Environmental Plan or listed on the State Heritage Register, a register of places and items of particular importance to the people of NSW.

The proposal would not impact directly or indirectly on any items of heritage significance (refer to Section 7.10).

4.3 COMMONWEALTH LEGISLATION

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Commonwealth Department of the Environment (DoE). Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minister.

The EPBC Act identifies eight MNES:

- World Heritage properties.
- National heritage places.
- Ramsar wetlands of international significance.
- Threatened species and ecological communities.
- Migratory species.

- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).

When a person proposes to take an action that they believe may be a 'controlled action' under the EPBC Act, they must refer the proposal to the DoE for a decision about whether the proposed action is a 'controlled action'.

A search of the Commonwealth Protected Matters Search Tool on 12 December 2016 indicated that there are no World Heritage Properties or National Heritage Places within the proposal area. Search results listed four Wetlands of International Importance that are either known to occur or have potential to occur in the area, however these are not relevant to the site or proposal. An Australian telecommunications commission occurs within 10 kilometres of the proposal. The proposal is not likely to have a significant impact on the environment of Commonwealth land. Section 6.2 discusses the results of searches in relation to threatened species, ecological communities and migratory species. Table 4-2, Table 4-3 and Table 4-4 summarise the results of the searches.

Table 4-2 Summary of Matters of National Environmental Significance (10 km search radius)

Matters of National Environmental Significance	Addressed in this EIS
World Heritage Properties	NA
National Heritage Places	NA
Wetlands of International Significance	NA
Great Barrier Reef Marine Park	NA
Commonwealth Marine Areas	NA
Threatened Ecological Communities	Section 6.2 and Appendix D
Threatened Species	Section 6.2 and Appendix D
Migratory Species	Section 6.2 and Appendix D

Table 4-3 Summary of Other Matters Protected by the EPBC Act (10 km search radius)

Other Matters Protected by the EPBC Act	Addressed in this EIS
Commonwealth Lands	Not applicable to site.
Commonwealth Heritage Places	Not applicable to site.
Listed Marine Species	Not applicable to site.
Whales and Other Cetaceans	Not applicable to site.

Other Matters Protected by the EPBC Act	Addressed in this EIS
Critical Habitats	Not applicable to site.
Commonwealth Reserves	Not applicable to site.

Table 4-4 Summary Extra Information (10 km search radius)

Extra Information	Addressed in this EIS
Place on the RNE	Not applicable to site.
State and Territory Reserves	Not applicable to site.
Regional Forest Agreements	Not applicable to site.
Invasive Species	Section 6.2
Nationally Important Wetlands	Not applicable to site.

Commonwealth listed threatened ecological communities, threatened species, migratory species and invasive species are discussed in Section 6.2 and Appendix D. A significant impact to any of these entities is considered highly unlikely and the proposed activity is considered highly unlikely to be a controlled action.

No other matter of national environmental significance would be affected by the proposed activity.

4.3.2 Native Title Act 1993

The *Native Title Act 1993* provides a legislative framework for the recognition and protection of common law native title rights. Native title is the recognition by Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. Where that traditional connection to land and waters has been maintained and where government acts have not removed it, the law recognises the persistence of native title.

People who hold native title have a right to continue to practise their law and customs over traditional lands and waters while respecting other Australian laws. This could include visiting to protect important places, making decisions about the future use of the land or waters, and hunting, gathering and collecting bush medicines. Further, when a native title claimant application is registered by the National Native Title Tribunal, the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a project on the area claimed.

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral lease.
- Some land held for Aboriginal communities.

- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the Register of Native Title Claims was carried out on 17 March 2017. There were no records of claims within the Murrumbidgee LGA. The proposal area is located on freehold land and not subject to any native title claims.

4.3.3 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act 2000* (RE Act) aims:

- To encourage the additional generation of electricity from renewable sources.
- To reduce emissions of GHGs in the electricity sector.
- To ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth government's renewable energy target scheme. This includes solar energy.

Certificates for the generation of electricity are issued using eligible renewable energy sources. This requires purchasers (called liable entities) to surrender a specified number of certificates for the electricity that they acquire. In January 2011, renewable energy certificates were reclassified as either large-scale generation certificates or a small-scale technology certificates following changes to the scheme.

The proposal is the subject of application to the Clean Energy Regulator under the RE Act and would receive large scale generation certificates.

4.4 OTHER RELEVANT POLICIES AND MATTERS

4.4.1 Ecologically Sustainable Development (ESD)

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*.

In NSW, the concept has been incorporated in legislation such as the EP&A Act and EP&A Regulation. For the purposes of the EP&A Act and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline principles which can be used to achieve ESD. These principles are presented below along with a description of how the proposal and this EIS have considered each principle.

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.*
The precautionary principle has been adopted in the assessment of expected impacts. All potential impacts have been considered and mitigated where a risk has been identified. Mitigation is commensurate with risk. Where uncertainty exists, measures have been included to address the uncertainty.

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.

Potential impacts of the Coleambally Solar Farm are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Importantly, the proposal provides additional renewable energy that contributes to minimising the risk of climate change to current and future generations by reducing carbon emissions intensity of electricity generation.

c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.

The impacts of the proposal on biodiversity, including EPBC listed species, have been assessed in detail in Section 6.2. This has included avoidance of higher conservation value areas where possible and management measures to minimise, manage and offset residual impacts. The impacts are considered to be justified by this assessment.

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.

Attributes of the proposal area such as existing native vegetation, soil and hydrology have been valued in terms of their broader contribution to the catchment and catchment processes. Pollution risks have been assessed and would place any cost of remediation solely upon the proponent.

The aims, structure and content of this EIS have incorporated the principles of ESD. The mitigation measures in Section 8.2 set out an auditable environmental management commitment by the proponent.

Based on the social and environmental benefits generated by the proposal at a local and regional level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of ESD and is justifiable.

4.5 SUMMARY OF LICENSES

Table 4-5lists licenses that have been identified as relevant to the proposal.

Table 4-5 Summary of licenses required

Instrument	Licence or approval requirement
EP&A Act, Part 4	State Significant development applications require approval from the Minister for Planning and Environment. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.
Roads Act, section 138	Any works to public or classified roads require consent under this act from the roads authority. Murrumbidgee Council is the roads authority for Ercildoune Road and NSW Roads and Maritime Services is the roads authority for Kidman Way.

Note, if it is determined that additional licenses or approvals are required, Neoen would obtain these prior to commencement of relevant activities.

5 STAKEHOLDER CONSULTATION

5.1 AGENCY CONSULTATION

Secretary's environmental assessment requirements (SEARs)

As the proposal is classified as State Significant Development (SSD), a scoping study was prepared and SEARs were requested (for a 150MW PV solar farm). These were provided by DPE on 13 February 2017 (refer Appendix A). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

The following sections provide a summary of the SEARs from the various agencies and cross reference where specific issues are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice. This additional consultation with agencies is also summarised below.

Department of Planning and Environment

Issue summary	Addressed in EIS
The EIS for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* In particular, the EIS must include:	Section 3 and Appendix B.
• a full description of the development, including: – 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;	Section 2.4.
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: – 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), 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;	Sections 6 and 7.
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and	Section 8.
• the reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development.	Section 2.

Issue summary	Addressed in EIS
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: – 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*); and – the consent in writing of the owner of the land	Provided separately to DPE
Biodiversity – The EIS must include an assessment of the likely biodiversity impacts of the development, (including but not limited to the impacts on *Weeping Myall Woodland* endangered ecological community) having regard to the *NSW Biodiversity Offsets Policy for Major Projects*, and in accordance with the *Framework for Biodiversity Assessment*, unless otherwise agreed by the Department;	Section 6.2 and Appendix D.
Heritage – The EIS must include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community;	Section 6.3 and Appendix F Section 7.9
Land – The EIS must include an assessment of the impact of the development on agricultural land, flood prone land, quarries, mineral resources and exploration activities, and a 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 during operation and after decommissioning, with reference to the zoning provisions applying to the land;	Section 6.5 Section 7.1 Section 7.2
Visual – The EIS must include an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners;	Section 3.2.14. Section 5.3. Section 6.4.
Noise – The EIS must include an assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and operational noise impacts in accordance with the *NSW Industrial Noise Policy* (INP) (including substation upgrades and operation), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	Section 6.6.
Transport – The EIS must include an assessment of the site access route, site access point and likely transport impacts of the development (including connection to the substation) 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);	Section 7.3.

Issue summary	Addressed in EIS
Water –The EIS must include: – an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses, wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure (including irrigation channels), adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; – details of water supply arrangements; and – a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004);	Sections 7.2.
Hazards and Electromagnetic Interference – The EIS must include an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields;	Section 7.5. Section 7.8.
Consultation In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners and exploration licence holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Murrumbidgee 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.	Section 5.1. Section 5.3. Appendix C.
Socio-Economic – The EIS must include an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	Section 7.6.

Neoen conducted further consultation with Department of Planning and Environment regarding the potential to include an energy storage system (battery) in the proposal. DPE advised that battery energy storage may be included in the proposal with full details or concept details. Where only concept details are provided the battery would be subject to further approval.

Office of Environment and Heritage

Issue summary	Addressed in this EIS
Biodiversity -. 1. Biodiversity impacts related to the proposed Coleambally Solar Farm are to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the Threatened Species Conservation Act 1995.	Section 6.2. Appendix D.

Issue summary	Addressed in this EIS
Impacts on the following species, populations and ecological communities will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment: • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • *Brachyscome papillosa* (Mossgiel Daisy) • *Convolvulus tedmoorei* (Bindweed) • *Lepidium monoplocoides* (Winged Peppercress) • *Maireana cheelii* (Chariot Wheels) • *Pilularia novae-hollandiae (*Austral Pillwort) • *Swainsona murrayana* (Slender Darling Pea) • *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) - nest trees only • *Polytelis swainsonii* (Superb Parrot) - nest trees only • *Circus assimilis* (Spotted Harrier) - nest trees only • *Falco hypoleucos* (Grey Falcon) - nest trees only • *Falco subniger* (Black Falcon) - nest trees only • *Lophoictinia isura* (Square-tailed Kite) - nest trees only • *Hieraaetus morphnoides* (Little Eagle) - nest trees only • *Ninox connivens* (Barking Owl) - nest trees only	
Aboriginal cultural heritage - 2. The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the proposed Coleambally Solar Farm and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 201 O}, and should also be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with OEH regional officers. 3. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS. 4. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must 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.	Section 6.3. Appendix F. Section 5.2.
Historic heritage – 5. 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,	Section 7.9.

Issue summary	Addressed in this EIS
gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall: a. outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996), b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed, the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria), c. include a statement of heritage impact for all heritage items (including significance assessment), d. consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.	
Water and soils – 6. The EIS must map the following features relevant to water and soils including: • Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map). • Rivers, streams, wetlands, estuaries (as described in Appendix 2 of the Framework for Biodiversity Assessment}. • Groundwater. • Groundwater dependent ecosystems. • Proposed intake and discharge locations. 7. The EIS must describe background conditions for any water resource likely to be affected by the proposed Coleambally Solar Farm, including: • Existing surface and groundwater. • Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations. • Water Quality Objectives (as endorsed by the NSW Government httQ://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters. • Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC {2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government. 8. The EIS must assess the impacts of the proposed Coleambally Solar Farm on water quality, including: • The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction. • Identification of proposed monitoring of water quality.	Section 7.1. Section 7.2.

Issue summary	Addressed in this EIS
9. The EIS must assess the impact of the proposed Coleambally Solar Farm on hydrology, including: • Water balance including quantity, quality and source. • Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas. • Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems. • Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches). • Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water. • Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options. • Identification of proposed monitoring of hydrological attributes.	
Flooding – 10. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: • Flood prone land • Flood planning area, the area below the flood planning level. • Hydraulic (floodways and flood storage areas). 11. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event. 12. The EIS must model the effect of the proposed Coleambally Solar Farm (including fill) on the flood behaviour under the following scenarios: • Current flood behaviour for a range of design events as identified in 11 above. This includes the 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change. 13. Modelling in the EIS must consider and document: • The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. • Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. • Relevant provisions of the NSW Floodplain Development Manual 2005. 14. The EIS must assess the impacts on the proposed Coleambally Solar Farm on flood behaviour, including: • Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure. • Consistency with Council floodplain risk management plans. • Compatibility with the flood hazard of the land. • Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. • Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.	Section 7.2.

Issue summary	Addressed in this EIS
• Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. • Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council. • Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council. • Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES. • Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	

OEH was further consulted regarding the biodiversity assessment requirements for the proposal. A teleconference was held with Andrew Fisher (OEH), Peter Ewin (OEH), Anne Frederic (Neone), Chris Leonard (Neoen), Nick Graham-Higgs (NGH Environmental), Gemma Barber (NGH Environmental) and Julie Gooding (NGH Environmental) on 28 February 2017 to discuss the biodiversity assessment including whether a Biodiversity Assessment Report (BAR) was required as part of the Frame Work for Biodiversity Assessment (FBA). Further telephone conversations were held with OEH officers throughout the preparation of the BAR. Issues raised have been considered in the Biodiversity Assessment Report (BAR) included as Appendix D and section 6.2.

Environment Protection Agency

Issue summary	Addressed in this EIS
Based on the information provided the proposed activity is not scheduled under the POEO Act and the proposed works do not require an Environment Protection Licence. The EPA recommends that the proposal should be required to appropriately manage noise and air quality impacts during construction and consider waste management throughout the life of the project.	Section 6.6. Section 7.4. Section 7.7.

Department of Primary Industries

Issue summary	Addressed in this EIS
DPI has reviewed the Preliminary Environmental Assessment and advises that the Environmental Impact Statement should be required to include the following:	
• An assessment of the impact of the development on agricultural land and flood prone land, a 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 during operation and after decommissioning, with reference to the zoning provisions applying to the land. • A Rehabilitation and Decommissioning/Closure Management Plan that outlines the rehabilitation objectives and strategies including; a description of the design criteria for the final land use and landform, indicators to guide the return of the land back to agricultural production, expected timeline for rehabilitation, monitoring and mitigation measures to be adopted for rehabilitation remedial actions, and a commitment to bury cables and pipes to a depth >500mm on any land with a cropping history	Section 7.1. Section 7.2. Section 6.5.

Issue summary	Addressed in this EIS
or land with a capability for cropping to allow greater opportunity for agricultural activities to continue above the cables. This is a particular issue for the cables/pipes which will be left in situ once restoration is complete. • An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources, 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 supply arrangements.	

NGH contacted DPI on 12 April 2017 to clarify the required depth of underground cabling. DPI confirmed that cabling buried at a depth of 500mm or greater could be left in place after decommissioning.

Roads and Maritime Services

Issue summary	Addressed in this EIS
Traffic related issues relevant to the development should be considered and addressed in 2 distinct stages as follows; • Establishment & decommission 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. A proposal a Traffic Impact Assessment (TIA) should be submitted with the Development Application. Any Traffic Impact Assessment needs to address the impacts of traffic generated by this development upon the nearby road network.	Section 7.3.
Develop a Traffic Management Plan (TMP) in consultation with Murrumbidgee Council. The TMP shall detail the potential impacts associated with the phases of the development, the measures to be implemented to maintain the standard and safety of the road network, and procedures to monitor and ensure compliance.	TMP to be created as part of the safeguard and mitigation section in 7.3.3.

In addition to consultation relating to the request for SEARs, NSW Roads and Maritime Services was contacted regarding the proposed access location and required road and intersection upgrades. The proposed access and intersection design has been prepared in accordance with advice received. Access and traffic is discussed in section 7.3.

Department of Industry – Division of Resources and Energy

NGH Environmental held telephone conversations with the Department of Industry - Division of Resources and Energy (DRE) on 23 February and 7 March 2017. DRE advised to continue to check if new licences have been applied for in the area, to consult with council regarding the operation of quarries and to ensure the proposed transmission line would not interfere with any mineral licences.

Riverina Local Land Services

No response was received from the Riverina Local Land Services (LLS) during request for SEARs.

Rural Fire Service

NGH Environmental contacted the district NSW Rural Fire Service (RFS) office, being the Murrumbidgee Irrigation Area district office located in Griffith on 31 March 2017.

No concerns were raised provided the EIS addresses access to the site, maintenance and water supply.

The RFS requires access to any locks on gates and asset protection zones to be conditioned as part of the development consent.

Coleambally Irrigation

Neoen has undertaken consultation with Coleambally Irrigation regarding the irrigation infrastructure that transverses and borders the proposal area. Access over the Tubbo irrigation channel is required from Ercildoune Road, access over the east-west channel is required and modification of the central drainage channel may be required. All design for the proposal would be undertaken in accordance with the requirements of Coleambally Irrigation.

Murrumbidgee Council

Neoen has been in constant contact with Murrumbidgee Council officers, including a face-to-face meeting, emails and telephone conversations regarding the following:

- A road opening permit has been obtained from council by Neoen to allow for the transmission line crossing across Ercildoune Road.
- Requirements of nearby quarry operations were discussed. No concerns were raised.
- Some council officers attended the community information session held by Neoen.
- Council's preferred location for access and the requirements for the treatment of Ercildoune Road.

TransGrid

Neoen have been in constant contact with TransGrid regarding the proposed connection to the Coleambally substation design and approval requirements.

5.2 ABORIGINAL COMMUNITY CONSULTATION

Local Aboriginal Land Council and Registered Aboriginal Parties

Consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the ACHCRP guide provided by OEH. The guide outlines a four-stage process of consultation as follows:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix A. A summary of actions carried out in following these stages are as follows.

Stage 1. Letters outlining the development proposal and the need to carry out an ACHA were sent to the Griffith LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspapers, the Daily Advertiser on the 10th of December 2016

seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by OEH in correspondence to NGH Environmental. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, two groups contacted the consultant to register their interest in the proposal. The groups who registered interest were the Griffith LALC who registered via email and Bangerang who registered via phone. No other party registered their interest.

Stage 2. On the 27th of January 2017, an Assessment Methodology document for the Coleambally Solar Farm was sent to the Griffith LALC. On the 30th of January 2017, an Assessment Methodology document for the Coleambally Solar Farm was sent to the Bangerang registered party. This document provided details of the background to the proposal, a summary of previous archaeological surveys and the proposed heritage assessment methodology for the proposal. The document invited comments regarding the proposed methodology and sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein. A minimum of 28 days was allowed for a response to the document. No comments were received on the methodology from either registered party.

Stage 3. The *Assessment Methodology* outlined in Stage 2 included a written request to provide any information that may be relevant to the cultural heritage assessment of the study area. It was noted that sensitive information would be treated as confidential. No response regarding cultural information was received.

At this stage, the fieldwork was organised and both registered parties were asked to participate in the fieldwork. Due to unforeseeable circumstance neither party could participate in the fieldwork. The fieldwork was carried out in early March 2017 by an archaeologist from NGH Environmental.

Stage 4 In March 2017 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal (this document) was forwarded to the Griffith LALC and Bangerang inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document, with the closing date for responses being 20 April 2017.

5.3 COMMUNITY CONSULTATION

Neoen has undertaken consultation with the local community in developing the proposal, in line with DPE's *Guidelines for Major Project Community Consultation* (October 2007) and the Australian Renewable Energy Agency's (ARENA's) *Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry* (ARENA n.d.). The following section describes the consultation undertaken. Consultation activities were informed by *Beyond Public Meetings: Connecting community engagement with decision making,* Twyford Consulting (2007).

5.3.1 Community consultation plan

Effective engagement requires an understanding of community stakeholders and prioritisation of potential impacts. It also relies on the community understanding the project and specific issues of interest to them, in order to contribute effectively. The focus of the consultation process for the Coleambally Solar Farm has been on providing this understanding and engagement.

A Community Consultation Plan (CCP) was developed early in the planning stages of the proposal. It is provided in Appendix C.

The aims of the plan are to:

1. Identify effective methods to inform the community about the Coleambally Solar Farm.
2. Facilitate engagement with the community, including input into the environmental assessment and project development.

The plan identifies:

- Community stakeholders for the proposal.
- Issues / risks related to the engagement of each stakeholder group.
- A consultation strategy for each stakeholder group.
- A set of activities against the project development time line to facilitate consultation.

5.3.2 Community consultation activities to date

In line with the CCP, a range of community engagement tools have been used with regards to the proposal. These include:

- Development of a project website to provide information and updates http://coleamballysolarfarm.com.au/. The website went live in January 2017 and is updated regularly. An online feedback form can be filled in to submit suggestions.
- Establishment of dedicated email address for feedback: contact@coleamballysolarfarm.com.au .
- Direct engagement with neighbours through phone calls, letters and face to face meetings. Face to face meetings with neighbours within two kilometres of the proposal area were held on 27 and 28 February 2017.
- Direct engagement with the nearest neighbour to negotiate landscaping for visual amenity on the neighbours property.
- Community drop-in session was held by Neoen in Coleambally on 20 March 2017 to provide proposal information and to answer questions. The session was announced in the Coly Point Observer, in the council's newsletter and on the council's social media page.

5.3.3 Results of community consultation

Five people completed feedback forms at the Coleambally Solar Farm information session held in Coleambally on 20 March 2017. Four of the respondents live more than five kilometres from the proposal area and one respondent lives between two and five kilometres of the proposal area. Another community consultation feedback form was completed during a one-on-one meeting with nearby neighbours. Responses include:

- Work opportunities (four respondents), community and family ties (three respondents), and recreational opportunities (such as sporting and nature-based activities) (one respondent) were selected as holding the most value for the local area.
- All five respondents cited renewable energy generation as what they liked most about solar farms generally. Local economic opportunities (three respondents) and diversification of land use (one respondent) were also cited.
- Concerns about solar farms in general included the effect on land use and land values (one respondent), visual impact (one respondent) and the impact on the community (one respondent). The potential impact on land values has been discussed in section 7.6. Visual impact has been addressed in section 6.4 and the impact on the community has been addressed in section 7.6.
- Concerns raised with specific reference to the proposed Coleambally Solar Farm included:
    - Accommodation availability for workers (one respondent).

- Employment and housing (one respondent).
- Movement of kangaroos from east to west across the proposal area would be restricted (one respondent). This has been addressed in section 6.2 and Appendix D.

- Specific consultation was held with the nearest neighbour (sensitive receiver 1 in Figure 6-10 with the view referred to as viewpoint ID 20 in section 6.4) regarding the possible visual impact of the solar farm. It was agreed that Neoen would conduct a further visual impact assessment from the landholders dwelling within six months of commissioning. Where the existing vegetation along the drainage channel on the neighbours property does not adequately screen the view of the solar farm Neoen would supplement planting. It was the landholder's preference for supplementary planting to be undertaken on the private holding rather than the proposal area.

While uptake levels of community engagement activities for the proposal have been relatively low, it is considered that this reflects a low level of concern about the proposal. The issues identified through the consultation process have been addressed in the EIA and proposal design.

5.3.4 Continued engagement

Engagement activities will continue throughout the determination period, as set out in the CCP.

The CCP will be reviewed regularly, as well as at key transition phases between different stages of project development (e.g. prior to construction or operation). The Plan will continue to guide engagement activities at all stages of the project, ensuring that engagement is appropriate and in line with good practice.

Continued consultation would also be carried out with the nearest neighbour regarding a further visual impact assessment and vegetation planting where required following commissioning of the solar farm, as discussed in section 5.3.3.

6 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 IMPACT ASSESSMENT APPROACH

Following the preparation of the Scoping Report, a risk assessment was undertaken to characterise the likely adverse environmental risks associated with the construction, operation, upgrade and decommissioning of the solar farm. The aim of the risk assessment was to ensure that all relevant risks were identified, investigated and mitigated as part of the EIS submission, relative to the degree of environmental risk they represented.

The environmental impact assessment below addresses all impacts likely to be attributed to the proposal (including the solar farm and transmission infrastructure). This includes consideration of:

- Direct impacts - impacts directly attributable to the construction, operational and decommissioning phases such as:
  - Disturbances to native vegetation, soil, water and air quality
  - Potential to impact on cultural features and values
  - Noise generated by equipment and traffic movements
  - Public safety, pollution risks and hazards.
- Indirect impacts – follow-on or cascading impacts such as:
  - Impacts on the local economy
  - Potential to impact existing and future land uses.
- Cumulative impacts - the combined potential effects of different impact types as well as the potential interaction with other proposals. For example:
  - The combined impact of construction noise, traffic and visual impacts for nearby receivers
  - The combined effects of the construction phase coinciding with other large infrastructure works that may be planned in the area.

The risk rating is a factor of the **consequence** of an impact occurring and the **likelihood** of the impact occurring. Depending on the combination of consequence and likelihood, the overall risk rating could be low to extreme (refer Table 6-1). High to extreme risks (termed 'key risks') have warranted a higher level of investigation. Risks identified as low to medium are discussed in less detail.

Table 6-1 Risk assessment rating matrix.

Likelihood	Consequence				
	Negligible	**Minor**	**Moderate**	**Major**	**Catastrophic**
Remote	Low	Low	Low	Medium	Medium
Unlikely	Low	Low	Medium	High	High
Possible	Low	Medium	High	Very High	Very High
Likely	Medium	High	Very High	Very High	Extreme
Almost certain/ inevitable	Medium	High	Very High	Extreme	Extreme

Table 6-2 summarises the results of the risk assessment. Fourteen environmental risks were investigated. The unmitigated risk rating is the risk rating prior to assessment and is therefore precautionary. It considers a 'worst case' in the absence of specific information and helps determine the level of assessment required.

