Wollar Solar

Environmental Impact Assessment

WOLLAR SOLAR FARM

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For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*.

EIS prepared by: NGH Environmental, Suite 11 89-91 Auckland Street, Bega NSW 2550.

Applicant: Wollar Solar Development Pty Ltd

Proposed Development:

The Wollar Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic solar farm that would produce 290 megawatts (MW) of electricity. Associated infrastructure would include a substation, battery storage and connection to an existing substation.

Land to be developed:

The Wollar Solar Farm proposal would be located on an approximately 878 hectare property comprising of Lots 22-25, 27, 30, 45, 49-51, 60-63, 69-80, 92, 105-107, 119 and 152-154 of DP 755430, and Lot 1 of DP 650653.

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 Regulation 2000.* To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure, and that information in the EIS is neither false nor misleading.

Name:	Louiza Romane	Jane Blomfield
Qualification	B.Sc (Honours)	BEnvSc (land & water), MEM
Signature:		
Date:	03/12/2018	03/12/2018

ACRONYMS AND ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AC	alternating current
ACHA	Aboriginal Cultural Heritage Assessment
ACHCRP	*Aboriginal cultural heritage consultation requirements for proponents*
AEP	Annual Exceedance Probability
AER	Australian Energy Regulator
AFT	Artefact scatter
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARI	Average Recurrent Interval
APZ	Asset Protection Zone
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASL	Above sea level
BAL	Basic Left Turn
BAM	Biodiversity Assessment Methodology
BAR	Basic Right Turn
BC Act	*Biodiversity Conservation Act 2016*
BCC	Biobanking Credit Calculator
BDAR	Biodiversity Development Assessment Report
BFMC	Bush Fire Management Committee
BOM	Australian Bureau of Meteorology
BOS	Balance of System
BSAL	Biophysical strategic agricultural land
CCP	Community Consultation Plan
CEC	Clean Energy Council
CEMP	Construction environmental management plan
CENTROC	Central West Regional Organisation of Councils
CER	Clean Energy Regulator
CHMP	Cultural Heritage Management Plan
CSG	coal seam gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application

dB(A)	Decibels, a measure of A-weighted *(c.f.)* sound levels.
DC	Direct current
DECC	Department of Climate Change (now OEH)
DECCW	Department of Climate Change and Water (now OEH)
DEMP	Decommissioning Environmental Management Plan
DIS	Department of Industry and Science
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DOE	Department of the Environment (Commonwealth)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
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)
EPC	Engineering Procurement and Construction
EPI	environmental planning instruments
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
ERP	Emergency Response Plan
ESD	Ecologically sustainable development
FM Act	*Fisheries Management Act 1994*
FPL	Flood Planning Level
FRV	Fotowatio Renewable Ventures
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	hectares
HBT	Hollow Bearing Tree
HV	High Voltage
Hz	Hertz
IBRA	International Bioregions of Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEA	International Energy Agency

IF	Isolated find
INP	Industrial Noise Policy
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
kl	kilolitres
km	kilometres
kV	kilovolts
kW	kilowatts
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LEMC	local emergency management committee
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LUCRA	land use conflict risk assessment
m	metres
mm	millimetres
ML	Megalitres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MW	Megawatt
MWh	Megawatt hours
NEM	National Electricity Market
NML	Noise Management Level
NPfI	NSW Policy for Industry
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NTNDP	National Transmission Network Development Plan
O&M	Office and Maintenance
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
OEMP	Operation Environmental Management Plan
PARF	Powering Australian Renewables Fund
PBP	Planning for Bushfire Protection
PCS	Power conversion stations
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PV	Photovoltaic
RAPs	Registered Aboriginal Parties

RBL	Rating Background Level - the level of background noise
RE Act	*Renewable Energy (Electricity) Act 2000* (Commonwealth)
RET	Renewable Energy Target
RFP	Request for Proposal
RFS	NSW Rural Fire Service
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
RNP	*Road Noise Policy*
Roads Act	*Roads Act 1993* (NSW)
SAII	Serious and Irreversible Impacts
SCS	Soil Conservation Service
SEARs	Secretary's Environmental Assessment Requirements
SEIFA	Socio Economic Indexes for Areas
SEPP	State Environmental Planning Policy (NSW)
SHI	State Heritage Inventory
SOE	State of the Environment
sp/spp	Species/multiple species
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011 (NSW)*
SSD	State Significant Development
SWMP	Soil and Water Management Plan
TEC	Threatened Environmental Communities
TMP	Traffic Management Plan
µT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
VOC	Volatile Organic Compound
WAL	Water Allocation License
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WHO	World Health Organisation
WMP	Waste Management Plan

EXECUTIVE SUMMARY

Introduction

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed Wollar Solar Farm (the Proposal). The proposed solar farm would generate approximately 290MW (AC) to be supplied directly to the national electricity grid. NGH Environmental has prepared the EIS on behalf of the proponent; Wollar Solar Development (WSD) a subsidiary of Solar Megawatt Holding Pty Ltd.