Table 6-2 Risk analysis of adverse environmental issues.

Environmental risk	Likelihood	Consequence	Risk rating (unmitigated)
Biodiversity	Likely	Moderate	Very High
Aboriginal heritage	Possible	Moderate	High
Visual	Possible	Moderate	High
Noise	Possible	Moderate	High
Land use	Likely	Moderate	Very High
Soils and water	Possible	Minor	Medium
Transport	Unlikely	Moderate	Medium
Hazards	Unlikely	Moderate	Medium
Resource Use and Waste Generation	Possible	Minor	Medium
Historic Heritage	Unlikely	Minor	Low
Climate	Unlikely	Minor	Low
Socioeconomic	Possible	Minor	Medium
Cumulative impacts	Possible	Minor	Medium

In summary, the following environmental risks were considered to be key issues for the EIS:

- Biodiversity
- Aboriginal cultural heritage
- Visual impacts
- Land use
- Noise impacts

Biodiversity, Aboriginal cultural heritage and visual impacts were investigated by specialists. Summaries of these reports are included in section 6. The full reports are attached as Appendices. Land use has been assessed in section 6.5 and addresses guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI 2013) and *The land and soil capability assessment scheme* (OEH 2012). A quantitative noise assessment is included in section 6.6 and was conducted in accordance with construction and operation guidelines. Lower risk issues are addressed in section 7.

6.2 BIODIVERSITY (FLORA AND FAUNA)

6.2.1 Approach

A specialist Biodiversity Assessment Report (BAR) was prepared by NGH Environmental to investigate and assess the potential impacts of the Coleambally Solar Farm on biodiversity. The aims of the report were to:

1. Address the requirements of the *Framework for Biodiversity Assessment* (FBA), the NSW biodiversity offsets policy developed for Major Projects (OEH 2014) and the requirements of the SEARs in relation to biodiversity.
2. Assess the proposal in relation to Matters of National Environmental Significance as per the *Environment Protection Biodiversity Conservation* (EPBC Act)

The full report is included in Appendix D and the report is summarised below.

The assessment approach involved literature reviews, database searches, and field surveys conducted in accordance with relevant survey guidelines. The proposed solar farm conforms to the definition of a *site-based development* according to the FBA; a development other than a linear shaped development, or a multiple fragmentation impact development.

The following methods were adopted during the surveys on the 16th December 2016, 3rd & 20th March 2017:

- *Random meander and targeted searches for threatened flora species.*
- *Biometric vegetation plots*. A total of 6 biometric plots were completed.
- *Fauna habitat assessment.* Trees within the proposal area were inspected for hollows, and the number, size and occupancy of the hollows, as well as the species, diameter at breast height and height of the hollow-bearing trees were all recorded.
- *Fauna surveys* were conducted with the aim of identifying occurrence or nest trees of threatened fauna species.

The aims of the site surveys were as follows:

1. Determine vegetation communities present within the proposal area, their condition and extent.
2. Identify potential EECs within the proposal area and determine their condition and extent.
3. Conduct searches for threatened flora and fauna species predicted to occur in the proposal area.
4. Assess the availability and extent of flora and fauna habitat, particularly threatened species habitat, such as hollow-bearing trees.

To undertake the assessment, two assessment circles (the inner and outer assessment circles) were established and the percent native vegetation cover in the landscape assessed, taking account both cover and condition of vegetation. The area of the inner and outer assessment circles for this assessment are 300 ha and 3,000 ha respectively.

A BioBanking credit assessment was completed. The proposal ID for the assessment is BioBanking Credit Calculator Major Project 144/2017/4276D Version 1.

6.2.2 Existing environment

Landscape features

The proposal area is located within the NSW Riverina Bioregion and the Murrumbidgee Subregion (IBRA v.7 2012). Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The geology of the region is Late Mesozoic to Quaternary in age, with landforms of sand plains, dune fields, salt lakes and alluvial plains. The dominant pre-European vegetation type is considered to be Eucalypt Low Woodland, dominated by Black Box (*Eucalyptus largiflorens*) and saltbush understory (*Atriplex and Chenopodium spp.*) (ASRIS accessed 27/2/17).

The following Mitchell Landscape occurs within the proposal area:

- Murrumbidgee Scalded Plains. The per cent cleared estimate for this landscape is currently 67% (OEH 2007).

The total area of native vegetation mapped within the outer assessment circle is approximately 855 ha and is shown in Figure 6-1. The majority of land within the development footprint is cleared (non-native vegetation) and cultivated land which provide very little in terms of fauna habitat.

No state or regionally significant biodiversity links, as defined in the FBA (OEH) occur within the proposal area and within the inner and outer assessment circles.

Native vegetation

Two distinct Plant Community Types (PCTs) were observed in the proposal area. These include:

3. Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (PCT 26).
4. Black Box Grassy open woodland wetland of rarely flooded depressions in south western NSW (Mainly Riverina Bioregion and Murray Darling Depression Bioregion) (PCT 16).

Weeping Myall Open Woodland forms part of the listed EEC - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregion*

WEEPING MYALL OPEN WOODLAND OF THE RIVERINA BIOREGION AND NSW SOUTH WESTERN SLOPES BIOREGION (PCT 26)

This PCT occurs in varying condition in the north east Corner of the proposal area (Figure 6-2). This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act – Weeping Myall Open Woodland of the Riverina and NSW South-western Slopes Bioregions. This vegetation community is also listed as an EEC under the EPBC Act – Weeping Myall Woodlands.

In the moderate to good condition woodland, the overstory is characteristically dominated by Weeping Myall (*Acacia pendula*). A second generation of *A. pendula* is present in the midstory along with Grey Mistletoe (*Amyema quandang*). The groundcover consists of Plains Grass (*Austrostipa aristiglumis*), Wallaby Grass (*Rytidosperma sp.*), Creeping Saltbush (*Atriplex semibaccata*), Ruby Saltbush (*Enchylaena tomentosa),* Climbing Saltbush (*Einadia nutans ssp nutans*), Ridged Sida (*Sida corrugata*) and juvenile *A. pendula.*

This vegetation community provides numerous habitat types for fauna. Canopy trees of Weeping Myall provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey provides foraging and

nesting sites for smaller birds. Ground plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well.

The development envelope has been designed to minimise impact to this community.

BLACK BOX GRASSY OPEN WOODLAND WETLAND OF RARELY FLOODED DEPRESSIONS IN SOUTH WESTERN NSW (MAINLY RIVERINA BIOREGION AND MURRAY DARLING DEPRESSION BIOREGION) (PCT 16)

Within the proposal area, this PCT occurs alongside the irrigation drain in the south of the proposal area. A further patch of this Black Box Woodland occurs at the northern end of the proposal area on the corner of Ercildourne and Kook Rd and alongside the transgrid substation. The proposed transmission line connecting to this substation would require some clearing of this community.

This vegetation community is not listed as an endangered ecological community under the TSC or EPBC act.

This vegetation community is in moderate to good condition and provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (where present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.

The development envelope has been designed to minimise impact to this community.

Cleared areas (Non-indigenous vegetation)

This highly disturbed and modified vegetation community occupies approximately 95% of the proposal area within cropping and pastoral areas (Figure 6-2). In these areas, there is a prevalence of exotic or planted non-local groundcover species. These include crop species such as soybean (*Glycine max*), Chickpeas (*Cicer arietinum*) and Wheat (*Triticum sp*.) or bare ground recently cultivated. In pastoral areas, the groundlayer is almost entirely exotic with species including Oats (**Avena sp.).* Barley Grass (**Hordeum leporinum*), Prickly Lettuce (**Latuca serriola*), Variegated Thistle (**Silybum marianum*), Spear thistle (**Cirsium vulgare*) and Horehound (**Marubium vulgare*).

Threatened species

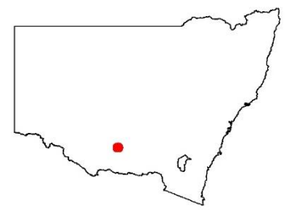
The following threatened species were identified from the Biobanking Credit Calculator (BCC) as potentially being present and requiring targeted survey. Table 6-3 states whether each species was detected during surveys and furthermore, if they are expected to be impacted by the proposal and therefore are required to be offset.

Table 6-3 Threatened species returned from the BCC as requiring survey

Common name	Scientific name	Surveys	Present/presumed present	Affected by the proposal
Mossgiel Daisy	*Brachyscome papillosa*	Not detected. No evidence of any Brachyscome species.	No	Unlikely
A Burr Daisy	*Calotis moorei*	Not detected however	Presumed Present	Possible. Will require surveying during Spring.

Common name	Scientific name	Surveys	Present/presumed present	Affected by the proposal
		timing not suitable for this species.		
A Spear Grass	*Austrostipa wakoolica*	Not detected. Timing suitable	No	Unlikely
Bindweed	*Convolvulus tedmoorei*	Not detected however timing not suitable	Presumed Present	Possible. Will require surveying during Spring.
Chariot Wheels	*Maireana cheelii*	Not detected Timing suitable	No	Unlikely
Lanky Buttions	*Leptorhynchos orientalis*	Not detected however timing not suitable	Presumed Present	Possible. Will require surveying during Spring.
Slender Darling Pea	*Swainsona murrayana*	Not detected. Timing Suitable	No	Unlikely.
Squirrel Glider	*Petaurus norfolcensis*	Not surveyed for	Presumed Present	Possible. Five hollow Bearing trees proposed to be removed in Zone 3.

Proposal Area
Development envelope
Substation Extension
New Transmission LIne
Sub Station
Native Vegetation
Mitchell Landscapes
Irrigation Channels
Roads



Notes:
- Data collected by nghenvironmental
- Client data courtesy of Client, received 2016
- Base map Copyright © Bing Maps and its data suppliers.

All locations are approximate and subject to detailed site assessment

0 0.2 0.4 0.8
Kilometers

Ref: Coleambally Solar Farm
Author: J. Gooding
7/03/2017

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Figure 6-1 Biodiversity location map showing inner and outer assessment circles of the proposal area.

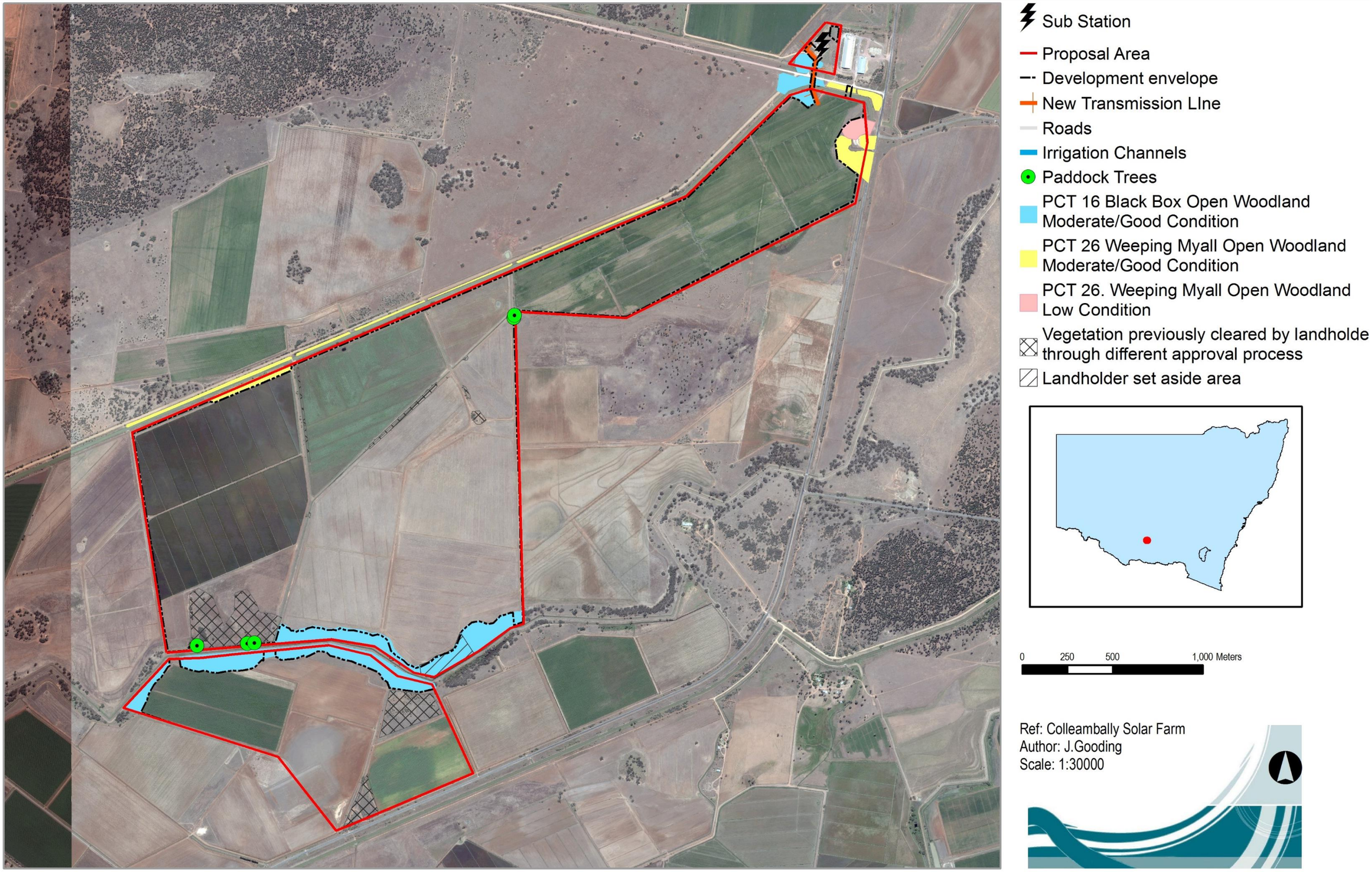


Figure 6-2 PCTs (including condition) within the proposal area with plot and transect locations and vegetation impact areas

6.2.3 Site surveys

Sixty-nine flora species and sixteen fauna species were detected during the surveys. None of these are listed as threatened species, either under NSW or Commonwealth legislation.

Eight threatened species were returned by the BCC assessment as requiring survey (and therefore with potential to generate species credits). Four of these were considered to have some potential to occur in the study area (see Table 6-4).

- A Burr-daisy (*Calotis moorei*), listed as Endangered under the TSC Act.
- Bindweed (*Convolvulus tedmoorei*), listed as Endangered under the TSC Act.
- Lanky Buttons (*Leptorhynchos orientalis*), listed as Endangered under the TSC Act Act.
- Squirrel Glider (*Petaurus norfolcensis*), listed as vulnerable under the TSC Act.

For these species, the BCC requires that further targeted surveys are necessary to determine if any offsets are required for these species. Targeted surveys are recommended to occur within the next flowering season which will be between September and November 2017.

6.2.4 Potential impacts

Construction

The BAR identified the potential direct and indirect impacts to biodiversity values of the site that would result during the construction phase (Table 6-4).

Table 6-4 Potential biodiversity impacts as a result of the proposal.

Impact	Frequency	Intensity	Duration	Consequence
Direct				
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, compound sites, stockpile sites, access tracks)	Regular	High	Construction phase	• Direct loss of native flora and fauna habitat including threatened species and EECs • Potential overclearing of habitat outside of the development footprint. • Injury and mortality to fauna during clearing of fauna habitat and habitat trees. • Disturbance to fallen timber, dead wood and bush rock
Indirect				
Accidental spills and contamination from construction activities (including compound sites)	Rare	Moderate	Construction phase	• Pollution of waterways
Earthworks	Regular	Moderate	Construction phase	• Erosion and sedimentation of waterways
Noise	Regular	Low	Construction phase	• Construction machinery and activities may disturb local fauna

Impact	Frequency	Intensity	Duration	Consequence
Direct				
Dust generation	Regular	Low	Construction phase	• Inhibit the function of plant species and communities, waterways
Light spills during night works	Rare	Low	Construction phase	• Night works may alter fauna activities/movements
Increased vehicle traffic	Regular	Low	Construction phase	• Increase potential for fauna mortality through vehicle strike
General construction activities	Regular	Moderate	Construction phase	• Feral pest, weed and/or pathogen encroachment

A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction phase are avoided where possible, and minimised where they cannot be avoided. The mitigation measures that would be employed during the construction phase are provided in Section 6.2.5. Mitigation measures have considered methods of clearing, clearing operations, timing of construction and other measures that would minimise impacts of the proposal on biodiversity values.

Operation

The BAR identified the following potential direct and indirect impacts to biodiversity values of the site during the operational phase.

Impact	Frequency	Intensity	Consequence	
Direct				
Existence of new and permanent solar infrastructure	Constant	Moderate	Operational phase	• Permanent removal of flora and fauna habitat • Collision risk to birds and microbats to exterior barbed-wire fencing
Inappropriate landscaping	Constant	Moderate	Operational phase	• Reduction in the quality of habitat for native flora and fauna species
Indirect				
Weed encroachment	Regular	Moderate	Operational phase	• Ingress of weeds along the boundary of the development
Increased Vehicle Traffic	Regular	Low	Operational phase	• Increase potential for fauna mortality through vehicle strike
Perimeter Fencing	Regular	Low	Operation phase	• Alter movements of fauna through the landscape, potentially channelling onto roads.

The development envelope has been selected to avoid or minimise impacts to biodiversity where possible. Most areas of EEC in the proposal area have been avoided through the design process. These areas include

the patches of Weeping Myall Woodland and Black Box Woodland along the drainage line. This, in turn would also avoid impacts to threatened species predicted to occur in the study area through the Biobanking Credit Calculator (BCC).

The credit report produced by the BCC, based on the clearing proposed by the development, has identified the following credit requirements:

- PCT 26 – Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (Mainly Riverina Bioregion and Murray Darling Depression Bioregion) – **23 Credits**
- Zone 4. PCT 16 – Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – **2 credits**

Given that that the proposed landscaping would occur in areas near existing stands of woodland, including Weeping Myall, an opportunity exists to offset these credits with suitable plantings as part of the landscape works. All other areas within the development envelope were without native vegetation and do not need to be assessed further and offsetting would not be required.

Four species produced species credits (Table 6-5).

Table 6-5 Species Credit Species

Scientific name	Common name	TS offset multiplier	Species credits required
Calotis moorei	A burr-daisy	7.7	3850
Convolvulus tedmoorei	Bindweed	7.7	3850
Leptorhynchos orientalis	Lanky Buttons	1.3	650
Petaurus norfolcensis	Squirrel Glider	2.2	7

These species are presumed to occur until such time as appropriate timed surveys can be completed in September – November 2017. Credits are generated for this species, unless appropriate timed surveys find the species does not occur onsite. With regard to the Squirrel Glider, given that a very low number of credits were returned by the BCC, it is not proposed to conduct any further surveys for this species.

Measures to avoid and minimise impacts that may occur during the operational phase would be implemented as part of the proposal. Where practical, measures to avoid impacts on biodiversity during operation have been identified and where impacts are unavoidable, measures to minimise impacts would be implemented.

6.2.5 Safeguards and mitigation measures

Table 6-6 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
BD1	Develop and implement a construction Flora and Fauna Management Plan (FFMP) for incorporation of construction related environmental management safeguards.	**C**		
BD2	Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be clearly demarcated and implemented. This will include environmentally sensitive areas such as EECs. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	**C**		
BD3	Clearing and construction contractors would be given inductions that make clear the importance of the sensitive area habitat and its species.	**C**		
BD4	Where trees are to be retained, an adequate tree protection zone (TPZ) will be provided around each tree for the duration of construction. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*.	**C**		
BD5	A pre-clearing process will be implemented before clearing begins. Pre-clearing surveys will be carried out by an ecologist and will include general fauna surveys, general tree hollow inspections and dam/waterway inspections. Habitat trees will be clearly marked with flagging tape.	**C**		
BD6	When programming the works, consider breeding periods of fauna that may be impacted.	**C**		
BD7	An unexpected threatened species finds procedure will be developed before clearing commences.	**C**		
BD8	A 'Clearing and Grubbing Plan' will be developed to; ➢ include best practice methods for the removal of woody vegetation and non-woody vegetation. ➢ Trees will be removed in such a way as not to cause damage to surrounding vegetation. Root systems of trees and shrubs to be removed will be retained in-ground to ensure surrounding ground layer vegetation is undisturbed and to prevent soil erosion. ➢ Require that where work cannot avoid encroaching into the TPZ, it not impinge on the structural root zones (SRZ) of trees to be retained. Details for calculating the SRZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. ➢ Where possible, trees to be removed will be mulched on-site and re-used to stabilise disturbed areas. ➢ Tree clearing protocol, that includes staged habitat removal, and a requirement for an ecologist being present during tree-felling of all hollow-bearing trees to ensure that any potential impacts on fauna are minimised	**C**		
BD9	Any fallen timber, dead wood and bush rock (if present) encountered on site will be left in situ or relocated to a suitable place nearby. Rock will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	**C**		
BD10	A Weed Management Plan would be developed for the proposal to prevent/minimise the spread of weeds. This would include:	**C**		

No.	Safeguards and mitigation measures	C	O	D
	➢ Management protocol for declared noxious weeds as stipulated by the *Noxious Weeds Act 1993* during and post construction ➢ A protocol for weed hygiene in relation to plant, machinery and importation and management of fill ➢ Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated and reported.			
BD11	To minimise fire risk from bird collisions, reflective power line marking balls may be used if required by TransGrid on any overhead transmission lines.		**O**	
BD12	Any onsite landscape plantings (such as to address visual impacts) will be comprised of local indigenous species (such as those of Weeping Myall Woodland) with the object of increasing the structure of the existing vegetation. Planting locations would be designed to improve the connectivity between patches in the landscape where consistent with landscaping outcomes and the solar farm operation.		**O**	

6.3 ABORIGINAL HERITAGE

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the proposal area and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. The full report is provided in Appendix F and is summarised below.

The ACHAR was prepared in line with the following:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011);
- *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010a), and
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (OEH 2010b).

Consultation with Aboriginal stakeholders was undertaken in accordance with clause *80C of the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010,* following the consultation steps outlined in the (ACHCRP) guide provided by OEH.

6.3.1 Background

Coleambally is within an area identified as part of the Wiradjuri language group. This is an assemblage of many small clans and bands speaking a number of similar dialects (Howitt 1996, Tindale 1974, MacDonald 1983, Horton 1994).

The Wiradjuri language group was the largest in NSW prior to European settlement. The borders were, however, not static, and were most likely fluid, expanding and contracting over time to the movements of smaller family or clan groups. Boundaries ebbed and flowed through contact with neighbours, the seasons and periods of drought and abundance.

It was the small family group that was at the core of Aboriginal society and the basis for their hunting and gathering life. The immediate family camped, sourced food, made shelter and performed daily rituals together. The archaeological manifestations of these activities are likely to be small campsites, characterised by small artefact scatters and hearths across the landscape. Places that were visited more frequently would

develop into larger site complexes with higher numbers of artefacts and possibly more diverse archaeological evidence.

These small family units were part of a larger band which comprised a number of families. They moved within an area defined by their particular religious sites (MacDonald 1983). Such groups might come together on special occasions such as pre-ordained times for ceremonies, rituals or simply if their paths happened to cross. They may also have joined together at particular times of the year and at certain places where resources were known to be abundant. The archaeological legacy of these gatherings would be larger sites rather than small family camps. They may include large hearth or oven complexes, contain a number of grinding implements and a larger range of stone tools and raw materials.

Most archaeological surveys are conducted in a situation where there is topographic variation and this can lead to differences in the assessment of archaeological potential and site modelling for the location of Aboriginal archaeological sites. However, as already noted, the proposal area is entirely within the broad scalded plains of the Murrumbidgee that have been laser levelled and divided into irrigation bays. There are no differences in the soil types and no micro features such as sand ridges or palaeochannels within the proposal area.

The only difference observed within the landscape is the presence of remnant vegetation boarding the canalised creek that bisects the proposal area into two. The vegetation in the proposal area can therefore be classified as either remnant vegetation or irrigation cropping bays.

The landforms for the survey were therefore determined to be two units, irrigation cropping bays and remnant vegetation. The nature of the irrigation cropping bays unit is an aggrading unit, although flooding regimes have been dramatically altered with the installation of channels and levees as part of the irrigation development. Soils are heavily disturbed and there is unlikely to be any remnant intact profile within at least the upper 20-30 cm.

There is a single once natural water course adjacent to the proposal area that bisects the assessment area. Although now a modified channel the design is believed to follow the natural course of an unnamed creek. The areas of remnant vegetation within the proposal area generally boarders this water source and it is therefore likely that areas within 200 metres of this water course would to have been a major focus for Aboriginal people. However, prior to European land modifications, this area may have provided resources, shelter, water and food for Aboriginal people.

Database searches and consultation

A search of the AHIMS database was conducted over an area approximately 22 km east-west x 22 km north-south centred on the proposal area, was undertaken on the 12th of December 2016. There were 18 Aboriginal sites recorded in the search area. No declared Aboriginal Places. Table 6-7 shows the site types previously recorded in the region and Figure 6-3 shows the locations of the AHIMS sites in relation to the proposal area.

Table 6-7 Breakdown of previously recorded Aboriginal sites in the region.

Site Type	Number
Modified Tree	9
Hearth, Aboriginal Resource and Gathering	5
Artefact, modified tree and burial	2
Aboriginal Resource and Gathering	1
Modified trees, Aboriginal Resource and Gathering	1
TOTAL	**18**

None of the sites are located within the proposal area. The closest sites to the project area is a modified tree (AHIMS # 49-4-0014) located approximately 200m to the north of the proposal area on the opposite side of the Tubbo Channel.

6.3.2 Site survey

Methodology

The intention for the heritage survey was to cover as much of the ground surface as possible given that the proposal would disturb approximately 555 hectares. Although the actual ground impact from the construction method was likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites.

The proposal area is within an irrigation development and has therefore been subject to considerable impacts from farming for many decades with areas of remnant vegetation and exposures adjacent to irrigations bays deemed to have the highest potential for sites.

The survey method was to carry out a series of pedestrian survey transects across the proposal area focusing on the tracks and edges of the irrigation bays and areas with remnant Black Box vegetation. This survey method would ensure enough coverage to be able to assess and characterise the archaeology of the proposal area especially given that several the irrigation bays contained water or were recently ploughed to a depth of 20-30cm in preparation for irrigation.

Whilst the proposal would retain existing viable native vegetation remnants, this landform was deemed to have high archaeological potential and mature trees within the proposal area were also inspected for any evidence of Aboriginal scarring.

It is considered the survey strategy was comprehensive and the most effective way to identify the presence of Aboriginal heritage sites.

The proposal area was divided into three sections as follows:

- The solar farm proposal area with irrigation bays and crops - comprising approximately 550 hectares.
- Areas of remnant vegetation, comprising approximately 14 hectares.
- The substation area, comprising approximately 3.5 hectares.

The survey was undertaken by an archaeologist from NGH Environmental on the 2nd and the 3rd of March 2017. Notes were made about visibility, photos taken and any possible Aboriginal features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin. Whilst members of the local Aboriginal community were invited to participate in the survey, none took up this invitation.

Over the course of the field survey, approximately 33 kilometres of transects were walked across the main solar farm proposal area. Allowing for an effective view width of 5 metres, this equates to an examined surface area of 16.5 hectares. However, allowing for the visibility restrictions, the effective survey coverage is reduced to 13.3 hectares, or 2.4% of the proposal area.

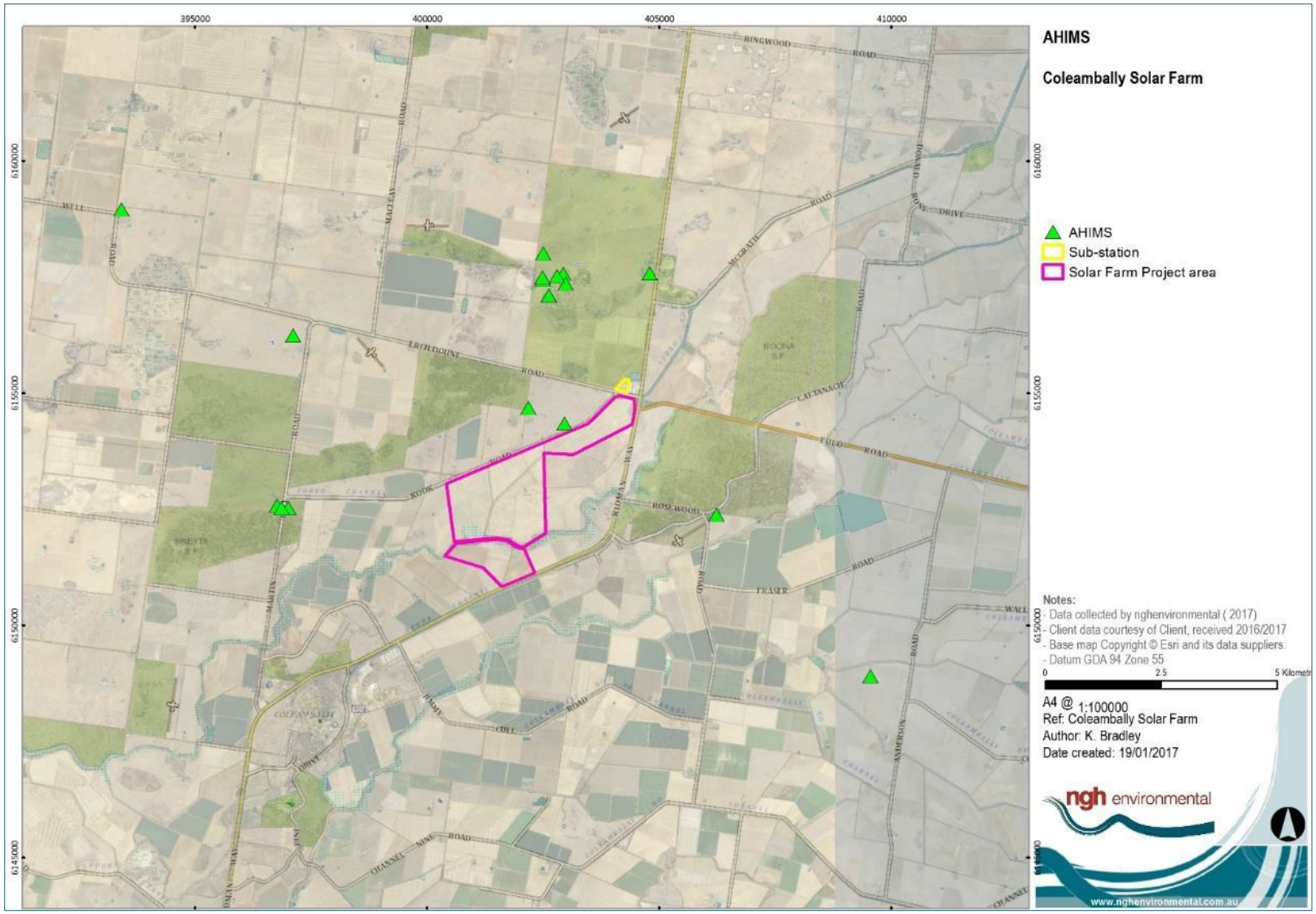


Figure 6-3. Location of AHIMS sites

Approximately 3 kilometres of transects were walked across the areas of remnant vegetation. Allowing for an effective view width of 5 metres, this equates to an examined surface area of 1.5 hectares. However, allowing for the visibility restrictions, the effective survey coverage is reduced to 0.08 hectares, or 0.55% of the proposal area.

The survey for the substation examined approximately one kilometre of transects around the existing structure, but allowing for visibility restrictions, the effective survey coverage was 0.3 hectares or 9% of the substation Lot.

Results and conclusions

Despite the variable visibility encountered during the survey, no Aboriginal cultural material or objects were found across the proposal area.

The ACHA concluded that, extrapolating from the results of the survey, it is unlikely that *in situ* stone artefacts occur within the proposed development envelope. Based on the land use history of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the broader proposal area.

6.3.3 Potential impacts

Construction

Given that no Aboriginal archaeological sites were located within the proposal area the assessment of harm and impact to Aboriginal heritage values for this development is nil. Consequently, the recommended safeguards for the proposal involves unexpected finds during construction.

Operation

During operation, it is unlikely the proposal would impact on Aboriginal archaeology. No mitigation is required.

6.3.4 Safeguards and mitigation measures

The ACHAR identifies that the development proposal can proceed with no additional archaeological investigations. The report identifies a number of safeguards, these are identified below.

Table 6-8 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	An unexpected finds protocol (UFP) must be prepared and followed should there be an inadvertent discovery of Aboriginal objects occur.	**C**		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	**C**		

C: Construction; O: Operation; D: Decommissioning

6.4 VISUAL IMPACT

NGH Environmental completed a Visual Impact Assessment (VIA) of the proposed Coleambally Solar Farm. It provides a full assessment of the visual impacts associated with the proposal, including:

- Landscape character and scenic vistas.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints (including glare and reflectivity).

The VIA includes a strategy to address identified impacts, including onsite vegetation screening, general design measures and a process to verify the actual visual impacts of the proposal. This improves the reliability of the measures and provides a trigger to undertake additional mitigation if required.

The report is provided in full in Appendix F and is summarised below.

6.4.1 Approach

The VIA includes the following components:

- Background investigations, mapping and modelling.
- Field survey including reconnaissance, ground truthing and photography.
- Community consultation.
- Impact assessment.
- Development of a visual impact mitigation strategy.

The impact assessment methodology used in the VIA is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the proposal. Mitigation measures are considered for impacts greater than medium visual impact; for a medium impact, the contrast is considered acceptable.

For the purpose of the assessment, a height of 3m was used to model onsite infrastructure to the proposal boundary. This is a realistic approximation of the height of panels and PV boxes or skids, which may actually be 2.3m and 3.5m, respectively. It is conservative as panels may not be distributed to the site boundaries and the model does not take into account screening such as vegetation or infrastructure. On this basis is considered a 'worst case' model.

6.4.2 Results

Existing environment

There are six residences located within two kilometres of the proposal area, with the closest being about 920 metres to the east. None are proposal-involved.

Landscape character units (LCU) and representative viewpoints

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to summarise differences in the receiving environment that may affect the visual impact of the proposed solar farm at different locations. The four LCUs identified within 16 kilometres of the proposal area are characterised in Table 6-9 in terms of their scenic quality (illustrated in Table 6-9):

- Agricultural - Scenic quality is low to moderate. Built elements are production related and include linear fences, powerlines, roads, and agricultural buildings and rural houses. Forms are generally uniform, of low elevation and linear. However, the colours would change with the seasons and where framed by road side vegetation remnants, expansive pastures and crops can have a higher scenic quality. This LCU is common and dominant in the study area. The proposed solar farm site is located within this LCU.
- Reserve - Scenic quality is considered moderate. These areas have variety in colour and form normal in this character type. Elements include woodland and recreational aspects. This LCU is common in the study area.
- Rural village - Scenic quality is considered moderate. These areas have variety in colour and form normal in this character type. Elements include recreational aspects; parks and gardens. This LCU is common in the study area.
- Industrial - Scenic quality is considered low. Elements are production related. The structures match the land use. Screening is present at both areas, breaking up views from the roads. This LCU is common in the study area.

Table 6-9 Landscape Characteristic Units within 16km of the proposed Coleambally Solar Farm

Agricultural LCU plates	
	
Reserve LCU plates	
	

Residential LCU plates

Industrial LCU plates

Representative viewpoints within each LCU were identified using ZVI modelling. The predicted sensitivity of each viewpoint was then determined, considering its proximity to the proposed solar farm and factors such as use, scenic quality and regional significance.

Figure 6-4 illustrates the locations of these representative viewpoints with reference to the proposal area and Table 6-10 provides details of representative viewpoints. Criteria for proximity and sensitivity are provided in the full visual assessment, Appendix F.

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

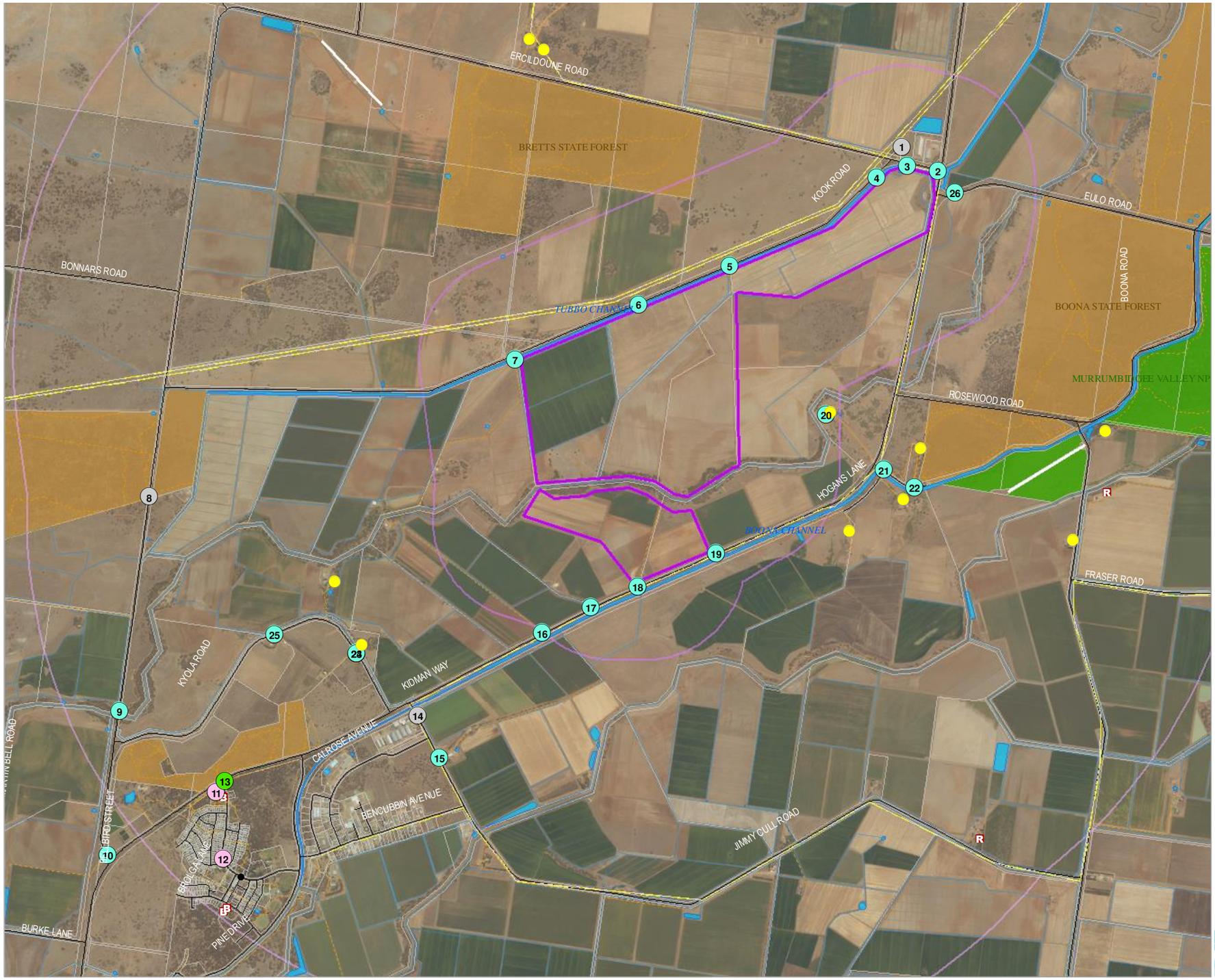
- **Residential / recreational viewpoints** were assessed as having high sensitivity generally. While the population is relatively low, in these locations, if there were a view to the solar farm infrastructure, the view duration could be expected to be high for a receiver. Maintenance of gardens and recreational areas in Coleambally and surrounds demonstrates the areas are valued for their visual amenity.
- **Road viewpoints** were assessed as having generally moderate sensitivity. While the Kidman Way is a high use corridor, in the 100km speed zone, motorists would have limited view durations, if there were a view to the solar farm infrastructure. There are limited pull over areas. As motorists use local roads such as Ercildoune Road and Kook Road, as well approaching intersections with the Kidman Way, view durations increase as vehicle speed is reduced (50-80km/hr). However, the expected amount of vehicles on these local road are considered to be low.

- **Industrial viewpoints** were assessed as having low sensitivity. In these locations, receivers would be more likely to be focused on work activities and view durations, if there were a view to the solar farm infrastructure, would be limited due to this work focus. While sites are tidy and well kept, there is limited effort expended on visual amenity, such as screening or garden plantings in Coleambally and surrounds. Built structure is more commonly functional than aesthetic in these commercial settings.

The sensitivity of each viewpoint is tabulated below. 26 representative viewpoints were identified and are mapped in Appendix B of the VIA, which colour codes the LCU of each viewpoint.

Table 6-10 Representative viewpoints (ID) with reference to the proposed Coleambally Solar Farm

ID	LCU	View location	Distance to site	Scenic quality	Sensitivity
1	Industrial	Industrial	Foreground	Low	Low
2	Agricultural	Road	Foreground	Moderate	Moderate
3	Agricultural	Road	Foreground	Moderate	Moderate
4	Agricultural	Road	Foreground	Moderate	Low
5	Agricultural	Road	Foreground	Moderate	Low
6	Agricultural	Road	Foreground	Moderate	Low
7	Agricultural	Road	Foreground	Moderate	Low
8	Reserve/Industrial	Industrial	Middle ground	Low	Low
9	Agricultural	Road	Middle ground	Moderate	Low
10	Agricultural	Road	Background	Moderate	Low
11	Village	Recreational	Middle ground	Moderate	High
12	Village	Residential	Middle ground	Moderate	High
13	Reserve	Road	Middle ground	Moderate	Moderate
14	Industrial	Industrial	Middle ground	Low	Low
15	Agricultural	Residential	Middle ground	Moderate	High
16	Agricultural	Road	Foreground	Moderate	Moderate
17	Agricultural	Road	Foreground	Moderate	Moderate
18	Agricultural	Road	Foreground	Moderate	Moderate
19	Agricultural	Road	Foreground	Moderate	Moderate
20	Agricultural	Residential	Middle ground	Moderate	High
21	Agricultural	Residential	Middle ground	Moderate	High
22	Agricultural	Residential	Middle ground	Moderate	High
23	Agricultural	Residential	Middle ground	Moderate	High
24	Agricultural	Residential	Middle ground	Moderate	High
25	Agricultural	Residential	Middle ground	Moderate	High
26	Agricultural	Residential	Middle ground	Moderate	High



LANDSCAPE CHARACTER UNITS

Coleambally Solar Farm

- Sensitive receiver (residence)

Landscape Character Unit (LCU)

- Agricultural
- Industrial
- Reserve
- Village
- Town
- Other accommodation
- Other possible residence
- Site boundary
- Existing transmission line
- Track
- Road
- Highway
- Railway
- Private runway
- Drainage line or canal
- Waterbody (man-made or natural)
- Cadastre
- Foreground (1km)
- Midground (5km)
- National Park
- State Forest

Notes:
- Designs courtesy of Neoen, received March 2017
- Base layers from LPI, accessed March 2017
- Base map Copyright © Esri and its data suppliers.

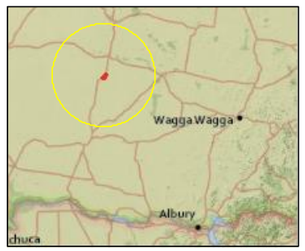


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Figure 6-4 Location of representative viewpoints and array infrastructure ZVI

6.4.3 Potential impacts

The visual impact assessment was undertaken considering the:

a) Infrastructure components proposed.
b) Their potential impact on landscape character units and representative viewpoints.
c) The degree of contrast the development would have within the identified Visual Landscape Management Zones and if these are considered acceptable.

Evaluation criteria

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

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

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

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

For high impact viewpoints, mitigation must be considered.

Table 6-11 below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating. Note, no high impact viewpoints were identified. Viewpoints assessed to have a low impact (little or not perceived and acceptable) are excluded but provided in full in Visual impact assessment.

Table 6-11 Visual impact at representative viewpoints with medium impact, with reference to the Coleambally Solar Farm

ID	LCU	Viewpoint	LMZ objective	Contrast	Visual Impact	Comment	Image
2	Agricultural	Road (foreground)	B Protect dominant visual features	Medium	**Medium**	The viewpoint is located at the junction of the Kidman Way and Ercildoune Road, adjacent to the north western corner of the proposal site. Dominant features are road infrastructure, transmission lines, cropping paddocks, irrigation channels and fencing. View extent to the solar farm site is relatively unimpeded for south bound traffic. Along this section of the Kidman Way views of the solar farm infrastructure would be visible for traffic travelling in both directions with some minor breaks through existing vegetation screening. View durations would be relatively short in this 100km/hr zone. **Mitigation is suggested** The view of the array site could be softened along its north-eastern corner to break up views of the array infrastructure. The aim in this area will be to minimise the cumulative impact of built elements. The mitigated visual impact would be considered low.	
3	Agricultural	Road (foreground)	B Protect dominant visual features	Medium	**Medium**	This viewpoint is located along Ercildoune Road, just 340m west of the Kidman Way junction and 100m east of the entrance into the Community Farm (also substation). Dominant features are cropping paddocks and overhead powerlines. The silos and substation north of the view point are well screened. This section of road would be used by locals and visitors to the community farm. View extent to the solar farm site is relatively unimpeded. View durations would be relative short in this 60km/hr zone. **Mitigation is suggested** The view of the array site could be softened along its north-eastern corner to break up views of the array infrastructure. The aim in this area will be to minimise the cumulative impact of built elements. The mitigated visual impact would be considered low.	

ID	LCU	Viewpoint	LMZ objective	Contrast	Visual Impact	Comment	Image
17	Agricultural	Road (foreground)	B Protect dominant visual features	Medium	**Medium**	The viewpoint is located along the Kidman Way, approximately 480m west of the south western corner of the proposal site. Dominant features are the road, cropping paddocks, irrigation channels and fencing. View extent to the solar farm site is relatively unimpeded for east-bound traffic. View durations would be relatively short in this 100km/hr zone. **Mitigation is suggested** The view of the array site could be softened along its south-western corner to break up views of the array infrastructure. The mitigated visual impact would be considered low.	
19	Agricultural	Road (foreground)	B Protect dominant visual features	Medium	**Medium**	The viewpoint is located along the Kidman Way, approximately 75m east of the south eastern corner of the proposal site. Dominant features are the road, cropping paddocks, irrigation channels and fencing. View extent to the solar farm site is relatively unimpeded for west-bound traffic. View durations would be relatively short in this 100km/hr zone. **Mitigation is suggested** The view of the array site could be softened along its south-eastern corner to break up views of the array infrastructure. The mitigated visual impact would be considered low.	

ID	LCU	Viewpoint	LMZ objective	Contrast	Visual Impact	Comment	Image
20	Agricultural	Residential (Middle ground)	B Protect dominant visual features	Medium	**Medium**	The viewpoint is the closest residence to the proposal site, approximately 932m south east of the site. The viewpoint was taken from the rear of the property. The residence and its backyard area faces the proposal site. The residence would have long term views of the site to the south-west, west and north. There is vegetation screening present however, between the residence and the solar site in these directions. An example of the vegetation present is shown in the adjacent image. **Mitigation is suggested** While existing screening may already soften the views sufficiently, potential for additional vegetation screening in this location has been discussed with the affected landowner.	

Visual impact assessment at representative viewpoints

No view points were assessed to have a high impact and as such no screening is required. However, in a number of locations it is considered that screening may soften close up views (not block views) of the infrastructure and assist to mitigate cumulative impacts. In these locations, screening is recommended, in consultation with the community.

Medium impact – mitigation could be considered

Medium impacts are seen for five viewpoints including four road viewpoints within the foreground and one residential viewpoint within the middle ground. Viewpoint 2 at the junction of the Kidman Way and Ercildoune Road and Viewpoint 3 along Ercildoune Road are in close proximity of the site. It is expected this area would be of moderate use with the access to the community farm and motorists would be travelling at a slower speed than that on the Kidman Way increasing view duration. There is minor vegetation screening present, however more is present to screen the silos and substation to the north. This existing screening to the north would make the solar infrastructure a dominant feature within the landscape. Screening as a mitigation strategy should be considered for these viewpoints.

Viewpoints 17 and 19 are adjacent the southern boundary of proposal site along the Kidman Way. The Kidman Way is considered a high use area, however view durations would be short of the proposal. At these two viewpoints existing vegetation screening is minimal and there would be dominant views of the infrastructure. The form of the infrastructure, low (<3m) and in rectangular arrays, is not incongruous with the existing low lying rectangular forms in this agricultural area however, screening as a mitigation strategy could soften views of infrastructure from these viewpoints.

A medium impact is also expected for the closet residence, represented by viewpoint 20. While it occurs in a low use area (one residence) and existing vegetation will to some extent screen views to the proposed solar farm site from the residence itself, there is potential for long duration views of infrastructure from some areas of the yard. The form of the infrastructure, low (<3m) and in rectangular arrays, is not incongruous with the existing low lying rectangular forms in this agricultural area however, screening as a mitigation strategy has already been considered in consultation with the landowner for this viewpoint. This consultation is discussed in section 5.3.3.

Proposed screening is provided in Figure 3-19 and discussed further in Section 6.2.

Low impact – no mitigation

Low impacts are seen for roads and residences, commercial, recreational and forestry reserves in the middle and background where views of the solar farm infrastructure would be difficult to perceive or indistinct. No mitigation is required for these locations.

Glare and reflectivity of solar panels

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

Other onsite infrastructure that may cause glare or reflections depending on the sun angle, include:

- Steel array mounting - array mounting would be steel or aluminium.
- Temporary site offices, sheds, containerised inverter stations.
- The onsite substation
- Perimeter fencing
- Permanent staff amenities.

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

Cumulative impacts

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

During construction, the additional traffic and dust generation impacts are probably the greatest potential for cumulative visual impacts. The Kidman Way is a high use road corridor carrying a large proportion of heavy and oversized vehicles. Ercildoune Road is unsealed and also carries large vehicles. The visual impact of increased traffic movements to the site and potential dust generation along Ercildoune Road would be predominantly limited to construction (approximately 9-12 months).

The operational view of the solar farm may generate a cumulative impact with the existing substation and powerlines. The array site requires security fencing and steel dominated infrastructure.

Further, at the northern boundary and at any of the proposed site access options, the solar array may add to existing transmission line, road, and fencing infrastructure, to detract from the visual amenity.