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

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and results in a Proposal that responds appropriately to the site constraints for the Wollar Solar Farm.

A Preliminary Environmental Assessment (PEA) was prepared in the early planning stages to determine environmental constraints associated with the site. The constraints were used to assist with designing the solar farm layout and planning the detailed methodologies for this EIS. Detailed investigations continued to inform the development throughout the assessment process. With reference to the site's key constraints, the proposal assessed in this EIS has:

Biodiversity:	• Avoided most areas of good condition White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community (EEC). • Minimised impacts to rocky outcrops. • Minimised impacts to hollow-bearing trees.
Aboriginal heritage:	• Avoided a grinding groove within the proposal site. A 15m buffer would be applied to ensure no indirect impacts. • Avoided a modified tree and a possible modified tree within the proposal site. A 15m buffer would be applied to ensure no indirect impacts. • Avoided a possible cultural site within the proposal site. A 20m buffer would be applied to ensure no indirect impacts.
Waterways:	• Buffered two waterways in accordance with their classification and the "Guidelines for Riparian Corridors on Waterfront Land" to minimise impacts on hydrology and water quality. This includes a 40m buffer along each 4th order waterway.

Proposal needs and benefits

There is a clear need for the proposal to meet Australia's greenhouse gas reduction, renewable energy targets and electricity needs. The proposal would bring local benefits such as job opportunities and local expenditure.

The Wollar Solar Farm would:

- Support Commonwealth and NSW climate change commitments.
- Generate enough clean, renewable energy for about 104,926 average NSW homes.
- Displace approximately 515,564 metric tonnes of carbon dioxide.
- Improve electricity reliability, security and cost.
- Create local job and training opportunities.
- Inject expenditure in the local area and spread of benefits through a local community fund.
- Diversify the regional economy by introducing new land use opportunities.

Proposal description

The proposed Wollar Solar Farm would be located 7km south of Wollar, NSW. The site access would be via Barigan Road and the existing TransGrid access (Northern Access) and Maree Road (Southern Access). The Proposal would connect to the existing Wollar substation west of Barigan Road.

The Wollar Solar Farm proposal involves the construction, operation and decommissioning of a ground-mounted PV solar farm which would generate approximately 290MW (AC) to be supplied directly to the national electricity grid. Development of the solar farm would make use of existing electricity infrastructure and contribute to Australia's transition to a low emission energy generation economy. The Wollar Solar Farm proposal site is outlined in the table below.

Table 1-1 Affected lots associated with the proposed Wollar Solar Farm.

Referred to in the EIS	Proposed infrastructure	Lots and DP	Owner	Existing use	Ownership arrangements
Proposal site and development footprint	All proposed solar farm infrastructure including solar arrays, connection infrastructure, battery storage, internal roads and ancillary infrastructure.	Lots 22, 23, 25, 27, 30, 45, 49-51, 60-63, 69-80, 92, 105-107, 119 and 152-154 of DP 755430 and Lot 1 DP650653.	Currently owned by one private landowner (involved landowner).	Agriculture.	WSD would purchase this land.
		Lot 24 DP755430	Currently owned by one private landowner (involved landowner).	Involved landowner residence.	WSD would purchase this land.
		Lot 7303 DP1139558.	Crown Land.	Agriculture.	WSD would lease or purchase this land.
Connection	Connection to existing Transmission line.	Lot 80 DP755430.	One Private land owner (involved landowner).	Agriculture.	Easement would be established.

Referred to in the EIS	Proposed infrastructure	Lots and DP	Owner	Existing use	Ownership arrangements
	Connection to Wollar substation.	Lot 1 DP1090027.	TransGrid.	Electricity generation – substation.	TransGrid.
Northern Access	Up to 1km of access track between the Wollar substation and the solar farm.	Lots 10 and 11 DP1090027.	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.
		Lot 1 DP1090027.	TransGrid.	Electricity generation.	Easement would be established.
	Use of existing TransGrid access road.	Lots 1, 2, 4, 6, 8 DP1090027.	TransGrid.	Access to Wollar Substation.	Right of way would be established.
Southern Access	Use of existing site access via Maree Rd.	NA	Mid-Western Regional Council.	Road easement.	Mid-Western Regional Council.
		Lot 84 DP755430	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.
	Use of existing site access via unnamed track.	Lot 46 DP755430.	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.