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

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

6.4.4 Safeguards and mitigation measures

Table 6-12 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
VA1	• The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape.	Design stage		
VA2	• Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be directed away from the Kidman Way, so as not to cause light spill that may be hazardous to drivers.	C	O	D

C: Construction; O: Operation; D: Decommissioning

6.5 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

The nature of a development determines whether a permanent land use change occurs or whether the development is reversible. Apart from direct uses of the land, such as agriculture, electricity generation or mining, associated impacts, such as the degree of visual impact and traffic regimes, can affect the compatibility of alternative land uses. These issues as they relate to the proposal are discussed below.

6.5.1 Existing environment

Agriculture and land capability

Sheep, beef cattle and grain farming involves 18.5 percent of the population of the Murrumbidgee LGA (ABS, 2011). Rice growing and processing are key industries in Murrumbidgee LGA. “Raised bed" furrow irrigation systems to produce crops such as maize, sweet corn, faba and soybeans is another prominent part of the local agricultural industry. Fruit such as almonds and sugarplums are also grown and processed in the LGA (MSC, 2017).

Although agriculture and the processing of agricultural products are key industries in the Murrumbidgee LGA (MSC, 2017), the proposal area is not mapped as being ***Biophysical Strategic Agricultural Land*** (BSAL) (DPE, 2017) or considered to be ***Prime Agricultural Land***.

Biophysical Strategic Agricultural Land is land that meets specific scientific criteria levels for soil fertility, land and soil capability classes and access to reliable water and rainfall levels. An amendment to the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* gave legal effect to the BSAL (NSW Government, 2014).

Given the proposal area is not located in an area mapped for Important Agricultural Land, land capability mapping has been used to determine whether the proposal area is considered to be Prime Agricultural Land**.** Prime Agricultural Land is considered to have a land capability class of 1 or 2 (Soil Conservation Service of NSW/ Emery, K.A. 1986). Given the proposal area consists of land capability classes 3 and 6, as shown in Figure 6-7, it is not considered to hold Prime Agricultural Land.

Class 3 land includes sloping land that can sustain cultivation on a rotational basis. To prevent soil and land degradation, the limitations of this land must be managed. Class 6 land has very severe limitations for a wide range of land uses. This land is generally only suitable for grazing. There are few management practices available to overcome the limitations of the land (OEH, 2012).

The proposal area is located within the Coleambally Irrigation Area (CIA), which is shown in Figure 6-6. The CIA covers an area of approximately 400,000 hectares, of which approximately 79,000 hectares are intensively irrigated. The CIA is made up of about 491 irrigation farms (Coleambally Irrigation, 2017). The proposal area is equivalent to approximately 0.14 percent of the land area within the CIA.

Surrounding land uses

Land use activities surrounding the proposal area include agriculture with associated rural dwellings, a partially constructed ethanol plant, quarries and an electricity substation. The ethanol plant, shown in Figure 6-5, was approved by Murrumbidgee Shire Council via DA 121213.

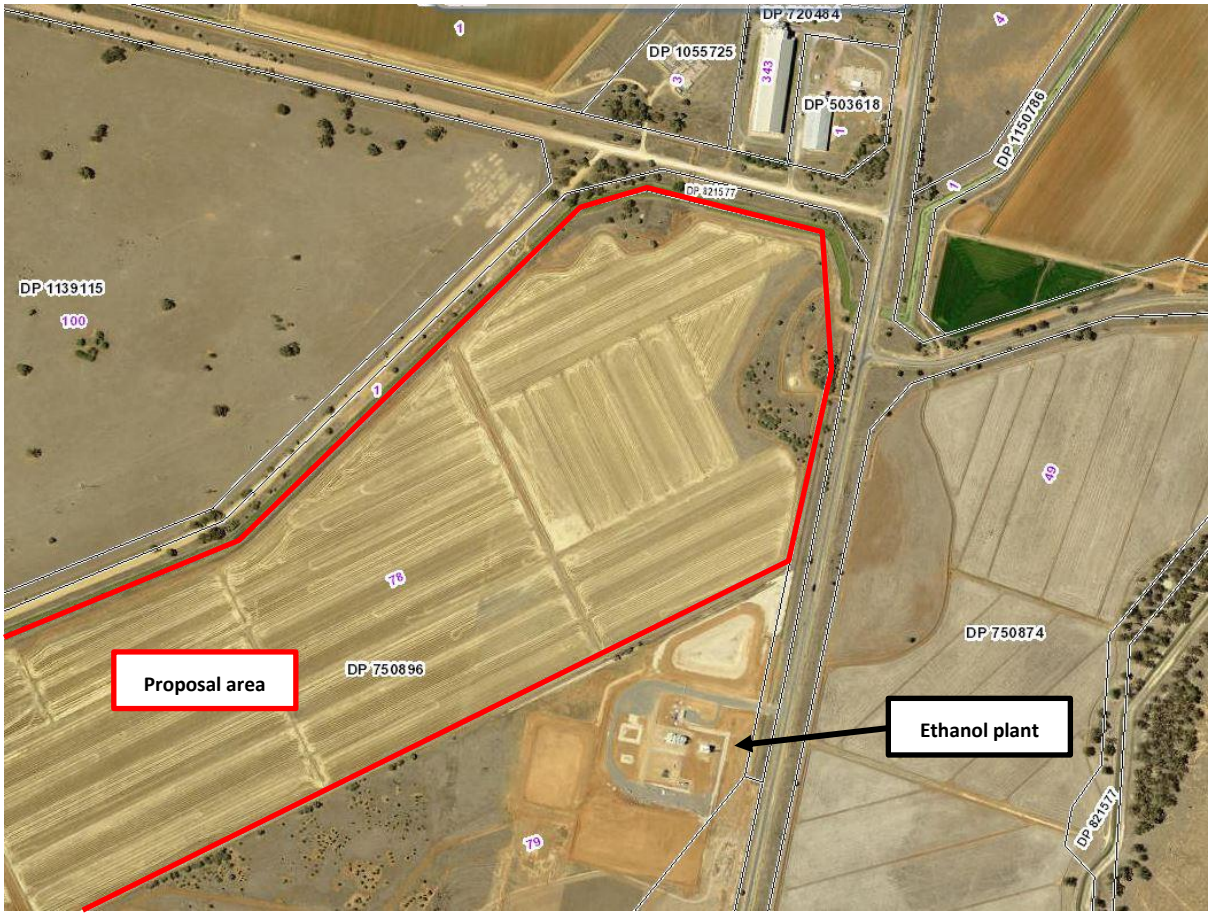

Figure 6-5 Aerial photograph showing ethanol plant construction

Surrounding agricultural land generally consists of cropping and grazing. A 'community farm', operated by a local charity group, is located to the northwest of the substation. It appears to be used for cropping, suggesting low visitation rates.

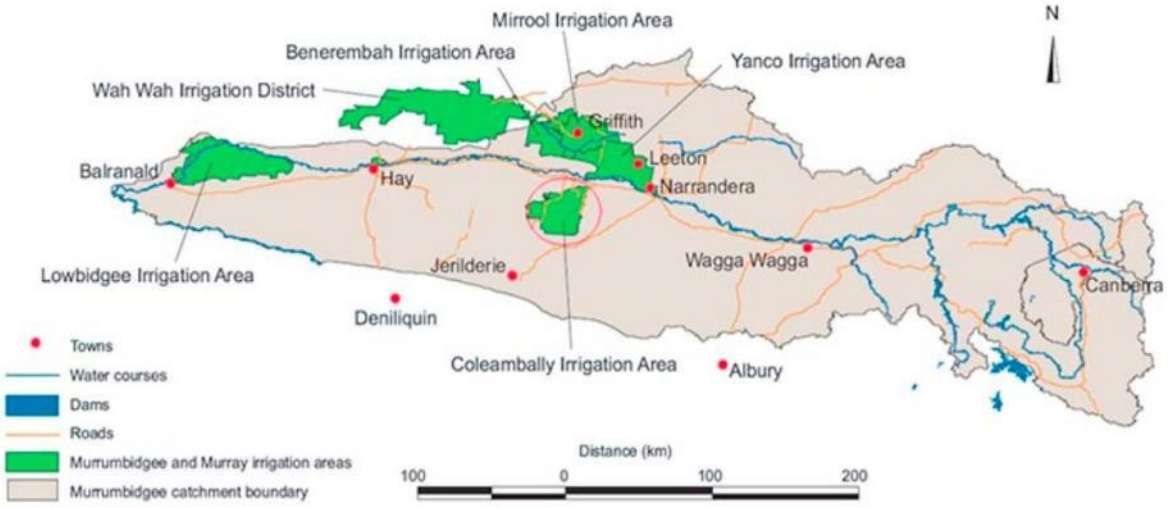

Figure 6-6 Coleambally Irrigation Area map (Source: CSU, 2017)

Figure 6-7 Land capability classes

Coleambally's general industrial zone is located approximately 2.5 kilometres south of the proposal area and the nearest residential zone approximately 3.8 kilometres south of the proposal area.

The proposal area does not hold any mineral exploration licences or licence applications and there are no exploration licences or licence applications within proximity of the proposal area. Figure 6-8 provides mineral and resources mapping for the proposal area and surrounding land. A number of quarries are located near the proposal area (Figure 6-9).

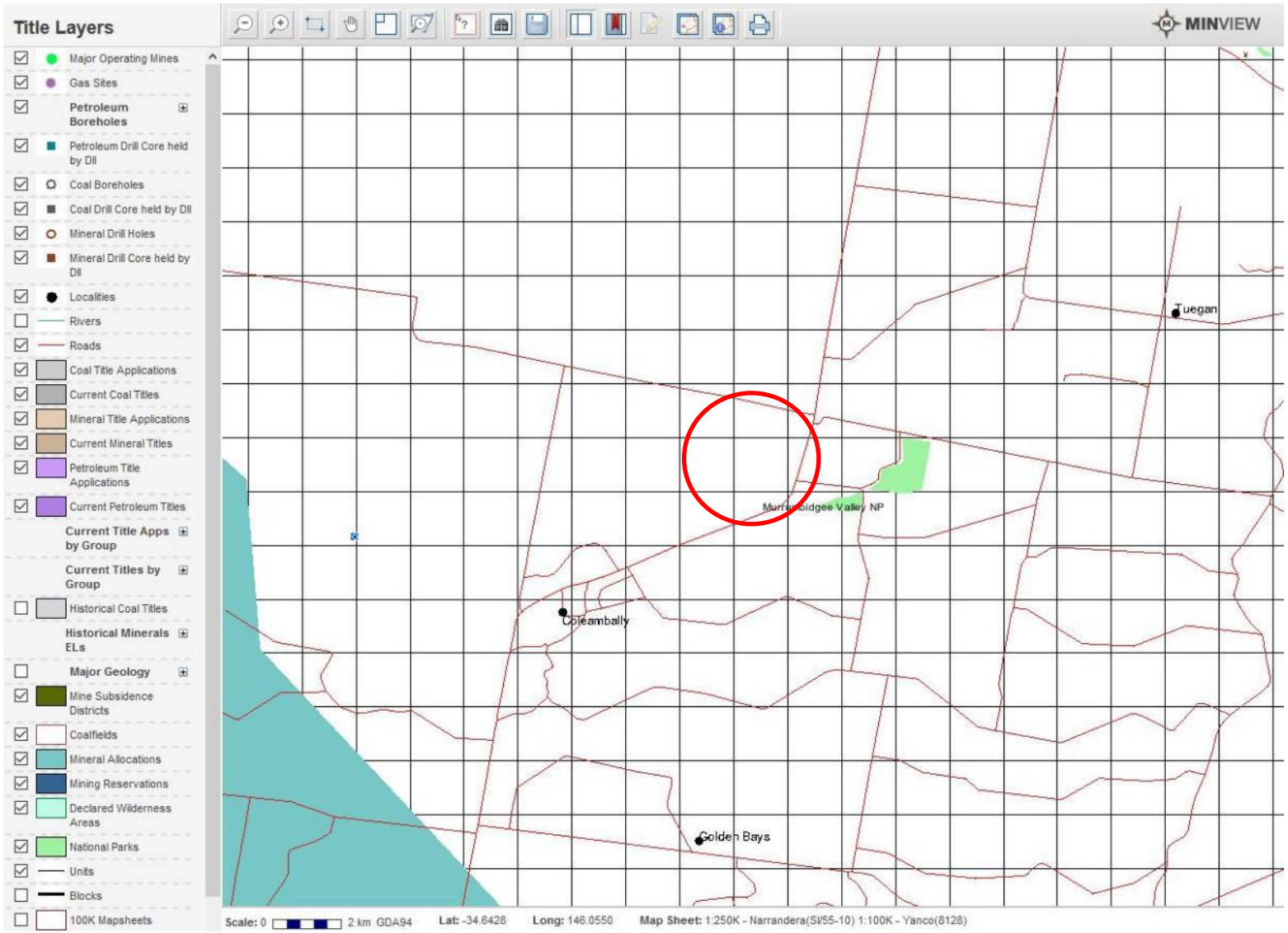

Figure 6-8 Mineral titles and applications near the proposal area (Source: Department of Trade and Investment, 2017). *The proposal area is indicated by red circle*

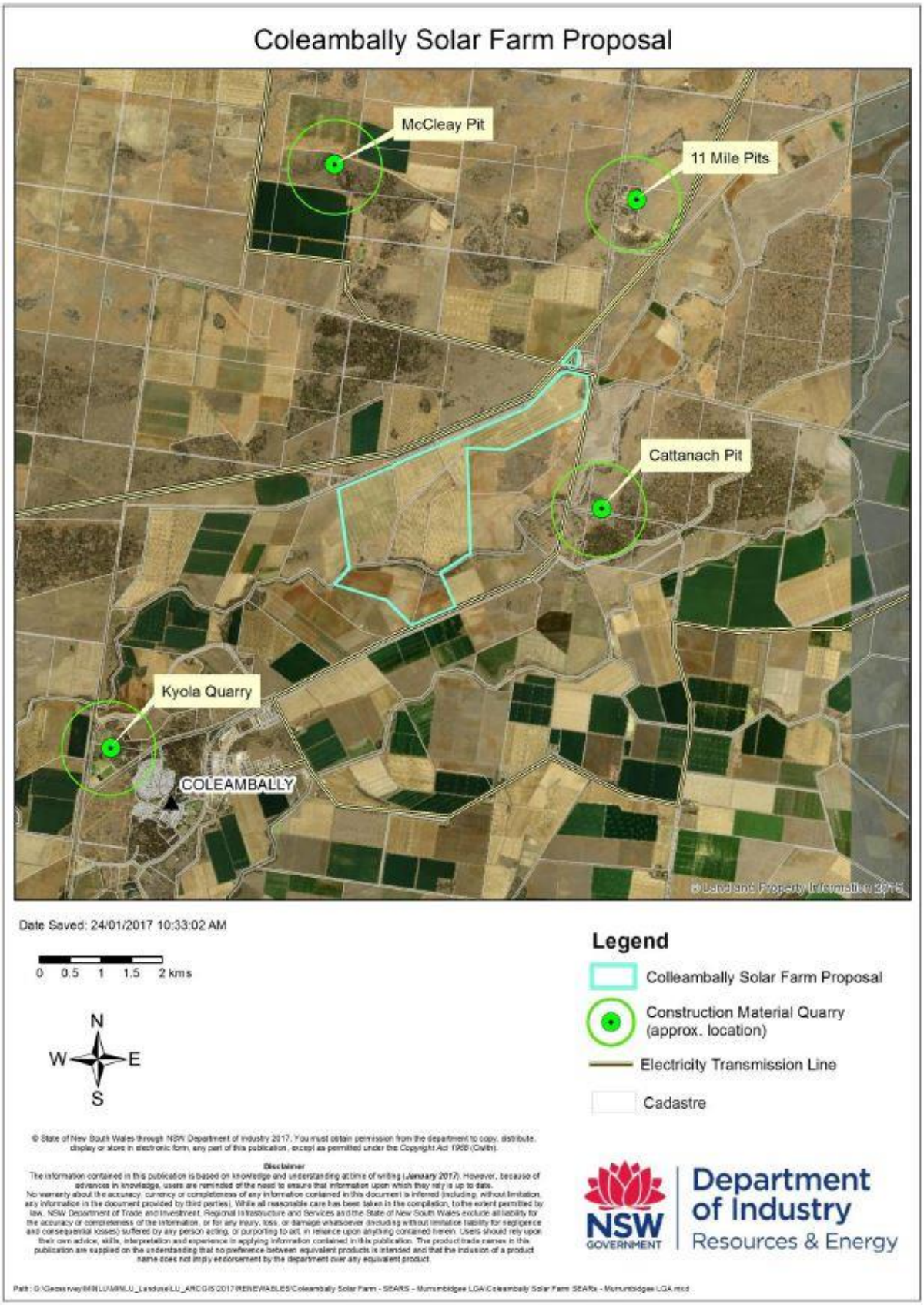

Figure 6-9 Quarry locations (Source: Department of Industry, 2017).

6.5.2 Potential impacts

Land use conflict risk assessment

A land use conflict risk assessment (LUCRA) has been carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). Given the proposed solar farm is different to the surrounding land use activities, primarily agriculture, this assessment aims to identify and rank potential land use conflicts so that they may be adequately managed. Where expected conflicts are adequately managed, the rights of the existing and proposed land uses can be protected.

The risk ranking in Table 6-14 has been determined using the risk ranking matrix shown in Table 6-13, and in accordance with the probability table and measure consequence table in Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011).

Table 6-13 Risk ranking matrix (Source: DPI, 2011)

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

Table 6-14 Land use conflict risk assessment summary

Identified Potential Conflict	Risk Ranking		Management Strategy	Revised Risk Ranking	
Ethanol plant - traffic	D4	5	The ethanol plant access is located along Kidman Way with the solar farm access point along Ercildoune Road. Conflict relating to traffic movements and access are considered unlikely, particularly given once the solar farm is operational traffic movements generated would be negligible.	D4	5
Ethanol plant - resources	E5	1	Given the proposed solar farm would rely on the sun to generate electricity and the ethanol plant produces fuel from grain, there would be no conflict relating to demand of resources.	E5	1
Ethanol plant - EMF	D4	5	Given the low levels of EMF that would be generated be the proposed solar farm, it is considered unlikely that EMF would have an impact on the operation of the ethanol plant.	D4	5

Agricultural spraying (aerial)	D4	5	There is unlikely to be an impact to aerial spraying activities given low levels of glare and the limited height of infrastructure.	D4	5
Contaminated surface water runoff	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generated during the construction and decommissioning stages to be managed by the use of water carts when required. Dust is not expected to generate a land use conflict during operation.	C5	4
Fire/ Bush fire	C1	22	Implementation of a Bush Fire Management Plan would significantly reduce the probability of solar farm operation starting a fire or a bush fire damaging the solar farm infrastructure	D3	9
Visual amenity	C2	18	Screen landscaping along boundaries where identified in Section 6.4 and Figure 3-19 would mitigate expected impact on visual amenity.	D5	2
Noise	C4	8	Noise generated during construction and decommissioning stages would be minimised through the implementation of mitigation measures. Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict.	D4	5
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely however the impact would be temporary and able to be managed (refer to Section 7.3). There are no Travelling Stock Reserves near the proposal area. Given the close proximity of the proposed access point to the Kidman Way and that there is adequate room on the northern side of Ercildoune Road for movement of	C4	8

			stock, it is considered unlikely that traffic movements would generate a land use conflict with movement of local stock. Traffic is not expected to generate a land use conflict during operation.		
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation phases	D4	5

Construction

The expected impact on surrounding land uses during construction is considered to be minimal given the temporary nature of the work and the implementation of mitigation strategies would further reduce the level of impact.

Once construction of the solar farm commences, agricultural activities would cease in the areas involved in access and construction.

There may be some disruption to local traffic, during the construction of the transmission line and due to construction traffic movements, which may impact the operation of surrounding land uses. This would be a temporary impact and could be managed in consultation with local landholders.

There are no Travelling Stock Reserves near the proposal area. Given the close proximity of the proposed access point to the Kidman Way and that there is adequate room on the northern side of Ercildoune Road for movement of stock, it is considered unlikely that traffic movements would generate a land use conflict with movement of local stock. The likelihood of conflict could be further minimised by consulting with local landholders.

Connection to the TransGrid substation and installation of transmission lines would be undertaken in consultation with TransGrid so that the operation and maintenance requirements of the substation are not impacted.

Operation

The potential operational land use impact has been assessed in accordance with guidance provided in *Primefact 1063: Infrastructure proposals on rural land* (DPI 2013) and *The land and soil capability assessment scheme* (OEH 2012).

AGRICULTURAL IMPACTS

The development of a solar farm would potentially result in the following agricultural impacts:

- Limited resource loss associated with each solar panel installation.
- The end of opportunistic cereal cropping at the subject site for the lifetime of the operation.
- A potential reduction in biosecurity, through reduced pest and weed control opportunity.
- Potential bushfire risks if not routinely grazed (DPI 2013).

Upon decommissioning of the solar farm, the proposal area would require rehabilitation to restore it to its pre-existing agricultural condition.

Resource loss and fragmentation

The proposal would not impact on land identified by the NSW Government as BSAL. The proposal would result in the development of a solar farm with an operational life of about 30 years. Construction works involve only minor excavation works with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to section 7.1 and section 7.2 for soil and water quality impacts). At the end of the operational period, solar farm infrastructure would be removed, the land would be rehabilitated to its pre-existing condition and available for agricultural use. The Coleambally Solare Farm would not result in the permanent removal of agricultural land.

The Coleambally Solar Farm has been designed to minimise the development footprint. Additionally, the proposal has been sited close to existing infrastructure avoiding the need to construct a new substation.

Disturbance to farming operations and livestock

Adjacent farming operations are compatible with the proposed Coleambally Solar Farm. Noise from nearby farming practices irrespective of the time of day would not impact on the solar farm. The proposed solar farm construction and decommissioning would largely occur in daylight hours and would not conflict with adjacent farming activity.

Should any surrounding land be used for grazing, after a period of time live stock would become accustomed to the solar panels as they are to hundreds of installations currently on farms around the state.

During operation, the solar farm would be fenced for security. Strategic sheep grazing may be used within the proposal area. The strategic sheep grazing would be used to reduce vegetation biomass and put grazing pressure on weeds adjacent the solar panels.

Increase in biosecurity risks – pest, diseases and weed risks

The Coleambally Solar Farm would result in the increased movement of vehicles and people to the proposal area. Higher numbers would access the proposal area during the construction and decommissioning phases. The primary risk to biosecurity is the spread of weeds that may result from the increased movement of vehicles in and out of the proposal area. Weed seeds can be transported through and from the proposal area on the tyres and undercarriages of vehicles and on the clothing of staff. The risk of weed dispersal would primarily be mitigated by confining vehicle and machinery movements to formed access tracks during all phases of the proposal and implementing a wash down procedure for vehicles entering the proposal area.

To assist in the management of weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on Murrumbidgee Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls. An Operational Weed Management Plan would also be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the proposal area and the importation and spread of weeds through vehicle movements. The plan would also focus on weed control techniques including herbicide and grazing pressure.

Establishment of a temporary construction site compound, specifically rubbish bins containing food, can potentially increase the risk of pest animals at the proposal area (mostly cat and fox). Covered rubbish bins and regular waste removal during construction and operation would minimise this risk by removing the food source. Rabbit and fox numbers would be controlled through targeted pest management during the operational phase of the proposal. Grazing pressure and reduced plant mater would also reduce resources and cover for pest species.

Summary

The duration of the project would be about 30 years. The loss of this amount of agricultural land in the region for this period is not considered a significant loss given:

- The proposal area is not Biophysical Strategic Agricultural Land or Prime Agricultural Land.
- The proposal is highly reversible with all above ground infrastructure being able to be removed to allow current agricultural land use activities to resume.

During operation of the proposal it is considered that all potential land use conflicts could be adequately managed through the implementation of recommended mitigation measures.

MINING IMPACTS

The proposed solar farm is not located within an area that has been identified as a mining resource and there are no current mining exploration licences over the proposal area. Impacts on mining would be negligible. In the long term (after decommissioning), the solar farm infrastructure would be removed and the site would be available for alternative land uses, including for mining purposes, if desirable.

RENEWABLE ENERGY IMPACTS

Given the proposal is for the construction of a solar farm, there would only be positive impacts in relation to renewable energy, such as increased renewable energy generation.

Decommissioning

As the development of the proposal area requires relatively low levels of impact on the soil surface, the proposal is considered to be highly reversible. The following activities, as discussed in section 3.3.7, would be involved in the rehabilitation of the site:

- Gravel from access track construction could be easily removed from the site.
- Compaction of soil from could be reversed through mechanical ripping of the soil.
- Laser-level land surface and irrigation furrows put back into place.

Following decommissioning the rehabilitated site would have similar opportunities for land use as the site currently possesses. At the end of the project, all above ground infrastructure would be removed and current agricultural activities could recommence.

6.5.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 7-12.

Table 6-15 Safeguards and mitigation measures for land use impacts

No.	Safeguards and mitigation measures	C	O	D
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	C	O	D
LU2	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above ground infrastructure.			D

	• Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. • Reinstate irrigation infrastructure in consultation with landowner, including laser levelling and contour/bund reconstruction where required.			
LU4	Prepare a pest and weed management plan to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Murrumbidgee Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	C	O	

C: Construction; O: Operation; D: Decommissioning

6.6 NOISE IMPACTS

6.6.1 Policy setting

Construction noise

The NSW *Interim Construction Noise Guideline* (DECC 2009) deals with managing construction noise impacts. According to the guideline, a quantitative assessment of noise impacts is warranted when works are likely to impact an individual or sensitive land use for more than three weeks in total.