Pending project approval, the proposal site is intended to be owned by WSD, excluding Lot 1, 2, 4, 6, 8, 10 and Lots 10 and 11 DP1090027. These lots would remain under the ownership of Peabody Australia Pty Ltd (Lots 10 and 11 of DP1090027 and Lots 46 and 84 DP755430) and TransGrid (Lot 1, 2, 4, 6 and 8 of DP1090027). Easements for the Northern Access and Southern Access would be established. The existing Wollar substation, located on Lot 1 DP1090027, is owned by TransGrid.

Of the 878ha proposal site, approximately 461ha would be developed for the solar farm and associated infrastructure. An existing TransGrid 330kV transmission line transects the proposal site in the north eastern corner and would be used to connect the solar farm to the national electricity grid. The indicative layout presented has been developed iteratively, in tandem with the environmental assessment and consultation with agencies and the community, to avoid and minimise potential impacts wherever practicable.

It is anticipated the Wollar Solar Farm would require the following infrastructure onsite:

- Approximately 922,432 PV solar panels mounted on either fixed or tracking systems, both of which are considered feasible:

  - Fixed-tilted structures in a north orientation at an angle of 32 degrees or
  - East-west horizontal tracking systems.
- Approximately 58 PCUs composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33kV AC energy.
- Steel mounting frames with driven or screwed pile foundations.
- An onsite 330kV substation containing two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 330kV transmission line onsite.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, indoor 33kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- Up to 1km of access track off Barigan Road to the site via the existing TransGrid substation access road, which would require construction of an access road between the Wollar substation and the proposed onsite substation.
- Internal access tracks for construction and maintenance activities.
- An energy storage facility with a capacity of up to 30 MWh (i.e. 30 MW power output for one hour) and comprising of lithium ion batteries with inverters.
- Perimeter security fencing up to 2.3m high.
- Native vegetation planting to provide visual screening for specific receivers, if any are required.

During the construction phase, temporary ancillary facilities would be established on the site and may include:

- Laydown areas.
- Construction site offices and amenities.
- Car and bus parking areas for construction staff.

The construction phase of the proposal would take about 12 – 18 months with peak activity lasting about 9 months. At the peak of the construction, it is anticipated that up to 500 workers would be required onsite. Up to 500 workers is a maximum estimation, the amount of workers required for proposal would likely be less.

At the end of the proposal's operational life, the site would be either returned to its pre-solar farm land capability for a return to agricultural land use, or to an alternative land use. During the site's decommissioning phase, all above ground above solar farm infrastructure would be removed.

Community and Stakeholder Consultation

WSD has undertaken comprehensive consultation with affected landowners, the local community and other relevant stakeholders in developing the proposal. A Community Consultation Plan (CCP) is in place for the Wollar Solar Farm. WSD's CCP considers stakeholders' views and provides timely feedback on any matters raised.

WSD has informed and engaged with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners and exploration licence holders on the proposal.

The development of the Wollar Solar Farm was made known to the public early in its development with a fact sheet distributed to the Wollar community.

While much of the consultation process focused on informing the community about issues relating to the proposal, activities to engage the community in two-way dialogue were also undertaken.

As well as one -on -one and small group meetings, to date, WSD has provided a variety of opportunities for the community members to find out more about the proposal (Table 1-2).

Table 1-2 Community and stakeholder consultation to date.

Date of activity	Description of activity
January 2018 – ongoing	WSD met with TransGrid on multiple occasions mostly relating to the electrical connection application for connection to the grid. At meetings with TransGrid, general proposal updates were provided and feedback was sought.
11 January 2018	WSD met with NSW Department of Planning and Environment staff to provide project briefing and to seek feedback.
1 February 2018 19 February 2018	Wilpinjong mine site representative contacted and informed of the proposal. Adjoining properties are all owned by the mine and sub leased to a Pastoral Management Company. Mine advised they will brief this company.
16 March 2018	WSD discussion with staff at offices of Geological Survey of NSW to discuss general geological, exploration and mining issues associated with the site.
25 March 2018	Development of website to provide project information, updates and contact details https://www.wollarsolarfarm.com.au/ Establishment of a dedicated email address for feedback info@wollarsolarfarm.com.au
1 May 2018	Establishment of a dedicated "1300" phone number for enquiries.
8 May 2018	Project information Newsletter 1 created and posted at Wollar General Store.
8 May 2018	Direct engagement by WSD with general store owners/workers including distribution of Newsletter 1 and contact details.
8 May 2018	Meeting with Wilpinjong mine representative to provide details of the proposal.
12 July 2018	Letter box drop of project information Newsletter 2 and feedback form to all Wollar and Tichular households.
10 August 2018 14 August 2018	Advertisement in the Mudgee Guardian to inform community of upcoming open house community information session in Mudgee.
13 August 2018	Project media release sent to local TV, radio and print media detailing the project status and the upcoming open house event on 16 August in Mudgee. Interview with local radio station ABC / Central West.
14 August 2018	Interview with local radio station 2MG.
16 August 2018	Open house community information session at the CWA hall in Mudgee. Event held by WSD and NGH to provide further information and an opportunity for community members to provide feedback.