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers. For works undertaken during standard working hours, residences are considered noise affected when construction noise is 10 dB above the rating background level (RBL) and 'highly noise affected' when construction noise is above 75dB (A). For works undertaken outside standard working hours, residences are considered noise affected when construction noise is 5 dB (A) above the RBL.

Operational noise

The NSW Industrial Noise Policy (INP) (EPA 2000) specifies noise criteria to protect the community from excessive intrusive noise. The assessment procedure in terms of the INP has two components:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for particular land uses for residences and other land uses.

According to the NSW INP, the intrusiveness of a mechanical noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the LAeq descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB(A).

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels for rural residential properties as detailed in Table 6-16.

Table 6-16 NSW Industrial Noise Policy amenity goals.

Receiver type	Indicative noise amenity area	Time of day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended maximum
Residence	Rural	Day	50	55
		Evening	45	50

		Night	40	45

6.6.2 Background

Existing environment

In terms of existing noise levels, land uses surrounding the proposal area are generally limited to sheep and cattle grazing on improved irrigated pastures and irrigated agriculture. Noise generating equipment would include irrigation systems such as pumps as well as tractors, quad bikes and 4WD vehicles. These land uses would not create substantial background noise within the area. Noise levels are likely to be concentrated at peak times during a given season determined by farm activities (sowing, spraying and harvest etc).

The surrounding road network would also be a source of noise. The Kidman Way is used by both light and heavy vehicles, including road trains. Given this, it is expected to general a moderate level of noise. The local roads are likely used sporadically by local traffic and occasional heavy vehicles for farm deliveries. These roads would have a low level of noise.

Residential properties are sparsely distributed in the locality (Figure 6-10). Properties in the locality are known to utilise generators and on demand pump pressurised domestic water systems, generating low levels of background noise. The nearest residential dwelling is approximately 920m east of the solar plant boundary.

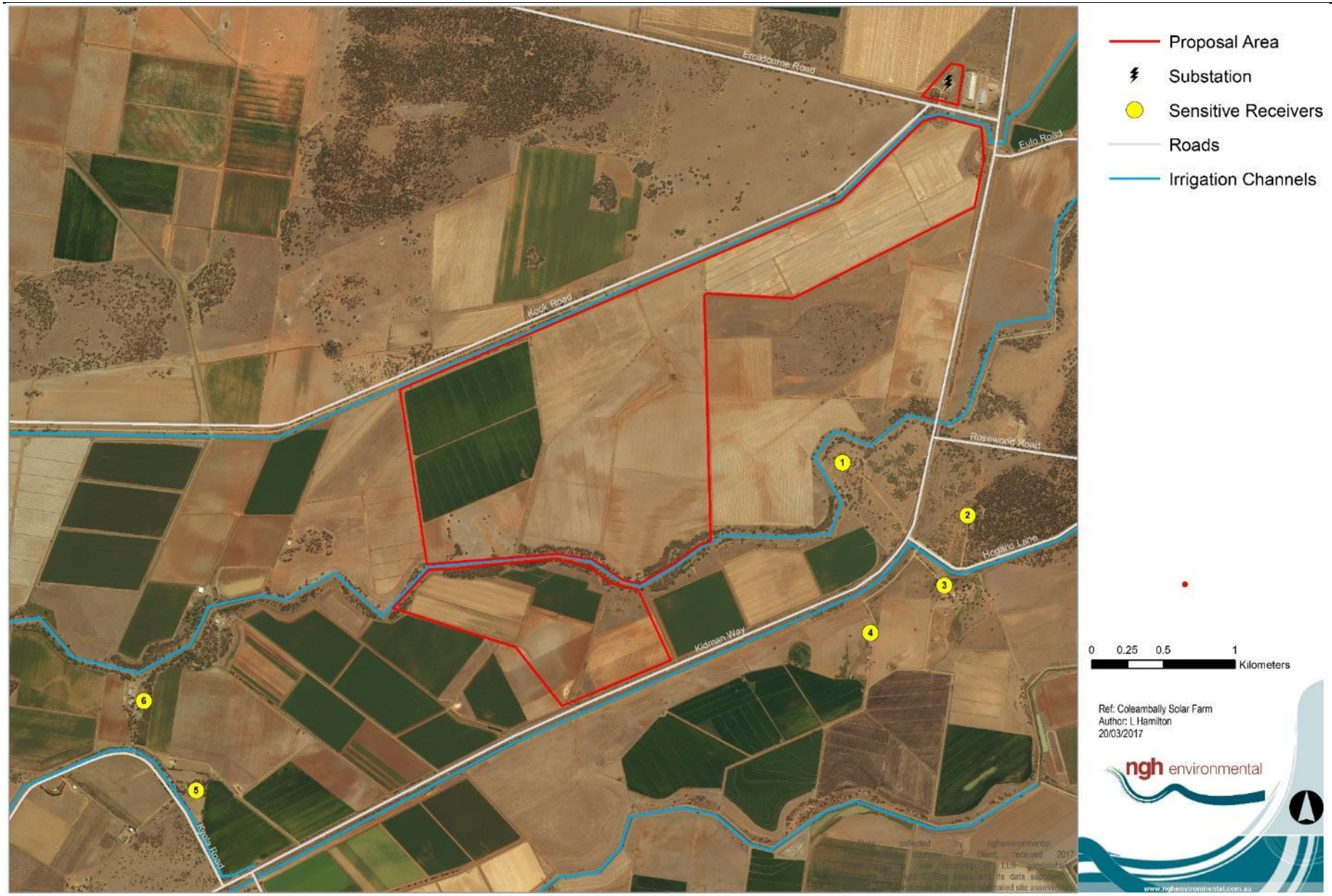

Figure 6-10 Residential receivers near the proposal area

Background noise levels

Background noise levels for the proposal area were assumed in accordance with Australian Standard (AS) 1055.2-1997. The value was adopted by assuming that the area experiences medium density transportation (i.e. relatively low background noise). Table 6-17 provides assumed background noise levels used for this assessment.

Table 6-17 Predicted Background noise level (AS 1055.2-1997)

	Daytime 0700-1800 hrs	Evening 1800-2200 hrs	Night 2200-0700 hrs
R3 Areas with medium density transportation	50 dBA	45 dBA	40 dBA

Sensitive receivers

The estimated distance of the nearest receivers to the proposal area and the proposed substation are shown below in Table 6-18.

Table 6-18 Distance to the nearest receivers to the proposal area

Receiver	Distance (m) from closest proposal boundary	Distance (m) from substation
1	920	2750
2	1814	3030
3	1654	3511
4	1264	3886
5	1904	7216
6	1900	7071

6.6.3 Construction noise impact assessment

Noise management levels

Table 6-19 identifies the adopted construction noise management levels (NMLs) for the nearest noise sensitive receivers (refer to Figure 6-10). The NMLs for the receiver locations are derived from assuming the background noise levels (Table 6-17) and NSW ICNG (DECC 2009) criteria (Table 6-16). Furthermore, during standard construction hours a highly affected noise objective of 75 dB(A) applies at all receivers.

Table 6-19 Construction Noise Management Levels at Residential Recievers

Location description	Day L_{A90} Background Noise Level (RBL)	Day NML L_{A90} (15min)	Evening NML L_{A90} (15min)	Night NML L_{A90} (15min)
All residential receivers	50	60	55	50

Construction noise sources

Noise impact predictions on each sensitive receiver were conducted. The predictions have taken into account the typical noise levels of construction equipment likely to be used for the construction phase as a worst-case scenario with all plant listed in Table 6-20 operating simultaneously.

Table 6-20 Construction equipment sound power levels

Equipment used	Sound power level (dBA) LAeq
Fixed Crane	113
Front End Loader	113
Pile drilling rig	111
Grader	110
Vibratory Roller	109
Concrete Truck	109
Delivery Truck	108
Water Cart	107
Concrete Pump	105
Backhoe	111
Power Generator	103
Concrete Vibrator	103
Light vehicles (eg 4WD)	103

The sound power levels for the equipment presented in the above table are sourced from the Australian Standard 2436 – 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites'; the Interim Construction Noise Guidelines (ICNG), information from past projects and information held in the NGH database.

Construction noise assessment

Using the sound power levels construction noise levels have been predicted (Table 6-21). The noise predictions at the nearest receivers were calculated based on noise attenuation with distance from source. They do not take into account any obstacles between the source nor weather conditions which can influence the level of noise perceived. Furthermore, noise has been predicted based on all construction plant working concurrently (worst case scenario).

Table 6-21 Predicted noise levels at each receiver, scenario 1 (construction of solar plant)

Receiver	Distance (m) from project boundary (Approximate)	Predicted Construction Noise Level (dBA) Worst case scenario with all plant working simultaneously	Daytime NML (dBA) (+10 dBA)	Evening & Night NML (dBA +5dBA)
1	920	53 dBA	60 dBA	55 dBA
2	1814	47 dBA	60 dBA	55 dBA
3	1654	48 dBA	60 dBA	55 dBA
4	1264	50 dBA	60 dBA	55 dBA
5	1904	46 dBA	60 dBA	55 dBA
6	1900	46 dBA	60 dBA	55 dBA

The predicted noise levels from the proposed works at the nearest sensitive receiver, with all construction plant working concurrently for would be around 53 dBA. Based on the noise attenuation modelling, the

construction activities are unlikely to exceed the Noise Management Level for standard or evening work hours at any of the receivers during construction (Table 6-21).

The connection of the powerlines to the existing substation would occur over three days with work being undertaken between 12am and 5am. Any noise impacts from this activity would be short term. The predicted noise levels from the proposed powerline works at the nearest sensitive receiver have been modelled (Table 6-22).

Table 6-22 Predicted noise levels at each receiver, scenario 2 (connection of powerlines to the substation)

Receiver	Distance (m) from substation (Approximate)	Predicted Construction Noise Level (dBA) Worst case scenario with all plant working simultaneously	night NML (dBA +5dBA)
1	2750	31 dBA	45 dBA
2	3030	30 dBA	45 dBA
3	3511	29 dBA	45 dBA
4	3886	28 dBA	45 dBA
5	7216	23 dBA	45 dBA
6	7071	23 dBA	45 dBA

Noise from the construction of the powerline at the nearest sensitive receiver is predicted to be around 41 dBA. Based on the noise attenuation modelling, the construction activities are unlikely to exceed the Noise Management Level (45 dBA) for night works at any of the receivers during the construction of the powerline.

Works would be undertaken in a rural environment where there is a low level of background noise. The works are likely to generate a small amount of short-term local noise pollution from the operation of machinery and plant, and the unloading of trucks with construction materials. The works would be undertaken during normal working hours (connection to substation an exception) and are not likely to cause undue concern to sensitive noise receivers.

6.6.4 Operation noise assessment

During operation, sources of noise from the solar farm would be from the electrical substation, on-site transformers, tracking actuators and occasional maintenance activities.

Solar plant

CRITERIA

In accordance with the INP, noise impact should be assessed in terms of both intrusiveness and amenity.

According to the NSW INP, the intrusiveness of a mechanical noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB(A). Based on the monitored

background noise levels, the intrusiveness noise criteria would be 30 + 5 = 35 dB(A) for day, evening and night.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels for rural residential properties as detailed in Table 6-23.

Table 6-23 Applicable amenity noise criteria

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Amenity Noise Level	
			Acceptable	Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

Comparing the amenity and the intrusiveness criteria shows that the intrusiveness criteria are more stringent for day, evening and night periods. Compliance with the intrusiveness criteria would result in compliance with the amenity criteria. Therefore, the intrusiveness criteria would be assessed for from herein.

NOISE ASSESSMENT

Noise from the operation of the solar farm would be generated by:

1. The solar substation
2. Maintenance activities
3. Tracking of the solar panels

The existing substation is located north of the proposal area, with power generated in the solar plant connected via a 132kv transmission line. Given that all noise sensitive receivers are greater than 2750 metres from the substation, noise from the substation is considered to be inaudible. The upgrade on the existing substation does not involve the addition of transformer or any equipment that would increase the existing noise level of the substation.

The solar substation would contain 1 or 2 transformers, and transform the 33 kv from the PV Panels to 132 kv for transmission to the substation. Australian Standard AS 60076 Part 10 2009 *"Power Transformers – Determination of Sound Levels"* specifies applicable sound power limits for all transformers based on the transformer rating (in MVA). Whilst the MVA rating of the solar substation is not yet available, a conservative assumption is provided below based on two 150 MVA facilities. It is expected that the sound power output from each facility would not exceed 95dBA. Based on a distance attenuation model, the predicted noise level at the closest property (1280 metres north of the solar plant's substation, ancillary Area B) from the solar substation would be 28 dBA, which at ambient background noise levels.

During operations, about 7 staff will be required on-site to operate and maintain the solar plant. Road noise from maintenance vehicle access will be infrequent with up to 7 vehicles accessing the proposal area per day (14 vehicle movements). Noise from the maintenance works would mostly be due to infrequent maintenance activities conducted inside a maintenance building located in the north-eastern corner of the proposal area. As such, noise from any maintenance works will be intermittent and occur during the day only. Given the large distance from the proposal area to the surrounding receivers, noise from scheduled

maintenance works is expected to be well below the NSW Industrial Noise Policy (INP) criteria. To provide an indicative assessment example of a maintenance activity, noise from light vehicles moving around the proposal area and people talking would result in a level of 8 dBA at the nearest residential receptor, which is well below the corresponding background noise level and considered inaudible.

The solar panels would be either on single-axis trackers (which would have approximately 7900 tracker units), north-oriented fixed-tilt, east-west facing fixed-tilt or a combination of these technologies. Of the three options the highest noise generating operation is the single axis-tilt trackers, as this tracking involves the panels being driven by motors to track the arc of the sun to maximise the solar effect. Therefore, the tracking motors are a potential source of mechanical noise and have been assessed here. The tracking motors would be evenly distributed across the proposal area. The tracking motors would turn no more than five degrees every 15 minutes and would operate no more than one minute out of every 15-minute period.

In addition to the above and in accordance with the INP, where the character of the noise in question is assessed as particularly annoying (low frequency or impulsive) then an increase of 5dB(A) for each annoyance aspect up to a total of 10dB(A) is to be added to the predicted value.

The predicted noise levels for the worst-case scenario at the nearest receiver, based on the concurrent operation of all of the tracking motors, the solar substation and maintenance activities is shown below.

Table 6-24 Predicted operational noise levels at the closest receiver

Receiver	Intrusiveness criteria Daytime LAeq + 5 dBA	Predicted operational noise levels, LAeq, 15 min	Comply? Y?N
1 **920m**	55	51	Y

Sleep disturbance

In accordance with the NSW EPA, Industrial noise Policy, the sleep disturbance criteria for the proposal is 15 dB (A) above the background noise level (Table 6-17). The sleep disturbance criteria above which sleep disturbance may occur is therefore 55dB (A).

During the night-time period, only mechanical plant would be operating, limited to tracking motors in the evening and invertors/transformers. Noise emissions from these plant are considered to be continuous with limited potential for peak noise increases. Therefore it is expected that noise levels at the closest receivers would be well below the sleep disturbance criteria.

Transmission line

Noise emissions from operational transmission lines can include aeolian and corona discharge noise. In the context of this proposal, aeolian noise could be generated when wind passes over transmission poles or lines. This type of noise is generally infrequent and is dependent on wind direction and velocity. Wind must be steady and perpendicular to the line to cause aeolian vibration. Given the distance to the closest sensitive receiver (920 metres), aeolian noise impacts are expected to be negligible.

SLR Consulting have previously measured corona noise (reference GEHA Report 045-109/2 dated 9 November 2004, pers. comm. I. Fricker December 2012) at a site near Officer in outer Melbourne, Victoria. SLR found it possible to measure corona noise at close distances, at high frequencies only, as

other noise sources, namely traffic and birds, caused some interference at times. A 500 kV line was measured during damp foggy conditions.

At a distance of 30 metres along the ground from the line an L_{eq} noise level of approximately 44 dBA was measured. At a distance of 100 metres the corona noise was calculated to be approximately 39 dBA. Assuming a minimum night time RBL value of 30 dBA, the minimum intrusive criteria as determined by the NSW Industrial Noise Policy (INP) would be 35 dBA. SLR therefore conservatively estimates that the minimum criteria level of 35 dBA would be complied with at a distance of 240 metres. The proposed transmission line is further than this distance from the closest receiver and hence any occasional corona noise would comply with the NSW INP minimum limit at all residential receivers.

Given the transmission line between the existing substation and the project site would be underground there would be no impact from these types of noise emissions.

6.6.5 Vibration

The NSW guideline Assessing Vibration: A Technical Guideline (DEC 2006) is designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. Sources of vibration covered in this guideline include construction and excavation equipment, rail and road traffic, and industrial machinery.

Based on the proposed plant items listed in Table 6-20 vibration generated by construction plant was estimated and potential vibration impacts summarised in Table 6-25.

Table 6-25 Potential impact from vibration to the two closest sensitive receivers

Receiver	Distance (m) from site proposal (Approximate)	Type of receiver	Level of risk for potential impact	Monitoring required
1	920	Residential	Very low	Not Required
4	1264	Residential	Very low	Not Required

No operational ground vibration sources have been identified that are likely to generate ground vibration impacts at the nearest residential dwellings (920 metres). Potential vibration impacts from operation are therefore not assessed any further.

6.6.6 Safeguards and mitigation measures

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 7am to 6pm • Saturday 8am to 1pm • No work on Sundays or public holidays	C		
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	C	O	D

No.	Mitigation strategies	C	O	D
NS3	A letter box drop would be prepared and provided to residences in close proximity to the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	C	O	D
NS4	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	C	O	D

C: Construction; O: Operation; D: Decommissioning

7 ASSESSMENT OF ADDITIONAL ISSUES

7.1 SOIL

7.1.1 Existing environment

Soils, landforms and geology

The landscape of the Coleambally irrigation area is an alluvial plain built up of sediments from ancient streams. These sedimentary deposits are interbedded with wind-blown clay deposits known as parna. There have been 94 different soil types mapped in the Coleambally Irrigation Area, however a report of the Coleambally Irrigation Area and Murray Irrigation Area has categorised the soils into five main groups (Hornbuckle & Christen, 1999). These five groups are:

1. Clays
2. Red Brown Earths
3. Transitional Red Brown Earths
4. Sands over Clay
5. Deep sands

A search of the CSIRO ASRIS and NSW OEH E-Spade databases identified two soil orders occurring within the proposal area including, vertosols which dominate the site and a small area classified as Rudosol.

Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates. They have a clay field texture of 35% or more clay throughout the solum (CSIRO, 2002).

Rudosols are soils that have negligible pedologic organisation. They are usually young soils in the sense that soil forming factors have had little time to pedologically modify parent rocks or sediments. The component soils can obviously vary widely in terms of texture and depth. Many are stratified and some are highly saline (CSIRO, 2002).

Soil profile records located using NSW OEH E-spade indicate a number of soil types including Self mulching grey vertosol, Black Earth, Red Brown Earth, and Calcic Red Chromosol occurring within 1 kilometre of the proposal area. During the field survey, these soils were visible after recent excavation works. The black earths can be seen in Figure 3-3.

Table 7-1 Soil types in the proposal area

Soil types	Location	Description/Limitations
Transitional Red Brown Earths	This is the dominant soil across the proposal area	Transitional red brown earths are soils between clays and red-brown earths. The topsoils of transitional red brown earths are shallower and of finer texture (higher clay) than those of red brown earths. Waterlogging is more likely in transitional red brown earths because of the shallower topsoil. Transitional red brown earths are usually found near flood plains. The soils have low subsoil permeability with increased waterlogging due to the shallow top soil and clay subsoil. Erodibility is moderate in these soils due to the clay content.

Soil types	Location	Description/Limitations
Black Earth (Black vertosol)	Was observed in the north east of the proposal area	Soil material with a clayey field texture (ie. light clay, medium clay, heavy clay) or 35% or more clay, which cracks strongly when dry and has slickensides and/or lenticular peds. The soils have low subsoil permeability with increased waterlogging due to the shallow top soil and clay subsoil. Erodibility is moderate in these soils due to the clay content.
Clays (Self mulching grey vertosol)	Grey soils were observed in patches throughout the proposal area including along the drainage canal associated with the Black Box Woodland.	Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates. These crumbly soils show virtually no change in texture from the surface downward with approximately 50-60% clay throughout. In some instances, the surface soil may be somewhat crusted but usually the crust is easily broken up. All soil profiles have in common very aggregated and dense subsoil. The soils have low subsoil permeability with increased waterlogging due to the shallow top soil and clay subsoil. Erodibility is moderate in these soils due to the clay content.

It is expected that soils in the proposal area are at a moderate risk of erosion due to previous vegetation clearing and regular earth moving activities. The soil types described have a high clay content and at least a clay subsoil layer resulting less erosion potential than that of sandy soils. However, they have reduced permeability often retaining water in the profile for longer periods.

Acid sulfate soils

The proposal area has a low probability of occurrence of acid sulfate soils.

Sodic soils

Given the proposal area has been under irrigation, it is considered that the soil has the potential to be sodic.

Potential contamination

A search of the OEH contaminated land public record (NSW Government, 2016a) was undertaken for contaminated sites within the Murrumbidgee LGA on 07 March 2017. The search returned no results for contaminated land within the Murrumbidgee LGA.

There is a risk that contamination associated with agricultural activities (e.g., use and storage of pesticides) could be present in the proposal area. However, no evidence of contamination was observed during the field work and this risk is considered very low. If contamination is identified during construction, it would be managed in accordance with a Construction Environmental Management Plan (CEMP).

7.1.2 Potential impacts

Construction and decommissioning

SOIL IMPACTS

Construction activities, such as excavation and earthworks, have the potential to disturb soils, cause soil erosion and subsequent sedimentation. The following earth moving activities are required as part of the proposal:

- Construction of internal access roads, compound, lay down and parking areas.
- Construction of the site access point(s) and associated road improvement works.
- Construction of underground transmission line.
- Possible levelling of minor irrigation infrastructure.
- Possible re-location of an irrigation channel.
- Trenching for underground cabling.
- Construction of a drainage crossing.
- Extraction of soil from borrow pit for substation extension construction.

These activities would remove the existing ground cover and disturb soils, potentially decreasing their stability and increasing susceptibility to erosion. The use of construction vehicles following rain could also increase the risk of soil erosion or soil loss. Due to the active cultivation of the site, in many areas the soils are heavily exposed and disturbed from agricultural practices.

Erosion and sedimentation impacts associated with soil disturbance from the construction and decommissioning activities can be minimised by undertaking such works in accordance with provisions of the Managing Urban Stormwater: Soils and Construction series, in particular:

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

Overall, the risk of erosion is considered low. With limited topographic relief, runoff containing sediment is considered to be readily manageable and unlikely to cause any impact on natural waterways.

Soil compaction would occur as hardstands and internal access roads are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. During excavations mixing of different soil horizons can retard plant growth due to inadequate top soil layer. Overall, these impacts would occur in small, discreet parts of the proposal area and are not considered substantial.

Pile driving/screwing of steel posts supporting the arrays as well as installation of fencing uses light equipment within a small and discrete footprint and is unlikely to result in substantial disturbance of soils. The areas of disturbance would be sparsely distributed and groundcover would be retained as far as possible prior to, during and post-construction. Dust may be generated through the movement of construction vehicles. Impacts of dust are discussed in further detail in Section 7.4.

The use of fuels and other chemicals onsite pose a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. When mobilised, such as in a rain event or flooding, the substances may spread via local drainage lines, affecting much larger areas including aquatic habitat. Overall, these risks are low and considered readily manageable.

Given the soil has the potential to be sodic, it is recommended that the soil be tested for clay content, CEC and EC to determine if the application of gypsum to the soil is required while trenching.

Operation

SOIL IMPACTS

Minimal impacts to soils would occur during operation. Maintenance activities and vehicles would be largely confined to the formalised access tracks. There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), requiring the development of emergency protocols (refer to Section 7.2.3). Erosion of the access tracks could occur over time, although this is considered to be readily manageable through regular maintenance.

The potential for wind erosion (dust generation) during maintenance activities would be low given the ability to stabilise soils exposed during and after construction. Areas that were temporarily used during construction (e.g. laydown and construction parking areas) would be rehabilitated.

Concentrated runoff from the solar panels could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts. Retaining vegetation cover would assist in reducing potential for erosion from rainfall run-off. Monitoring would be required to address any bare areas and erosion that develop, either by vegetation (grass seeding) where possible, or armouring with materials such as jute mesh if vegetation cannot be maintained.

7.1.3 Safeguards and mitigation measures

Activities with potential for adverse soil impacts would be managed through the development and implementation of site specific sediment control plans and spill controls, as detailed below.

Table 7-2 Safeguards and mitigation measures for soil impacts

No.	Safeguards and mitigation measures	C	O	D
SO1	A Ground Cover Management Plan would be developed to address soil erosion, fire control and biodiversity issues. The plan would include monitoring and triggers for action to address issues arising from erosion that develops during operation.		**O**	
SO2	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as: • At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads.	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	• In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately, so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction.			
SO3	A Spill Response Plan would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation). • A protocol would be developed in relation to discovering buried contaminants within the proposal area (e.g. pesticide containers if any). It would include stop work, remediation and disposal requirements.	**C**	**O**	**D**
SO4	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposal area. This includes dust from stockpiled materials.	**C**	**O**	**D**
SO5	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored back to original condition or re-vegetated with native plants.		**O**	
SO6	Soil must be tested for clay content, CEC and EC prior to commencement of construction work to determine whether the application of gypsum is required while trenching and the rate of application.	**C**		

C: Construction; O: Operation; D: Decommissioning

7.2 WATER USE AND WATER QUALITY (SURFACE AND GROUNDWATER) AND HYDROLOGY

7.2.1 Existing environment

Surface water

The proposal area is located in the Riverina Local Land Services area within the Murrumbidgee River Catchment. The nearest natural water course is Cooinbil Creek located about 16 kilometres north west of the proposal area. The Murrumbidgee River is located about 21 kilometres to the north east.

The proposal area is located on flat and low lying land. This has allowed the site to be suitable as an irrigation farming enterprise, as part of the Coleambally Irrigation Area. Irrigation channels transverse the proposal area which are fed from a main channel (Tubbo Channel) which runs along the north-west boundary. A drainage channel also runs through the centre of the proposal area. Currently there is temporary access across this channel.

There is one farm dam located within the northern portion of the proposal area (refer Figure 7-1 and appendix B).

Figure 7-1 Farm dam near the central paddock looking north.

Groundwater

There are no ground water bores located within the proposal area. Coleambally Irrigation Cooperation Limited (CICL) has conducted ground water works around the proposal area, with water attained for all test bores. Two monitoring bores are located in the north east of the proposal area (Figure 7-2). There is potential for a bore water source to be created to address water resourcing as part of the proposal.

The proposal area is located in an area mapped as having groundwater vulnerability under the Murrumbidgee LEP.

Figure 7-2 Groundwater works in the area (NSW DPI, 2016). *The proposal area boundary is indicated by the red line. Monitoring bores are indicated by the yellow boxes.*

Groundwater Dependent Ecosystems (GDEs)

Potential GDEs within the vicinity of the proposal area are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2017). There are no GDE's listed within 10 kilometres of the proposal area. Murrumbidgee River, located about 21 kilometres to the north east, is listed as a GDE as it interacts with groundwater. There are no High Priority GDEs in close proximity to the proposal area. There is low to moderate potential for ground water interaction in areas north of the proposal area (Figure 7-3).

Surface hydrology and flooding

The proposal area is located within the Murrumbidgee River Catchment. The site is very flat with elevation ranging from 118 metres to 122 metres.

The proposal area does not occur on Flood Prone Land (Murrumbidgee LEP, 2012). Irrigation infrastructure within the proposal area allows the control of surface water. In the unlikely event of storm water flooding, where water may pool from heavy rainfall events, the solar farm infrastructure would likely remain stable. The development of the solar farm is unlikely to increase any impacts associated with flooding of the area.

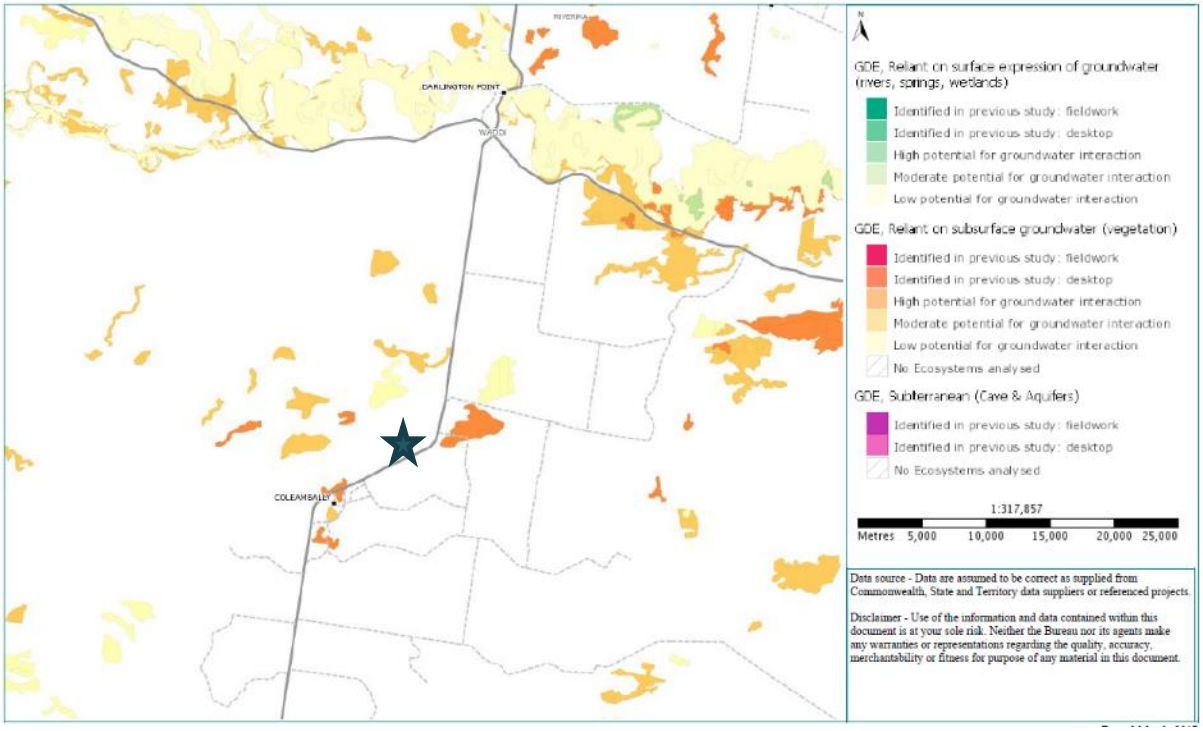

Figure 7-3 GDEs in proximity to the proposal area (BOM, 2017). Blue star indicates location of proposal area.

Water entitlement

The proposal area is located within the Coleambally Irrigation District (CID). The district encompasses 491 irrigation farms which are typically 200ha in size. These farms employ very sophisticated layouts and recycling systems to ensure a high level of water efficiency. Irrigation water is delivered across an area of approximately 400,000ha of which only 79,000ha is intensively irrigated (DPI Water, 2016).

Water is diverted to the irrigation area from the Murrumbidgee River through 41 kilometres of main canal and 518 kilometres of supply channels (DPI Water, 2016). It is drained by three major drainage channels covering some 734 kilometres: the Coleambally Outfall Drain which heads west to join Billabong Creek just upstream of Darlot; DC800 which heads south to join Yanco Creek; and the Catchment Drain which heads east to join Yanco Creek (Green, Petrovic, Moss, Burrell, 2011).

Water entitlement, such as a water license, refers to an ongoing entitlement to exclusively access a share of water. Under the 2004 National Water Initiative (NWI), a water access entitlement is required for any productive use of water. It is defined as a permanent share of the consumptive pool of a water resource system as defined under a water sharing plan (Murrumbidgee Irrigation, 2015).

A water allocation refers to the specific volume of water that is allocated to water access entitlements in a given season. Water allocations are made by the NSW Office of Water at the start of each water year (July), and from time to time during the year. General security licenses are usually held by broad acre irrigators who farm vegetables, cereal crops, rice and livestock. As of 15th November 2016, allocations for Murrumbidgee general security licences holders have reached full entitlement. High security licenses holders receive a share of 362 GL and general security license holders receive a share of 1518 GL (DPI Water, 2016).

7.2.2 Potential impacts

Construction and decommissioning

WATER USE

Water use during the construction phase would be minimal and mainly for dust suppression on unsealed roads and for the construction of access roads. This water requirement is likely to vary depending on weather conditions such as rainfall and wind and is estimated to be up to 401,500kL in total. Potable water requirements for staff and workers would be approximately 80 kL (refer Table 7-3).

Table 7-3 Water requirements during construction

Water quality	Annual construction water requirement (kL)	Potential sources	Availability
Potable (drinking)	80 kL (for ~9 months)	Bottled water	Available as required – commercial supply
Non-potable	401,500 (for ~9 months)	Truck delivery Irrigation channel Groundwater bore	Available as required

The proposed solar farm is currently assessing a number of options for sourcing water for the construction and operation of the solar farm including:

- Trucking water in from a water stand.
- Utilising the current water licence to extract water from the irrigation channel.
- Negotiating commercial arrangements with local water supply authorities (CICL and Office of Water).
- Applying for a ground water extraction license.

The provision of potable water and wastewater infrastructure would be confirmed during the detailed design phase of the proposal.

The development is unlikely to impact on adjacent licensed water users or land-holders basic rights.

Impacts on water use during the decommissioning would be similar to those during construction. They are considered low risk and would be managed using standard measures.

SURFACE WATER QUALITY

The proposal would not directly affect surface water quality.

Indirectly, the proposed works would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff, affecting local water ways including the irrigation channels, during rainfall events. This is discussed in Section 7.1 and are unlikely to cause substantial water quality impacts.

The use of fuels and other chemicals on site pose a risk of surface water contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and herbicides, none of which are considered difficult to manage.

Detention ponds, if required to manage surface water during construction and operation, will be detailed in the design phase, specific to the array layout.

GROUNDWATER

No Groundwater Dependent Ecosystems (GDEs) are known to occur within the proposal area. It is unlikely that ground water would be extracted during construction.

Although the proposal area is mapped as having groundwater vulnerability under the Murrumbidgee LEP, it is considered that the proposal would have negligible impact on groundwater quality given the low pollution potential of the solar farm.

Impact to ground water as a result of the proposed works is unlikely.

Operation

WATER USE

Water use volumes during operation would be minimal, approximately 1,500kL per year. Water would be required for staff amenities at the control and maintenance building and for panel cleaning. Requirements would be extremely minor except for cleaning which is fully dependant on weather. Some solar plants are never cleaned, others require more than two cleanings per year. Should water be required, it would be sourced from the proposal area or trucked in from a standpipe.

The toilet facilities would be connected to a septic tank installed in line with Murrumbidgee Council requirements.

WATER QUALITY

During operation, there is minimal potential for any impact to surface water quality. Appropriate drainage features would be constructed along internal access roads and irrigation channels to minimise the risks of dirty water leaving the site or entering waterways. With the exception of internal roads, parking areas and areas around site offices, the site would be largely vegetated with grass cover. Risks to water quality impacts during operation would therefore be low.

There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented.

GROUNDWATER

No operational activities would affect groundwater. There would be no impacts to GDEs during operation.

7.2.3 Safeguards and mitigation measures

Table 7-4 Safeguards and mitigation measures for water quality impacts

No.	Safeguards and mitigation measures	C	O	D
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	**C**	**O**	**D**
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	**C**	**O**	**D**
WA3	Adequate incident management procedures will be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	**C**	**O**	**D**
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

7.3 TRAFFIC, TRANSPORT AND ROAD SAFETY

7.3.1 Existing environment

Regional road network

Coleambally is located on the Kidman Way (B87) between Jerilderie and Darlington Point. Kidman Way is a state-controlled rural highway running north-south through southern NSW, extending from Bourke at its northern end all the way to its connection to the Newell Highway at the southern end near Jerilderie, a total distance of approximately 640km. It is a designated B-Double route and also an approved Road Train route. The speed limit varies along the route, with a maximum posted speed limit of 80 or 100km/h occurring outside urban areas (RoadNet, 2015).

The Kidman Way is of vital importance to communities living in towns within central NSW. The sealing of Kidman Way in 1999 provided a complete sealed road between Melbourne and Darwin (Kidman Way, 2017). Kidman Way would experience traffic from freight and livestock transporters, agricultural machinery, caravaners, and holiday makers, emergency services and local traffic. Council road traffic data for the Kidman Way between Darlington Point and Coleambally states an annual average daily traffic (AADT) of 1370 vehicles with a heavy vehicle proportion of 30%.

The Kidman Way runs adjacent to the south of the proposal area for about 500 metres, and connects back at the north east of the proposal area for about 600 metres before the intersection of Ercildoune Road. Road use increases during periods such as grain harvest.

There are no railway lines located within 10 kilometres of the proposal area.

Local road network

Kook Road intersects with Ercildoune Road and runs south along the northern border of the proposal area for about 4 kilometres. This road is unsealed and managed by the Murrumbidgee Council. The road is primarily used by local traffic, with a speed limit of 100 km/hr.

Ercildoune Road runs along the north-eastern boundary for about 400 metres. This is a low use unsealed local road managed by Murrumbidgee Council. This road is primarily used by local traffic, with a speed limit of 100 km/hr. Site access to the Coleambally Solar farm during construction and operation is proposed from this road, as shown in Appendix B.

Existing farm access points, one along Kook Road and one along Kidman Way, as shown in Appendix B, would be retained for emergency access.

7.3.2 Potential impacts

Proposal requirements

Access requirements can be separated into the following categories:

- Cars - would be required by project management staff and site workers to access the site. Cars would make up the largest proportion of vehicles accessing the site.
- Buses – would be used to transport workers to and from the site to minimise traffic volumes and transit risks during construction.
- Utility vehicles – would be required to transport equipment and materials around the site and for local pick up of materials.
- Trucks – would be used to transport equipment and materials around the site and for local pick up of materials. Larger sized deliveries would be undertaken by trucks as opposed to utility vehicles.
- Standard articulate trucks – would be used to transport approximately 12 metre containers from point of origin.
- Oversize and/or over-mass vehicles – may be required to deliver larger infrastructure components

Vehicle access to the site would generally be confined to the standard hours of construction. Exceptions would occur as staff arrive and leave the site, before and after shifts. Additionally, the delivery of large components may take place outside normal working hours.

Vehicles would travel around the site via constructed access tracks, which will be required to access the following locations:

- Around the perimeter of the solar farm.
- Site office/compound.
- Construction equipment laydown area.
- Transmission line route.
- Solar substation.

Internal access tracks would remain unsealed but would be re-sheeted with gravel or crushed and compacted soil, to maintain their condition during the construction phase.

Construction and decommissioning

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby receivers.
- Disruption to existing services (public transport and school buses).
- Reduction of the level of service on the road network caused by 'platooning' of construction traffic.
- Road closures along Ercildoune Road during construction of the substation connection and site access.

HAULAGE

While a detailed haulage program has not yet been developed, it is expected that the project's components are most likely to be delivered by road from Sydney and in some instances Melbourne. From Sydney, the route would likely include the South Western Freeway, the Hume Highway (M31), the Sturt Highway (A20),

and the Kidman Way (B87). From Melbourne, the route would likely include the Hume Highway (M31), Goulburn Valley Freeway (M39), Newell Highway (A39) and Kidman Way (B87).

These roads are of sufficient capacity to accommodate the haulage of components required for the construction of the solar farm and transmission line.

INCREASED VEHICLE NUMBERS

Approximately 40 employees would be required during the first month of construction, rising to 300 employees during the peak construction period (approximately three - four months duration). Preliminary plans for the site proposed parking for approximately 40 vehicles, accommodating light vehicles and buses. During peak construction time between 160 to 175 vehicle movements per day to and from the site are predicted.

Approximately 15 - 30 utility vehicles would be used on a daily basis at the site during peak construction, 7 – 15 would be required during non-peak construction periods (Table 7-5).

There is the potential to use buses to transport workers to and from the site during construction. Assuming an up-take rate of 80% and 20 person capacity, up to 16 bus trips would be required per day during peak construction. During non-peak periods, approximately 2 buses are expected to be required.

It is anticipated that up to 25 trucks a day will deliver equipment during peak construction period and 15 trucks during non-peak. The number of oversize/overmass vehicles required is expected to be low. A 50T mobile crane may be required for the offloading of the PV boxes or PV skids, the delivery station and bridge construction. Six or seven piling or drilling machines would also be present on site during the first months of the works.

Traffic volumes associated with the construction of the proposal are summarised in Table 7-5.

Table 7-5 Summary of the estimated construction traffic volumes during peak and non-peak times

Vehicle type	Trips per day (peak: 3-4 months)	Trips per day (non-peak: 6-9 months)
Cars (project management, construction staff etc.	110	60
Utility vehicles	15-30	7-15
Buses	10	5
Delivery trucks (including overmass vehicles)	25	15
Total trips per day:	**160-175**	**87-95**

INCREASED COLLISION RISK

The increased collision risk relates primarily to traffic entering and exiting the site on Ercildoune Road and entering Ercildoune road from Kidman Way. This relates to both oncoming traffic and traffic following vehicles that are turning off Kidman Way.

Based on a 100km/hr speed limit and a reaction time of 2 seconds, a sight distance of 248 metres is required. At the Ercildoune Road / Kidman Way intersection, sufficient sight distance is available for vehicles along Kidman Way and Ercildoune Road. Given the flat and straight alignment of Ercildoune Road the available sight distance to the west exceeds the Austroads requirement, and the sight distance to the

east extends to its intersection with Kidman Way. Accordingly, the sight distance at the access is considered acceptable.

DAMAGE TO ROAD INFRASTRUCTURE

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along the Kidman Way, the impact is expected to be negligible due to the existing capacity of the road network. However, the impact of turning traffic at the Kidman Way / Ercildoune Road intersection would likely require monitoring after the upgrade, to ensure that the road is maintained in an adequate condition.

The Ercildoune Road will remain unsealed, but would require upgrading near the access point to accommodate construction traffic. Road upgrade works would meet the requirements of the Murrumbidgee Council. The proponent would manage construction impacts on Kidman Way and Ercildoune by way of a Traffic Management Plan. This may require periodic road improvements and lane closures to preserve traffic flow.

The construction of the underground transmission line across Ercildoune road may cause temporary road closures and modifications to road infrastructure. A Road Opening Permit has been obtained in consultation with Murrumbidgee Council.

ASSOCIATED NOISE AND DUST

The increase in traffic during construction and decommissioning may increase noise and dust in the local area, particularly on the unsealed portion of Ercildoune Road. Due to the access of the site being located approximately 200 metres from the intersection, it is unlikely that traffic will be travelling at high speeds along this unsealed road. Impacts from dust generated from the proposed activity, including that associated with increased traffic is considered in Section 7.4.

The increase in traffic and heavy vehicle movement during construction and decommission will result in a minor increase in noise as a result of the proposed works. The Kidman Way is located directly to the east of the project and forms part of the intersection where the concentration of traffic is expected. The Kidman Way already experiences moderate levels of traffic including heavy vehicles. The closest receiver is located 2.5 kilometres from the access point and Ercildoune Road. The traffic noise during construction and decommission would be unlikely to be noticeable at the nearest sensitive receiver.

DISRUPTION TO EXISTING SERVICES

Local traffic in Coleambally and Darlington Point would be minimally affected. There would be an increase in vehicles in these centres from construction staff seeking accommodation and services, and conducting commercial activities relating to the solar farm. This would extend outside construction hours but would be insignificant in the context of existing traffic movements in and around Coleambally and Darlington Point.

Increased traffic along the Kidman Way during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along the road. These disruptions would be short term only to provide traffic control during road work.

ROAD CLOSURES

Temporary road closures may be required along Ercildoune road during the construction of the site access and transmission line. This may cause minor disruptions to the local traffic, which may be required to use a detour to gain access to locations in the north west. Alternatively, work may occur under traffic using traffic control measures, resulting in minor disruptions to local traffic.

SUMMARY OF CONSTRUCTION AND DECOMMISSIONING IMPACTS

Overall, the additional traffic associated with the construction and decommissioning of the solar farm would be a small component of the existing traffic loads on local and state roads. No substantive increased collision risk, damage to road infrastructure, noise or dust impacts, disruption to existing services or reduced level of service is expected to accompany construction or decommissioning.

Operation

Vehicles would use the designated road network to access the site and travel within the site during the operational phase (about 30 year period). Up to seven cars per day would be expected during normal operation of the solar farm. Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure. Operational staff would be confined to designated parking areas and access roads/tracks within the proposal area.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access, or be above the background noise levels.

Additional risks to road safety from operational traffic would be minimal.

7.3.3 Safeguards and mitigation measures

Table 7-6 Safeguards and mitigation measures for traffic, transport and safety impacts

No.	Safeguards and mitigation measures	C	O	D
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).	C		D
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan would include, but not be limited to: • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.	C		D

No.	Safeguards and mitigation measures	C	O	D
TT3	The proponent would consult with the Murrumbidgee Council regarding the proposed upgrading of Ercildoune road. The upgrade would be subject to detailed design, and must be designed and constructed to the relevant Australian road design standards.	C		
TT4	The proposed Ercildoune Road and Kidman Way intersection upgrade must be designed and constructed in accordance with NSW Roads and Maritime Services requirements.	C		
TT5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	C	O	D

C: Construction; O: Operation; D: Decommissioning

7.4 CLIMATE AND AIR QUALITY

7.4.1 Existing environment

Climate

The proposal area is located in the east of the Riverina Bioregion. The Riverina Bioregion is dominated by a persistently dry semi-arid climate, and characterised by hot summers and cool winters. Seasonal temperatures vary little across the bioregion, although in the north both summer and winter temperatures tend to be higher than in the south (OEH, 2016). The highest levels of rainfall in the Riverina Bioregion occur in May and September. Summer rainfall tends to occur mainly from localised thunderstorms, with more consistent rainfall occurring in the winter months. Annual rainfall tends to increase from west to east and from north to south. Mean annual rainfall across the region is between 238mm and 617mm. Mean annual temperatures range between 15-18˚C (OEH, 2016).

The closest Bureau of Meteorology Weather Station is Coleambally Irrigation NSW, located about 5 kilometres south west of the proposal area (7 Brolga Pl, Coleambally NSW). Mean annual temperature is 16.7 °C (Climate data, 2017). The mean annual rainfall for Coleambally is 410 mm with highest rainfall occurring in December (BOM, 2017). Rainfall data is listed in Table 7-7.

Table 7-7 Annual rainfall data for Coleambally (BOM, 2017)

Year	Annual Rainfall
2009	269.2
2010	580.7
2011	650.7
2012	347.7
2013	-
2014	-
2015	433.4
2016	558.5

Local air quality

The air quality in the proposal area is generally expected to be good and typical of that found in a rural setting in NSW. Existing sources of air pollution for the proposal area include:

- Vehicle emissions.
- Dust from nearby unsealed roads.
- Agricultural activities including lime application, burning of paddocks or earth moving.
- Operation of solid fuel heating (during the colder months).

A search of the National Pollutant Inventory (Australian Government 2016) identified eight facilities (Poultry farms-ANZSIC Class) located within 12 kilometres of the proposal area. These facilities are required to monitor ammonia emissions.

There are 11 sensitive receivers within 5 kilometres of the proposal area. Six of these occur within 2 kilometres of the site. The closest receiver is approximately 920 m east of the proposal area. Topography of the proposal area is relatively flat and there is minimal vegetation screening the proposal area.

CRITERIA

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m^2/month are also specified by the EPA.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases (GHGs) in the atmosphere. GHG's include carbon dioxide, methane and water vapour. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall declines in southern Australia and more extreme weather events including intense rainfall, more severe drought and harsher fires (CSIRO, 2015).

7.4.2 Potential impacts

Construction and decommissioning

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along the unsealed access road during construction and decommissioning of the proposed solar farm. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving or lead to adverse health impacts where severe or prolonged. Emission of GHGs are likely to contribute to climate change.

The construction phase is expected to last approximately nine months with a peak period lasting approximately three - four months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, largely using shared (bus) transport, (up to 300 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in Section 7.3).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. The construction of the solar arrays uses a pilling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be less than 1% of the proposal area.

The closest residential dwelling is approximately 920 metres from the proposed solar farm. Existing mature vegetation occurs between this receiver and the proposal area. Due to the distance between the receiver and the proposal area, and the existing vegetation, it is unlikely that this sensitive receiver would be affected by dust generated from the construction or decommissioning of the solar farm.

There are also five other receivers within two kilometres of the proposal area. Due to the distance of these residential dwellings, dust and emissions would be expected to dissipate readily over this distance. Substantive air quality impacts are not anticipated for these dwellings. With the minor earthworks involved and implementation of mitigation measures, air quality issues are considered manageable.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase. Traffic requirements would be similar in type but of shorter duration than that required for the construction phase. The construction and decommissioning of the proposal is not anticipated to have a significant impact on air quality. Identified impacts are highly manageable.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. Haulage traffic and plant and equipment would generate emissions however, the short duration of the work, the scale of the proposal and mitigation strategies in place, suggests this contribution would be negligible in a local or regional context.

Operation

The generation of solar energy during the operation of the proposal would generate negligible air quality impacts and emissions. The operation of the solar farm would produce minimal CO_2 emissions when compared to conventional coal and gas fired powered stations (Table 7-7). As discussed in Section 2.3, the operation of the proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 380,000MWh, the proposal would offset the equivalent of more than 300,000 tonnes per annum of CO_2 emissions and power the equivalent of 52,000 NSW homes.

Table 7-8 Comparison of CO_2 equivalent emissions produced per kilowatt hour for the lifecycle of the asset

Generation method	Emissions produced (grams CO2 equivalent per kWh)	Source
PV solar farm	**19-59**	**Wright and Hearps (2010)**
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema *et al*. (2006)

Maintenance activities during operation would result in some minor, localised vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads. The impacts on local and regional air quality are expected to be negligible during operation. During regular operation, no vehicles would be present at the site on a permanent basis, with only occasional visits by light vehicles. During major maintenance activities, this number could increase to 20-30 vehicles at any one time for a limited period.