Date of activity	Description of activity
	Consultation with representative from Bylong Coal Project, Mudgee Hospital Redevelopment, Community members and environmental groups.
14 November 2018	Advised Petroleum Exploration Licence Holder (PEL456 – Hunter Gas Pty Ltd) by of development by letter and sought feedback. Advised Exploration Licence Holder (EL6676 – Dept. Planning & Environment) of development by letter and sought feedback.
26 November 2018	Discussion with Peabody Australia Pty Ltd representative relating to key construction activities associated with the Wilpinjong Extension Project and anticipated construction timing.
6 December 2018	Consultation with TransGrid requesting landowner consent to lodge the Development Application.
6 December 2018	Consultation with Peabody Australia Pty Ltd requesting landowner consent to lodge the Development Application.
24 January 2019	Received TransGrid landowner consent from The Treasury on behalf of the Electricity Transmission Ministerial Holding Corporation to lodge the DA.
25 January 2019	Received DPI – Crown Lands and Water acknowledgement of receipt of landowner consent application.
31 January 2019	Received Peabody Australia Pty Ltd acknowledgment of previous consultation regarding intent to lodge a DA.
14 March 2019	Consultation with Mid-Western Regional Council regarding accommodation strategy. Council provided public examples of other large infrastructure projects that have considered accommodation impacts.

Biodiversity

A Biodiversity Development Assessment Report (BDAR) was completed by NGH Environmental to assess the impacts of the proposed Wollar Solar Farm according to the NSW Biodiversity Assessment Methodology (BAM). Consideration has been given to avoid and minimise impacts to native vegetation where possible through several layout iterations.

Biodiversity impacts have been assessed through comprehensive survey, mapping and assessment completed in accordance with the BAM. Regarding onsite surveys, three targeted survey programs were undertaken to address all candidate species. Three were confirmed onsite: the Large-eared Pied Bat (*Chalinolobolus dwyeri*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Eastern Cave Bat (*Vespadelus troughtoni*). Although detected onsite, it was concluded after extensive inspection of rocky scarp habitat that no specialised breeding/roosting/refuge habitat was present inside the development footprint, as such no species credits would be generated.

For biodiversity impacts that are unavoidable, native vegetation direct impacts comprise:

- 367 ha out of the 461 ha development footprint.

This is comprised of:

- 26 ha of structural woodland, the remainder being derived grasslands and cultivated low condition area.
- 340 ha of vegetation that meets the NSW criteria for Endangered Ecological Communities, most (92%) in degraded condition that does not generate offsets.
- 229 ha of vegetation that meets the Commonwealth criteria for Critically Endangered Ecological Communities, most (88%) in degraded condition.

The areas above include nine hollow-bearing trees (HBTs) that would need to be removed.

The majority of the development footprint (55%) will consist of solar panels. The impacts of shading and diversion of rainfall runoff from the panels themselves is largely unknown. For the purpose of this BDAR report, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial peripheral areas are likely to be unimpacted and it is likely that a number of perennial native species will persist underneath the solar arrays. Certainly, only a minor proportion of the seed bank will be impacted, given the limited excavation proposed. This is therefore a 'worst case' conservative approach. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact; such as the results of ground cover monitoring beneath the solar array.

As such, the NSW credit requirement for the 'worst case' impact has been defined as:

- 747 ecosystem credits (5 of these credits generated by paddock tree removal)
- 0 species credits

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Scheme (BOS).

The project is subject to a 'streamlined assessment', to capture MNES, as well as NSW matters. Regarding MNES, potential impacts on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community are considered likely to be significant and warrant offsets. No other Commonwealth entity was assessed to have potential for a significant impact by the project.