Limited amounts of fuel would be required for maintenance vehicles during operation of the solar farm and for temporary power generation in the event of an unplanned outage. During operation, the proposal would have a significantly positive impact on global climate by assisting to reduce Australia's reliance on fossil fuels for electricity generation (discussed in Section 2.3).

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 7.11.

7.4.3 Safeguards and mitigation measures

Air quality impacts would be addressed via the mitigation strategies in Table 7-8.

Table 7-9 Safeguards and mitigation measures for climate and air quality impacts

No.	Safeguards and mitigation measures	C	O	D
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	C	O	D
AQ2	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	C	O	D
AQ3	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposal area. This includes dust from stockpiled materials.	C	O	D

C: Construction; O: Operation; D: Decommissioning

7.5 ELECTRIC AND MAGNETIC FIELDS

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs).

7.5.1 About EMFs

EMFs consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO 2012).

Electric fields are produced by voltage. Magnetic fields are produced by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances while operational (WHO 2007). Electric and magnetic field strengths reduce rapidly with distance from the source, and while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50 Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

Research into photovoltaic solar arrays in California by Chang and Jennings (1994), indicated that magnetic fields (the EMF type of greatest public concern) was significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO undated). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF *electric* fields at the low levels generally encountered by the public (WHO 2007), such as those that would be produced by electricity generation at the proposed solar

farm and along the transmission line. Although recently studied, there has been no support for the notion that exposure to 50-60Hz magnetic fields is a cause of childhood leukaemia (ICNIRP, 2010).

Whether exposure to ELF *magnetic* fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA 2015) advises that 'the scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

Australia does not currently have a standard regulating exposure to ELF electric or magnetic fields. The International Commission on Non-Ionizing Radiation Protection (ICNPR) published Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz) in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects.

To prevent health-relevant interactions with ELF fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached. The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a way that remaining below the reference levels (in the air) implies that the basic restrictions will also be met (in the body) These are not the actual limits, they are simply guidance figures for when it is necessary to investigate the basic restriction (ICNIRP, 2010). Reference levels for occupational and general public exposure are shown in Table 7-10.

Table 7-10 ICNIRP reference levels for electric and magnetic fields. Values are for 50Hz

Exposure characteristics	Electric fields	Magnetic feilds
Occupational		
	ICNIRP reference level: 10 kV/m	ICNIRP reference level: 1 mT
	field actually required: 24.2 kV/m	field actually required: 3.03 mT
General public		
	ICNIRP reference level: 5 kV/m	ICNIRP reference level: 200 µT
	field actually required: 9.9 kV/m	field actually required: 606 µT

The proposal includes five main types of infrastructure that could create EMFs:

1. Solar Panels and invertors.
2. Underground cables.
3. Underground 132 kV transmission line.
4. Solar substation
5. Battery

Typical and maximum EMF levels for these types infrastructure are discussed below. Strength attenuates with distance from the infrastructure, as seen below.

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however magnetic fields still occur. They are expected to be minimal. It is proposed that the 132 kV

transmission line would be underground, further reducing exposure to electric fields. Figure 7-7 displays the typical magnetic field for a 132 kV underground power line.

The TransGrid substation is classified as an intermediate substation. The highest electromagnetic field is usually produced by the lines and cables supplying the substation and not by the equipment inside the substation itself. If the substation itself produces a field outside its perimeter, it usually falls away over the first few metres (EMFs info, 2017). Works undertaken to facilitate the connection of the transmission line will require mitigation measures to ensure reduced exposure. These mitigation measures are described in section 7.5.2.

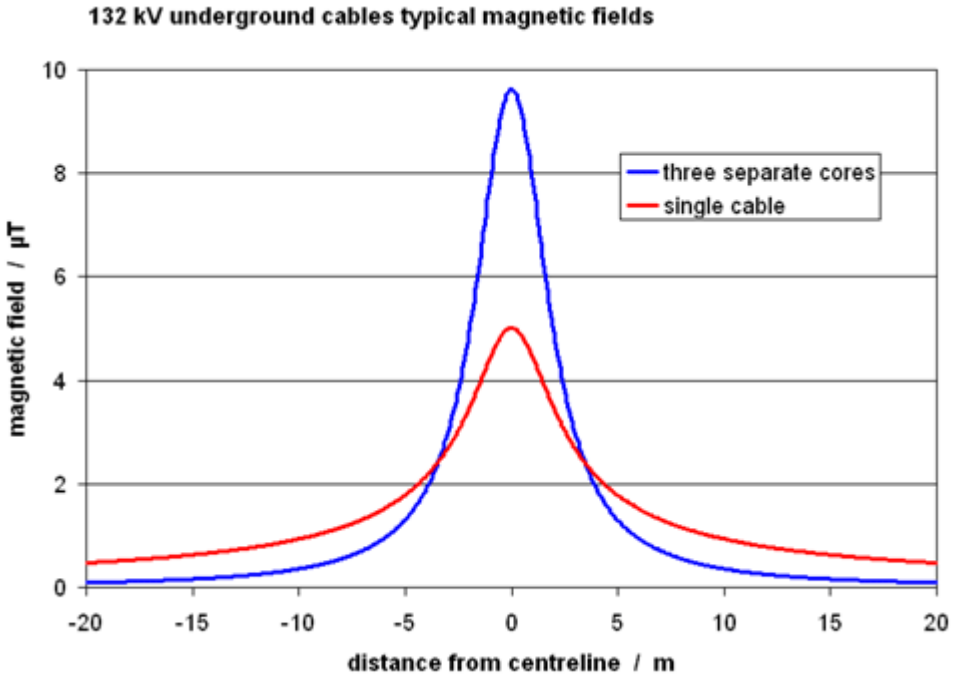

Figure 7-4 Typical magnetic field from 132 kV underground powerlines (EMFS info, 2017).

Table 7-11 Typical magnetic field from underground powerlines (EMFS info, 2017).

Source (132 kV)	Location of measurement	Magnetic field (µT) at distance from centreline of cable			
		0m	5m	10m	20m
Separate cores (flat formation)	1 metre depth	9.62	1.31	0.36	0.09
Single cable	1 metre depth	5.01	1.78	0.94	0.47

7.5.2 Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the project. The maximum magnetic field of the proposed transmission line is well under the 200 µT and 1000 µT limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the proposed 132 kV underground transmission line. Exposure to EMFs during the construction of the transmission line and connection to substation will be short term, therefore the effects are likely to be negligible.

With the exception of the underground transmission line, the construction site would be fenced to protect the public from construction health and safety risks.

Operation

During operation, EMF sources would include a 132 kV underground transmission line, underground cabling, and the solar array incorporating inverters.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts minimised also.

The site is surrounded by agricultural land. Public access would be restricted by site fencing around the site and existing substation during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

Using the Principle of Prudent Avoidance to design and site infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

7.5.3 Safeguards and mitigation measures

ICNIRP sets out a number of protective measures to reduce personal harm from EMFs if the basic restrictions are expected to be exceeded. These include engineering design, administrative control, and personal protective clothing. The works undertaken for the proposed solar farm are not expected to exceed the basic restriction levels. The following safeguard and mitigation measures will be implemented to reduce any further risks associated with EMF exposure (Table 7-12).

Table 7-12 Safeguards and mitigation measures for health and safety

No.	Safeguards and mitigation measures	C	O	D
EM1	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
EM2	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
EM3	Transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure to EMFs.	**C**		
EM4	Design of electrical infrastructure would minimise EMFs. (underground).	**C**		

C: Construction; O: Operation; D: Decommissioning

7.6 SOCIOECONOMIC AND COMMUNITY

Large and new types of developments can produce social and economic impacts on local communities. These can be positive, such as the provision of employment and increased retail trade. They can also produce unintended or adverse impacts, such as creating strains on existing infrastructure (such as public transport or accommodation facilities during construction, or social infrastructure such as volunteer services, social ties and networks). This section investigates the socio-economic profile of the region to understand the impact of the proposal on socioeconomics and the community.

7.6.1 Background

Socio-economic profile

The Murrumbidgee LGA has a population of 2,261 people (ABS, 2011). In the 2006 Census, the population was 2,503 people, which represents almost 10 percent decline in population over a period of five years. The percentage of people of Indigenous origin in 2011 was 10.2 percent, which is high in comparison to the Australian average of 2.5 percent. The overseas immigrant population is small with 87 percent of the population born in Australia compared to the Australian average of 69.8 percent (ABS, 2011).

The local economy is based on irrigated and dryland agriculture, including broadacre cropping and sheep and cattle production. Sheep, beef cattle and grain farming involves 18.5 percent of the population. Other sectors that support the economy include poultry farming, meat and meat product manufacturing, school education and residential care services (ABS, 2011). The unemployment rate for Murrumbidgee LGA is 4.4 percent, which is less than the national rate of 5.6 percent (ABS, 2011).

Coleambally is a service centre for the area and includes:

- Location along the Kidman Way, being a highway connecting Bourke with the Newell Highway north of Jerilderie.
- Tourist accommodation including one motel, one hotel motel and one caravan park (Murrumbidgee Council, 2017).
- Educational facilities within the Coleambally Shire include one Catholic primary school and one combined primary and high school.
- Tirkandi Inaburra Cultural and Development Centre.
- Medical centre.
- Aged care facility.
- Small shopping precinct with banks, post office, supermarket, newsagency, pharmacy and cafes.
- Community Hall, Masonic Hall, sports stadium and youth and sports centre.
- Recreational and sporting facilities including a public swimming pool, 9 hole golf course, recreation grounds for football and cricket, netball courts and tennis courts (Murrumbidgee Council, 2015).

Community make up and priorities

In 2016, Murrumbidgee Shire Council amalgamated with Jerilderie Council to form Murrumbidgee Council. Prior to the amalgamation, Murrumbidgee Shire Council adopted the Murrumbidgee Community Strategic Plan 2030. The plan is a 10 year plan identifying the community's main priorities and aspirations for the future. It outlines strategic principles to help meet these priorities and aspirations, including:

- Community principles:

  - Create a connected and caring community where people look out for each other.
  - Develop and grow a community understanding of shared responsibility.
  - We have access to a range of services which support our needs.
  - We support and promote healthy lifestyles.
  - We have access to range of health, medical and specialist services to maintain our health.
  - We have access to education and further education opportunities for all members of the community.
- Economy principles:
  - Whilst we recognise that agriculture is the basis of our economy we welcome and support other economic development which is aligned and will contribute to the overall wellbeing of our community.
  - Council is the driver of economic development for the Shire.
- Natural environment principles:
  - We have temporary custody of our natural environment and work to preserve it for future generations.
  - We are fortunate to live in such a beautiful place and we want to showcase and share it with others but in a way that is sensitive to the impacts people can cause.
  - We have a waste management strategy that encourages reducing, reusing and recycling and have a long-term goal of achieving zero waste.
  - We explore, embrace and promote alternate sustainable energy sources.
- Infrastructure principles:
  - We manage our infrastructure responsibly.
  - The infrastructure we provide is responsive to community needs.
- Leadership principles:
  - Council leads the community by example demonstrating a high level of leadership and accountability.
  - Community leaders are encouraged and supported, especially young people.

It is considered that the proposed solar farm meets the principles of the Community Strategic Plan, with particular reference to welcoming and supporting economic development other than agriculture and to explore, embrace and promote alternate sustainable energy sources.

General attitudes to renewable energy projects

Research indicates there is widespread support for solar energy as a source of energy for electricity generation in Australia (ARENA n.d); 78% of respondents to the ARENA survey were in favour of large scale solar energy facilities and 87% are in favour of domestic installations. The large scale solar energy sector is still at a relatively early stage of development in Australia, however. While most members of the community are aware of large scale solar energy, many do not know a great deal about their impacts (ARENA n.d.).

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

- Provision of images (from many angles) of large scale solar facilities, particularly in the early stages of a proposal.
- Understanding the similarities between highly supported domestic scale installations and large scale facilities.

- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for (Source: extracted from ARENA n.d).

Section 6.4 and Appendix E of this EIS provides a visual assessment of how the impact the proposed solar farm would have on the rural landscape and visual amenity of the area.

Community feedback on the proposal

Neoen have undertaken extensive preliminary consultation with surrounding neighbours and the general community including one-on-one meetings, community information sessions and creating a website dedicated to the proposal providing information about the proposal and allowing communication and feedback to be received.

ONE-ON-ONE MEETINGS

One-on-one meetings were offered to the six neighbours located within two kilometres of the boundary of the proposal area. Positive feedback from the neighbours that participated in the meetings included:

- Good opportunity for the local community in terms of local employment, investment the project will bring and dynamism for the region.
- Support for the town being a contributor to more sustainable energy generation.

Concerns raised by one neighbour include:

- Visual impact.
- Impact on property value.
- Potential increased fire risk.

DROP-IN SESSION

A drop-in information session was held in Coleambally on March 20th. Five feedback forms were completed at this session. Respondents were generally in support of the proposal with concerns raised with specific reference to the proposed Coleambally Solar Farm being:

- Accommodation availability for workers (one respondent).
- Employment and housing (one respondent).
- Movement of kangaroos from east to west across the proposal area would be restricted (one respondent)

WEBSITE

Neoen has established a dedicated project website (http://coleamballysolarfarm.com.au/) which provides information for the proposal. The website includes an online community feedback form that can be filled in by any members of the community. An email address contact@coleamballysolarfarm.com.au also allows local businesses to reach Neoen to express their interest in the project.

Three responses have been submitted through the website. One respondent was a journalist contacting the proponent for information about the proposal. One respondent was a local business expressing interest in the proposal. The third respondent was a resident from more than five kilometres from the proposal area. This respondent values community and family ties in the area and values renewable energy generation, local economic opportunities. No concerns about the proposal were raised.

Accommodation availability

Accommodation available in Coleambally includes a motel which offers motel rooms and apartments, a hotel/motel and a caravan park which provides ensuite cabins and ensuite caravans. Accommodation is

also available at surrounding small centres such as Darlington Point, located approximately 32 kilometres north and Jerilderie, located approximately 69 kilometres south of the proposal area. Jerilderie offers nine places to stay including motels, hotel/motels, hotels, a bed and breakfast and backpacker accommodation. Darlington Point offers six places to stay including a caravan park, cabins and cottages and a hotel.

The closest large centre to the proposal area is the regional city of Griffith. Griffith has a population of around 19,500 and is located approximately 67 kilometres north of the proposal area. Griffith provides substantial accommodation opportunities, including around 15 motels, apartments and bed and breakfast establishments, two caravan parks as well as other self-contained cottages, farmstay, hostels and backpacker accommodation.

Narrandera, with a population of about 3,800, offers nine motels, two caravan parks as well as hotels and bed and breakfast establishments. It is located 82 kilometres east of the proposal area.

7.6.2 Potential impacts

Construction

During construction, it is considered the proposal would generate some adverse socio-economic impacts, however significant positive impacts are likely. Likely positive impacts include:

- Significant boost to the local and regional economies through generation of employment. Up to 300 staff would be employed during peak construction, many of these could be drawn from the local area.
- Significant boost to the local and regional economies through increased demand for accommodation, goods and services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to section 7.3)
- Change in the rural landscape character and visual amenity of the area (refer to section 6.4)
- Influx of workers may put pressure on local accommodation and health services.
- Demand for accommodation and increase in traffic movements may have an impact on tourism if the construction phase coincides with local festivals.

Although there is not a large stock of accommodation available in Coleambally, it is in within an easy travel distance from the regional city of Griffith which provides a large amount of visitor accommodation. There is also accommodation within surrounding town of Jerilderie, Darlington Point and Narrandera. It is possible that, in conjunction with other major projects, shortages of accommodation may occur at times during the construction stage. The project would engage with local accommodation providers and Murrumbidgee Council if necessary to provide additional short term and temporary accommodation at these businesses. The proponent would also consult with Murrumbidgee Council to co-ordinate construction schedules to minimise conflict with any local festivals or activities. Scheduling 'Rostered Day's Off' could help alleviate accommodation pressures by allowing itinerant workers to go back home.

It is considered that the demand for health care would also be dispersed throughout the surrounding towns to coincide with where workers are staying.

The community is in support of the development, demonstrated through the strategic principles of the Murrumbidgee Community Strategic Plan 2030 and the feedback gained from the community during consultation activities. Overall, it is considered that the proposal would have a positive socio-economic impact given the significant economic boost the proposal would generate. It is considered that the

expected adverse impacts would be minimal given the temporary nature of the construction phase and that impacts would be managed through the implementation of safeguards.

Operation and decommissioning

The development of rural land uses compatible with agricultural activities, such as solar power generation, have potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. They also provide a substitute for carbon emission producing electricity production that is stable, renewable and consistent with State and National greenhouse emission reduction objectives.

The installation of solar array modules that involve little soil disturbance and provide an alternative income stream for large agricultural properties, can be seen as an important local economic benefit.

Minimal adverse impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be consistent but at low levels. The additional accommodation, traffic and healthcare impacts of around seven operational staff are not likely to be noticeable.

Although the number of employees required during decommissioning would be less than that for construction, it is considered likely to offer a similar economic benefit in terms of opportunities for local staff and industries. Decommissioning may also include local recycling of infrastructure components.

Members of the community raised questions about whether the proposed solar farm could affect land prices. It is generally considered that land prices around the proposal area are strongly linked to the agricultural productivity of the land. Agricultural productivity on surrounding land would not be affected by the proposal. No residentially-zoned or lifestyle properties are located within 2km of the proposal area. It is therefore considered unlikely that land prices would be adversely effected by the proposal.

7.6.3 Safeguards and mitigation measures

Table 7-13 Safeguards and mitigation measures for socioeconomic and community impacts

No.	Safeguards and mitigation measures	C	O	D
SE1	A Community Consultation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	**C**		
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**		
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaison with local tourism industry representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**

C: Construction; O: Operation; D: Decommissioning

7.7 RESOURCE USE AND WASTE GENERATION

7.7.1 Existing environment

Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the proposed solar farm include those listed in Table 3-2.

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Water requirements during operation are estimated to be 1,500 kL / year.

Waste generation

POLICY POSITION

Legal requirements for the management of waste are established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The proposal's resource management options would be considered against a hierarchy of the following order:

- Avoidance of unnecessary resource consumption.
- Resource recovery (including reuse, reprocessing, recycling and energy recovery).
- Disposal.

Adopting the above principles would encourage the most efficient use of resources, and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development.

CONSTRUCTION

Solid waste is one of the major pollutants caused by construction. Several construction activities would produce solid wastes, such as:

- Packaging materials.
- Excess building materials.
- Scrap metal and cabling materials.
- Plastic and masonry products, including concrete wash.
- Excavation of topsoils and vegetation clearing (expected to be minimal).
- Bio wastes from onsite septic systems.

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction phase would be classified as building and demolition waste within the class general solid waste (non putrescible). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescible) in accordance with the POEO Act.

OPERATION

During operation the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels, lubricants and metals may require replacement over the operational life of the project.

DECOMMISSIONING

Decommissioning of the site would involve the recycling or reuse of materials including:

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

7.7.2 Potential impacts

Construction and decommissioning

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the proposal are not currently limited or restricted. In the volumes required, the proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

Water would be required during construction for activities including watering of roads and in the site office and amenities. Water use is considered in Section 7.2

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. The proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. The majority of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

Operation

LIFE CYCLE ANALYSIS

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total life cycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A life cycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 25-30 year lifetime of the panels, it is expected that 28 g of GHG would be produced per kWh of energy generated (Fthenakis *et al*, 2011). The 'energy payback time' for multicrystalline PV panels is dependent on the geographical location, however on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be even less than 1.5 years (Fraunhofer ISE, 2015), which is considered comparable to the proposal area.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis *et al*, 2011). The waste produced during production of the panels which can be recycled include graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol).

However, silicon crystals cannot be recycled during this stage (Fthenakis *et al*, 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste but less than the production of panels.

The 'energy yield ratio' of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it is referred to as the system's. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it (Fraunhofer ISE, 2015). This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems' life cycle (GA and ABARE 2010).

When compared to the major electricity generating methods employed in Australia, solar farms are favourable for the following reasons:

- CO_2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the project.
- Potential to reuse and recycle component parts.

RESOURCES AND WASTE STREAMS

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the solar farm.

Operational waste streams would be very low given the low maintenance requirements of the solar farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the solar farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation, however these activities would occur very infrequently and there would be a high potential for recycling or reuse of the waste.

7.7.3 Safeguards and mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Impacts are proposed to be addressed via the mitigation measures in Table 7-15.

Table 7-14 Safeguards and mitigation measures for resource use and waste generation

No.	Safeguards and mitigation measures	C	O	D
WM1	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	C	O	D

C: Construction; O: Operation; D: Decommissioning

7.8 FIRE AND BUSH FIRE ISSUES AND IMPACTS

Bush fire presents a threat to human life and assets and can deliver adverse ecological impacts. Bush fire risk can be considered in terms of environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines and other electrical components).

7.8.1 Existing environment

The study area is relatively flat. Localised native remnant vegetation occurs in the locality. These are present as linear strips of vegetation along irrigation channels and also as scattered patches of woodland vegetation within paddocks. The total area of native vegetation mapped within 3000 ha of the site is 855ha (28.5%). There are two state forests located within 5 kilometres of the proposal area including Brett's State Forest located about 1.4 kilometres to the north of the site, and Boona State Forest located about 1.7 kilometres to the east. The majority of the proposal area has been cleared and cultivated in the past. There is 2% native vegetation remaining in the proposal area. The site is not identified as bush fire prone land (NSW RFS, 2017).

The existing bushfire hazards within the proposal area are as follows:

- Narrow strip of Eucalypt woodland which occurs along the central irrigation drain.
- A small patch of acacia woodland to the north east.
- Existing substation and upgrade infrastructure, and solar panel infrastructure

Ground cover has largely been removed or reduced due to cultivation practices. The irrigation channels within the paddocks provide natural fire breaks. These would reduce the potential fire hazard from infrastructure within the site.

The existing substation is located approximately 150 metres north of the site.

The local bush fire danger period occurs between October and March. The harvest period of November to mid-December is considered a prime risk period due to machinery in crops and generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas.

In terms of resources to fight fire, there is the major irrigation channel (Tubbo channel) which borders the north of the proposal area. Boona irrigation channel runs on the southern side of Kidman Way. The nearest natural water course is Cooinbil Creek, approximately 16 kilometres to the north west. The Murrumbidgee River is located about 21 kilometres to the north east. The nearest rural fire brigade is located in the town of Coleambally about five kilometres south west of the proposal area.

The internal access tracks would be 5 metres wide ensuring that safe operational access and egress for emergency service personnel is available.

In terms of receivers and assets at risk from bush fire, six dwellings are located within two kilometres of the proposal area. Additionally, farm sheds, watering points, silos and equipment are common in the local area. As stated above, November to mid-December represents a period of high activity when many people may be active in harvest and other farm activities onsite and in the local area.

7.8.2 Potential impacts

Construction and decommissioning

Activities associated with construction that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol powered tools.
- Hot works, including welding and soldering activities.
- Operating a petrol, LPG or diesel powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the low vegetation cover over the proposed area and other factors discussed above, it is considered unlikely that construction of the solar farm would pose a significant bush fire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

The bush fire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bush fire mitigation measures outlined in Section 7.9.3.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction and operation activities (below), any bush fire risk associated with decommissioning of the project would be highly manageable.

Operation

Repairs and maintenance activities during operation could increase bush fire risk. All electrical components would be designed to minimise potential for ignition. Ground cover beneath panels would be maintained and not allowed to build up to high fuel levels (access and solar input requirements are in line with this activity).

An Asset Protection Zone would be maintained around buildings at the site including, PV boxes or skids, delivery station, solar substation and battery. It is anticipated that TransGrid would maintain the additional substation infrastructure to minimise bush fire ignition risks.

Existing farm accesses off Kook Road and the Kidman Way would be retained to provide alternative emergency access points. This allows emergency access to the north and south of the proposal area. Internal access tracks are 5 metres wide allowing adequate access for emergency vehicles including fire trucks.

The positioning of the Tubbo Channel along the north of the proposal area will reduce the potential for fires to spread to adjacent land and provide firefighting resources.

Bush fire risks during operation of the solar farm and connection infrastructure is considered highly manageable.

7.8.3 Safeguards and mitigation measures

Table 7-15 Safeguards and mitigation measures for fire and bush fire

No.	Safeguards and mitigation measures	C	O	D
BF1	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of *Planning for Bush Fire Protection 2006*: ○ Identifying asset protection zones ○ Providing adequate egress/access to the site ○ Emergency evacuation measures • Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.	C	O	D

C: Construction; O: Operation; D: Decommissioning

7.9 HISTORIC HERITAGE

A search of listed items (under the NSW *Heritage Act 1977*, the Australian Heritage Database and those listed by local Councils and State Government agencies) was completed for the Murrumbidgee LGA on 16th March 2017. None of the items listed are located within 10 kilometres of the proposal area.

7.9.1 Approach

A desktop study was undertaken to identify any historic heritage (non-indigenous) items or places in proximity to the study area, with a particular focus on the proposal area. Heritage databases searched as part of this assessment included:

- The NSW State Heritage Inventory (SHI) (includes items on the State Heritage Register and items listed by state agencies and local government) to identify any items currently listed within or adjacent to the proposal area. The area searched was the Murrumbidgee LGA.
- The Australian Heritage Database (includes items on the National and Commonwealth Heritage Lists) to identify any items that are currently listed within or adjacent to the proposal area.
- The Environmental heritage (schedule 5) of the Coleambally LEP (2013) for locally listed heritage items that are within or adjacent to the proposal area.

7.9.2 Results

The results of the heritage searches listed above indicate that no known historic items or places occur within the proposal area. A summary of the results of the heritage searches are illustrated in Table 7-17. Details of listed items are provided below.

Table 7-16 Summary of heritage listings in the Murrumbidgee LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage List	7
NSW State Heritage Register / State Agency heritage Register	4
Murrumbidgee Local Environment Plan (LEP) 2013	5

Commonwealth Heritage List

A search of the Australian Heritage database within the Murrumbidgee LGA indicated seven listings:

- Carrathool Bridge, Wright Lane, Carrathool
- Courthouse Group (former), Darlington Point
- Indigenous Place, Darlington Point
- Old Warrangesda Mission, Darlington Point
- Tubbo Station Group, Sturt Highway, Darlington Point
- Tuibbo Station Homestead and Out buildings, Sturt Highway, Darlington Point
- Tubbo Station Woolshed Complex, Sturt Highway, Darlington Point

State Heritage Register

A search of the NSW State Heritage Register within the Murrumbidgee LGA indicated one listing:

- Warangesda Aboriginal Mission and Station, Darlington Point

This items is listed under the *NSW Heritage Act 1977*. This item is not located in or adjacent to the proposal area.

NSW State Agency Heritage Register (Section 170)

A search of the NSW State Agency Heritage Register within the Murrumbidgee LGA indicated 3 listings. These included:

- Coleambally Main Canal Bridge No.2, Coleambally
- Coleambally Offtake Bridge Regulator, Coleambally
- Survey Tree "BM AN 42", Kidman Way, Darlington Point

The above items are listed by State Agencies under s.170 of the *Heritage Act 1977*. None of the above items are located within the proposal area.

Local Heritage Schedule

A search of the Murrumbidgee LEP (2013) resulted in a total of 5 local heritage items being recorded within the LGA. The majority of these items are concentrated in the town of Darlington Point (Figure 7-5) and include;

- Court House Group (former), Darlington Point
- Old Warrangesda Mission, Darlington Point

- Scarred Trees at Waddi Creek, Darlington Point
- The Homestead, Darlington Point
- Tubbo Station Group, Darlington point

No local heritage items are identified as being within 10 kilometers of the proposal area.

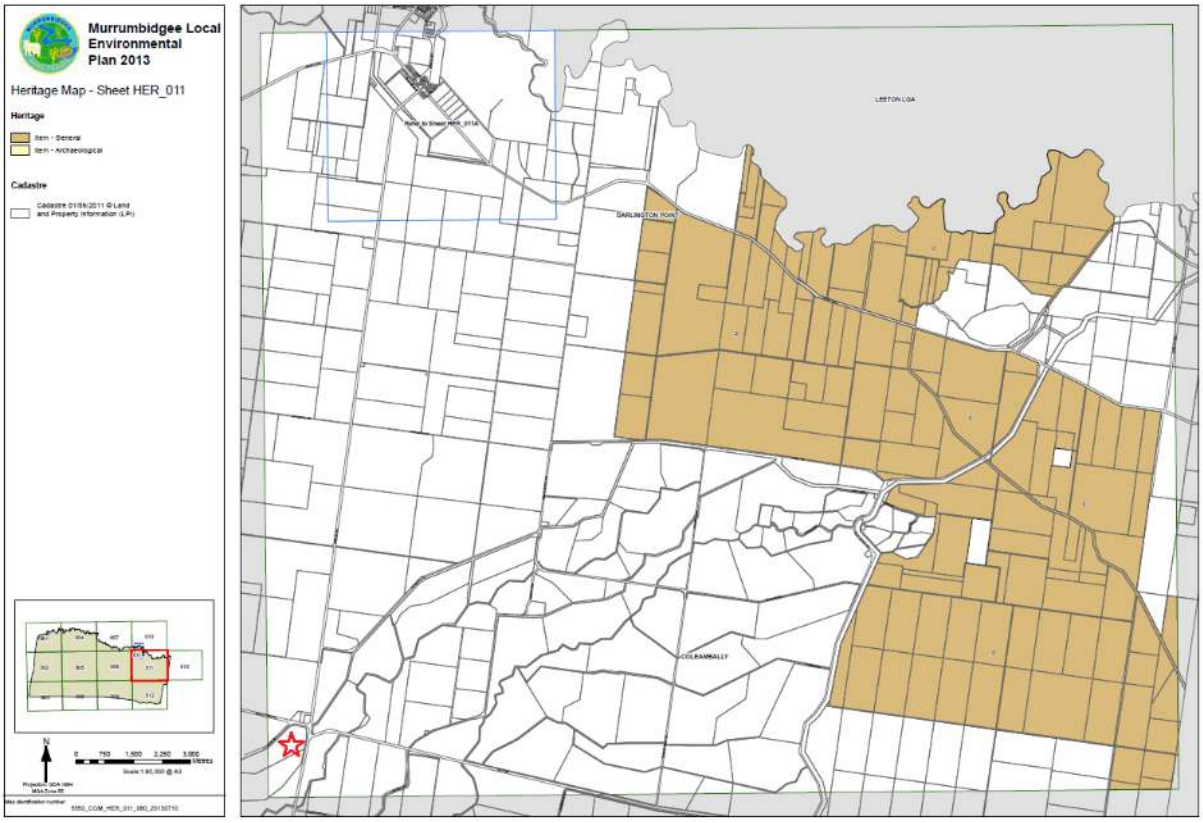

Figure 7-5 Murrumbidgee LEP Heritage Map results for the Coleambally Solar Farm. Red star indicates the solar farm proposal area (NSW Government, 2013).

Potential heritage items

During the field survey three potential items of heritage significance were identified. These include;

- *Coleambally European Survey marker tree 1*
- *Coleambally European Survey marker tree 2*
- *Coleambally European Survey marker tree 3*

Details of the Marker Trees are described below and can be seen in Figure 7-9, Figure 7-8 and Figure 7-9 .

COLEAMBALLY EUROPEAN SURVEY MARKER TREE 1

This site consists of a single European survey marker tree considered not to be Aboriginal in origin within an area of remnant vegetation adjacent to the proposal area near the intersection of Kook and Ercildoune Roads. The tree is a mature living Black Box tree in good condition that has a single arch shaped scar. The scar had an arrow engraved above the writing BM34. A branch has grown out below the scar partially obstructing the view. Regrowth was noted to also have partially covered some of the engraved writing. The tree is approximately 15m in height and is located approximately 35m north of the Tubbo Channel.

Figure 7-6 Coleambally European Survey marker tree 1

COLEAMBALLY EUROPEAN SURVEY MARKER TREE 2

This site consists of a single European survey marker tree considered not to be Aboriginal in origin within an area of remnant vegetation adjacent to the unnamed channel that bisects the proposal area. The tree is a mature living Black Box tree in good condition that has a single oval shaped scar facing west. The scar has remnants of white paint with the writing B9C1. The tree is approximately 15m in height and is located approximately 45m south of the unnamed channel. Regrowth was noted to have partially covered some of the engraved writing.

Figure 7-7 Coleambally European survey marker tree 2

COLEAMBALLY EUROPEAN SURVEY MARKER TREE 3

This site consists of a single European survey marker tree considered not to be Aboriginal in origin within an area of remnant vegetation adjacent to the unnamed channel that bisects the proposal area. The tree is a mature living Black Box tree in good condition that has a single oval shaped scar. The scar had an arrow engraved above the writing 1N. Regrowth was noted to have partially covered some of the engraved writing. The tree is approximately 10m in height and is located approximately 40m south of the unnamed channel.

Figure 7-8 Close-up of Coleambally European survey marker tree 3

The European Survey marker trees would not be impacted by the proposed works. The European Survey marker trees will be avoided by the proposed works.

7.9.3 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. Most of these items are found in Darlington Point and other towns and villages. None of these items are found within 10 kilometers of the proposal area.

The three European marker trees identified within the proposal area are unlikely to be affected by the construction, operation or decommissioning phases of the proposed solar farm. These areas would be avoided and no vegetation is proposed to be removed near these trees. No heritage approvals would be required.

The proposal is not considered likely to have a significant impact in accordance with the NSW *Heritage Act 1977*, the EP&A Act, or the EPBC Act, in terms of heritage.

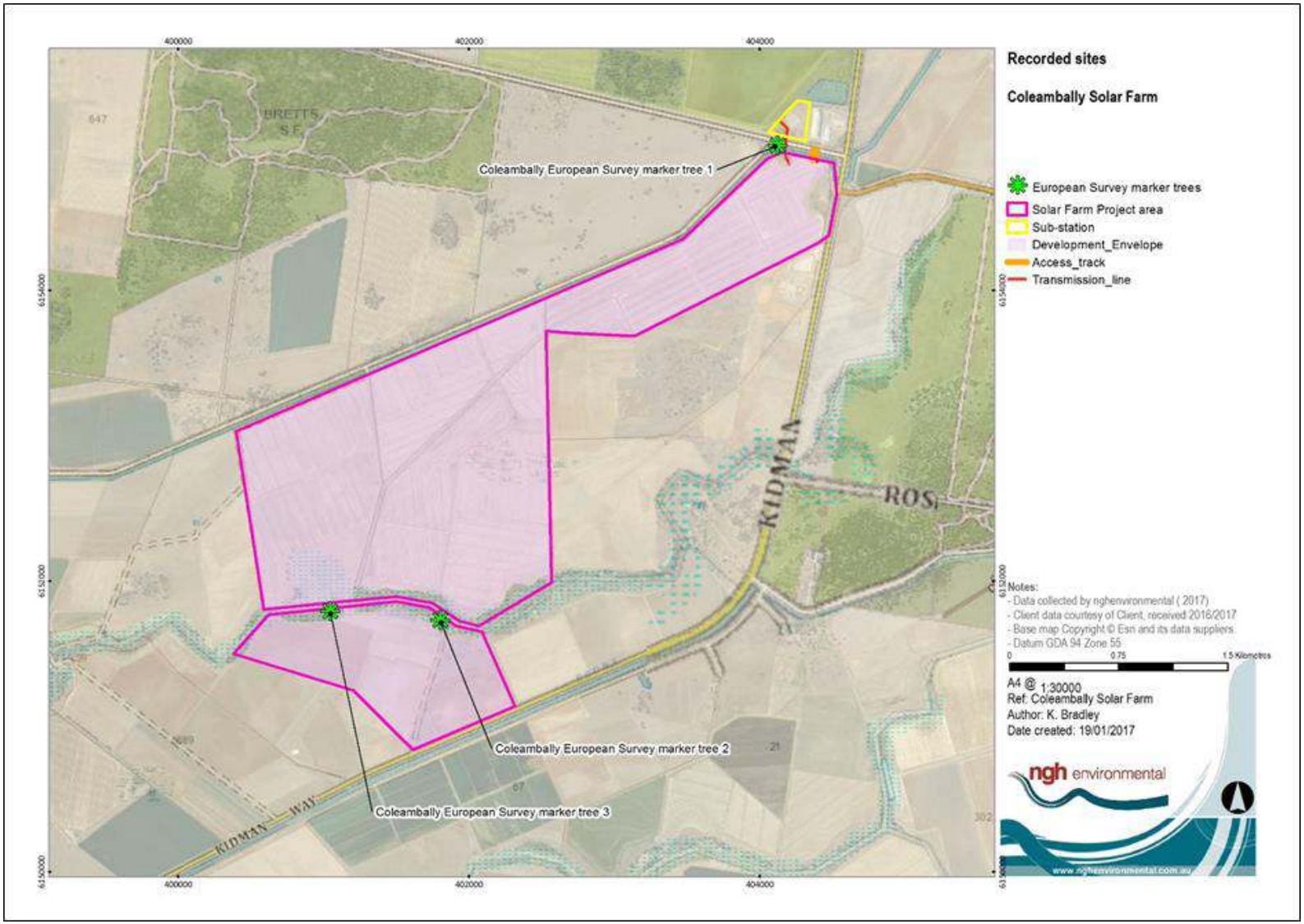

Figure 7-9 Location of recorded European marker trees.

7.9.4 Safeguards and mitigation measures

Table 7-17 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	The European Survey Marker Trees should be clearly identified in the Construction Environmental Management Plan. If construction work is required within 50m of any of these trees, the trees would be protected prior to work commencing using paraweb fencing or similar and not removed until construction work has been completed.	**C**		**D**
HH2	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**

C: Construction; O: Operation; D: Decommissioning

7.10 CUMULATIVE IMPACTS

Adverse cumulative impacts occur when the infrastructure or activities at the proposal area exacerbate the negative impacts of other infrastructure or activities occurring nearby.

During construction, the additional traffic and dust impacts are probably the greatest potential for cumulative visual impacts. The Kidman Way is a high use road corridor carrying a large proportion of heavy vehicles, particularly in harvest periods. The visual impact of increased traffic movements to the site would be predominantly limited to construction (approximately 9 months). During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles are all that would be required.

A large scale development, being an ethanol plant, has been approved by the Department of Planning and Environment within the vicinity of the proposed solar farm, as discussed in section 1.2.7. Should construction activities for both developments occur at the same time, this would generate cumulative impacts. Although considered unlikely, in the event of concurrent construction activities, proponents of both developments must consult to manage and minimise the potential cumulative impacts.

The operational view of the solar farm may generate a cumulative impact with the existing substation and solar farm infrastructure. The substation has partial screening from the Black Box Woodland and the adjacent Rice Sheds which would reduce the view of substation infrastructure from Ercildoune Road and Kidman Way. The security fencing and steel dominated infrastructure of the solar farm proposal area would be visible from the Kidman Way and Kook Road. This would not affect any residences due to existing vegetation screening and topography. View durations would be short and considered acceptable along the 100 kilometre per hour speed zone, however mitigation strategies have been recommended to reduce impacts where possible. These mitigation measures are discussed in section 6.4.4.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

8 ENVIRONMENTAL MANAGEMENT

8.1 ENVIRONMENTAL FRAMEWORK

The environmental risks associated with the proposed Coleambally Solar Farm would be managed by implementing a project-specific suite of mitigation measures detailed in Sections 5 and 7 and summarised below.

All commitments and environmental safeguards would be managed through the implementation of a Project Environmental Management Plan, consisting of a CEMP, an Operation Environmental Management Plan and a Decommissioning Environmental Management Plan. These plans would be prepared sequentially, prior to each stage of works.

These plans would detail the environmental management responsibilities of specific staff roles, reporting requirements, monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training, complaint response procedures and adaptive management mechanisms to encourage continuous improvement.

8.2 MITIGATION MEASURES

Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Construction (C), Operation, (O), Decommissioning (D)

No.	Safeguards and mitigation measures	C	O	D
BD1	Develop and implement a construction Flora and Fauna Management Plan (FFMP) for incorporation of construction related environmental management safeguards.	**C**		
BD2	Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be clearly demarcated and implemented. This will include environmentally sensitive areas such as EECs. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	**C**		
BD3	Clearing and construction contractors would be given inductions that make clear the importance of the sensitive area habitat and its species.	**C**		
BD4	Where trees are to be retained, an adequate tree protection zone (TPZ) will be provided around each tree for the duration of construction. Details for calculating TPZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*.	**C**		
BD5	A pre-clearing process will be implemented before clearing begins. Pre-clearing surveys will be carried out by an ecologist and will include general fauna surveys, general tree hollow inspections and dam/waterway inspections. Habitat trees will be clearly marked with flagging tape.	**C**		
BD6	When programming the works, consider breeding periods of fauna that may be impacted.	**C**		
BD7	An unexpected threatened species finds procedure will be developed before clearing commences.	**C**		
BD8	A 'Clearing and Grubbing Plan' will be developed to;	**C**		

No.	Safeguards and mitigation measures	C	O	D
	➢ include best practice methods for the removal of woody vegetation and non-woody vegetation. ➢ Trees will be removed in such a way as not to cause damage to surrounding vegetation. Root systems of trees and shrubs to be removed will be retained in-ground to ensure surrounding ground layer vegetation is undisturbed and to prevent soil erosion. ➢ Require that where work cannot avoid encroaching into the TPZ, it not impinge on the structural root zones (SRZ) of trees to be retained. Details for calculating the SRZs are provided within *Australian Standard 4970-2009 – Protection of trees on development sites*. ➢ Where possible, trees to be removed will be mulched on-site and re-used to stabilise disturbed areas. ➢ Tree clearing protocol, that includes staged habitat removal, and a requirement for an ecologist being present during tree-felling of all hollow-bearing trees to ensure that any potential impacts on fauna are minimised			
BD9	Any fallen timber, dead wood and bush rock (if present) encountered on site will be left in situ or relocated to a suitable place nearby. Rock will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	**C**		
BD10	A Weed Management Plan would be developed for the proposal to prevent/minimise the spread of weeds. This would include: ➢ Management protocol for declared noxious weeds as stipulated by the *Noxious Weeds Act 1993* during and post construction ➢ A protocol for weed hygiene in relation to plant, machinery and importation and management of fill ➢ Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated and reported.	**C**		
BD11	To minimise fire risk from bird collisions, reflective power line marking balls may be used if required by TransGrid on any overhead transmission lines.		**O**	
BD12	Any onsite landscape plantings (such as to address visual impacts) will be comprised of local indigenous species (such as those of Weeping Myall Woodland) with the object of increasing the structure of the existing vegetation. Planting locations would be designed to improve the connectivity between patches in the landscape where consistent with landscaping outcomes and the solar farm operation.		**O**	
AH1	An unexpected finds protocol (UFP) must be prepared and followed should there be an inadvertent discovery of Aboriginal objects occur.	**C**		
AH2	In the unlikely event that human remains are discovered during the construction, all work must cease in the immediate vicinity. OEH, the local police and the registered Aboriginal parties should be notified. Further assessment would be undertaken to determine if the remains were Aboriginal or non-Aboriginal.	**C**		
VA1	The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. ○	**Design stage**		
VA2	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	directed away from the Kidman Way, so as not to cause light spill that may be hazardous to drivers.			
LU1	Consultation with adjacent landholders would be ongoing to manage interactions between the solar farm and other properties.	**C**	**O**	**D**
LU2	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	**C**		
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • Removal of all above ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. • Reinstate irrigation infrastructure in consultation with landowner, including laser levelling and contour/bund reconstruction where required.			**D**
LU4	Prepare a pest and weed management plan to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Murrumbidgee Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	**C**	**O**	
NS1	Works should be undertaken during standard working hours only. (Except for the connection to substation) • Monday – Friday 7am to 6pm • Saturday 8am to 1pm • No work on Sundays or public holidays	**C**		
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	**C**	**O**	**D**
NS3	A letter box drop would be prepared and provided to residences in close proximity to the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	**C**	**O**	**D**
NS4	Regular inspection and maintenance of equipment to ensure that plant is in good condition.	**C**	**O**	**D**
SO1	A Ground Cover Management Plan would be developed to address soil erosion, fire control and biodiversity issues. The plan would include monitoring and triggers for action to address issues arising from erosion that develops during operation.		**O**	
SO2	A Soil and Water Management Plan and Erosion and Sediment Control Plans would be prepared, implemented and monitored during the construction and decommissioning of the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions such as:	**C**		**D**

No.	Safeguards and mitigation measures	C	O	D
	• At the commencement of the works, and progressively during construction, install the required erosion control and sediment capture measures. • Regularly inspect erosion and sediment controls, particularly following rainfall. • Maintain a register of inspection and maintenance of erosion control and sediment capture measures. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads. • In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately, so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • Manage works in consideration of heavy rainfall events. • Areas of disturbed soil would be rehabilitated promptly and progressively during construction.			
SO3	A Spill Response Plan would be developed and implemented during construction, operation and decommissioning to prevent contaminants affecting adjacent surrounding environments. It would include measures to: • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation). • A protocol would be developed in relation to discovering buried contaminants within the proposal area (e.g. pesticide containers if any). It would include stop work, remediation and disposal requirements.	**C**	**O**	**D**
SO4	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposal area. This includes dust from stockpiled materials.	**C**	**O**	**D**
SO5	Any area that was temporarily used during construction (laydown and trailer complex areas) would be restored back to original condition or re-vegetated with native plants.		**O**	
SO6	Soil must be tested for clay content, CEC and EC prior to commencement of construction work to determine whether the application of gypsum is required while trenching and the rate of application.	**C**		
WA1	All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	**C**	**O**	**D**
WA2	All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area.	**C**	**O**	**D**
WA3	Adequate incident management procedures will be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
WA4	The refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas.	**C**	**O**	**D**
WA5	Machinery would be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills	**C**		**D**
TT1	A Haulage Plan would be developed and implemented during construction and decommissioning, including but not limited to: • Assessment of road routes to minimise impacts on transport infrastructure. • Scheduling of deliveries of major components to minimise safety risks (on other local traffic). • Traffic controls (signage and speed restrictions etc.).	**C**		**D**
TT2	A Traffic Management Plan would be developed and implemented during construction and decommissioning. The plan would include, but not be limited to: • Assessment of road condition prior to construction on all local roads that would be utilised. • A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.). • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.	**C**		**D**
TT3	The proponent would consult with the Murrumbidgee Council regarding the proposed upgrading of Ercildoune road. The upgrade would be subject to detailed design, and must be designed and constructed to the relevant Australian road design standards.	**C**		
TT4	The proposed Ercildoune Road and Kidman Way intersection upgrade must be designed and constructed in accordance with NSW Roads and Maritime Services requirements.	**C**		
TT5	The proponent would repair any damage resulting from project traffic (except that resulting from normal wear and tear) as required at the proponent's cost.	**C**	**O**	**D**
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	**C**	**O**	**D**
AQ2	Protocols to guide vehicle and construction equipment use, to minimise emissions would be included in construction and operational environmental management plans. This would include but not be limited to Australian standards and POEO Act requirements.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
AQ3	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposal area. This includes dust from stockpiled materials.	**C**	**O**	**D**
EM1	All design and engineering would be undertaken by qualified competent persons with the support of specialists as required.	**C**		
EM2	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	**C**		
EM3	Transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure to EMFs.	**C**		
EM4	Design of electrical infrastructure would minimise EMFs. (underground).	**C**		
SE1	A Community Consultation Plan would be implemented during construction to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the project and project benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints received.	**C**		
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	**C**		
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	**C**		**D**
SE4	Liaison with local tourism industry representatives to manage potential timing conflicts or cooperation opportunities with local events.	**C**		**D**
WM1	A Waste Management Plan (WMP) would be developed and implemented during construction, operation and decommissioning to minimise wastes. It would include but not be limited to: • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage would be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads).	**C**	**O**	**D**
BF1	A Bush Fire Management Plan would be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to: • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression.	**C**	**O**	**D**

No.	Safeguards and mitigation measures	C	O	D
	• The below requirements of *Planning for Bush Fire Protection 2006:* ○ Identifying asset protection zones ○ Providing adequate egress/access to the site ○ Emergency evacuation measures Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.			
HH1	The European Survey Marker Trees should be clearly identified in the Construction Environmental Management Plan. If construction work is required within 50m of any of these trees, the trees would be protected prior to work commencing using paraweb fencing or similar and not removed until construction work has been completed.	**C**		**D**
HH2	Should an item of historic heritage be identified, the Heritage Division (OEH) would be contacted prior to further work being carried out in the vicinity.	**C**	**O**	**D**

9 CONCLUSION

NGH Environmental has prepared this EIS on behalf of the proponent Neoen Australia. This EIS has assessed the broader Coleambally Solar Farm development envelope where infrastructure may be located. Overall, the Coleambally SF would represent a further contribution to Australia's transition to a low emission energy generation economy. It is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous agricultural capacity.

The key environmental risks have been investigated through specialist investigations:

- Biodiversity impacts – the BAR concluded that no significant impacts to threatened species and ecological communities would result. No referrals under the EPBC or TSC Act are considered to be required.
- Aboriginal heritage impacts – the Aboriginal Heritage survey and assessment found that no impact to Aboriginal cultural heritage would occur from the proposal.
- Visual impact - the VIA concluded that the construction and operation would have a very low visual impact on the majority of people living in or travelling through the landscape surrounding the proposed solar farm.
- Noise impacts – the noise assessment concluded that noise impacts during construction, operation and decommissioning would be within the accepted noise criterion. Noise exceedances would not occur.
- Land use - While the agricultural output from the existing farmland would be reduced by the operation of the solar farm this would form a very small reduction in the agricultural output of the Coleambally area. The Coleambally Solar Farm is reversible and would not result in the permanent loss of agricultural land.

A suite of management measures have been developed to address environmental impacts and risks to these and other physical, social and environmental impact areas. Key management strategies centre on the development of management plans and protocols to minimise impacts and manage identified risks. The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Impacts are considered justifiable and acceptable.

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APPENDIX A SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

APPENDIX B PROPOSAL MAPS AND DRAWINGS

APPENDIX C CONSULTATION

C.1 AGENCY CONSULTATION

C.2 COMMUNITY CONSULTATION PLAN

APPENDIX D BIODIVERSITY ASSESSMENT REPORT

APPENDIX E VISUAL IMPACT ASSESSMENT

APPENDIX F ABORIGINAL CULTURAL HERITAGE ASSESSMENT

APPENDIX G ACCESS DESIGN