In advance of the NSW BOS being endorsed by the Commonwealth (as of 15 February 2019 it is on public exhibition), the Wollar Solar Farm offset strategy retains flexibility. The strategy demonstrates that:

- Securing in perpetuity physical offsets within the study area are likely to be feasible.
- Similar vegetation occurs in the locality and could also be considered, if required, for physical offsets.

Payment options may also be considered, such as making payments into the NSW Biodiversity Conservation Fund using the offset payments calculator, or funding a biodiversity action.

Aboriginal heritage

NGH Environmental prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) to provide an assessment of the Aboriginal cultural values associated with the site, to assess the cultural and scientific significance of any recorded Aboriginal sites and to identify whether any Aboriginal objects or places would be impacted by the proposal.

The Aboriginal heritage investigations included consultation, background research, a field survey and significance assessment. The 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* (NSW). The assessment was guided by the *Guide to Investigating, Assessing and Reporting* *on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010a).

The survey strategy was to cover as much ground surface as possible within the development footprint within the proposal site. The survey recorded 37 site occurrences. These archaeological features have been recorded as 12 artefact scatters and 25 isolated finds. One grinding groove, one scarred tree, one possible scarred tree and a culturally significant site were also recorded

The proposed construction methodology for the project would result in only small areas of disturbance. The construction of access and maintenance tracks may involve some grading but given the nature of the majority of the terrain, this is likely to be minimal. The installation of the solar arrays involves drilling or screwing the piles into the ground and no widespread ground disturbance work such as grading required to accomplish this. . Localised areas of earth works (cut and fill, grading and compacting) may be required in areas where there is sudden, significant changes in ground slope. The major ground disturbance will be the trenching for cables and vehicle movement during construction

Additionally, the possible cultural site (Wollar SF Cultural Site 1), grinding groove (Wollar SF GDG 1), modified tree (Wollar SF ST1) and possible modified tree (Wollar SF ST2) would not be impacted by the proposal. The other sites would be salvaged prior to construction. As such, the assessment of harm overall for the project is therefore assessed as moderate.

Agriculture and land use

The proposal site occurs in a rural landscape with agriculture and mining as the current dominant land uses. The proposal site is predominantly mapped as Land and Soil Capability Class 5 (Moderate – low capability land) and Class 7 along the south-western boundary. Class 5 land is described as being largely restricted to grazing, some horticulture (orchids), forestry and nature conservation. Development is not proposed in areas mapped as Class 7. Additionally, the site is not mapped as Biophysical Strategic Agricultural Land (BSAL). The closest BSAL is located 13km south east of the proposal site.

The proposal site is zoned as RU1 Primary Production and the land surrounding is RU1 Primary Production (grazing) and E3 Environmental Management (Crown Land). The proposal site represents a small proportion (0.001%) of land zoned for Primary Production within the Mid-Western Regional LGA.

No land use conflicts are anticipated for existing adjacent agricultural land uses or future agricultural land uses on the proposal site or adjacent lands during construction. A land use conflict risk assessment (LUCRA) was carried out in accordance with the Department of Primary Industries Land Use Conflict Risk Assessment Guide (DPI, 2011). Land use conflicts identified included conflicts with agriculture, exploration licences and crown land during all phases of the proposal. All conflicts identified during construction, operation and decommissioning are expected to be manageable with measures presented within this EIS.

Hydrology and flooding

A Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd to assess the impact of the proposed permanent infrastructure on hydrology and flooding.

The Wollar Solar Farm proposal site is located in the Central Tablelands Local Land Services area within the 22,000km^2 Hunter River Catchment. The dominant surface water feature within the locality is the Goulburn River, located approximately 18km north of the proposal site and feeds the Moolarben Dam storage area.

The proposal site is traversed by two named waterways (Wollar Creek and Spring Flat Creek) both of which are categorised as 4th order streams. Wollar Creek traverse the site in the east in a north-south direction and Spring Flat Creek (a tributary of Wollar Creek) flows through the proposal site in a south-west to north-east direction. Eight unnamed tributaries of Spring Flat Creek also traverse the site (Figure 8-2). All watercourses are described as ephemeral and would only contain flowing water during rainfall.

There is not predicted to be a significant impact on flood behaviour within the floodplain as a result of the proposed solar farm, with flood levels, depths, velocities and hazards remaining relatively unchanged. Importantly the modelling demonstrates that changes in peak flood levels are limited to within the proposal site and are therefore not anticipated to adversely affect adjoining properties.

The mitigation measures presented within this EIS are considered sufficient in managing any potential impacts posed by the solar farm on hydrology and flooding.

Cumulative impacts

Proposed developments within the locality or region which may contribute to cumulative impacts of the proposal include:

- Wilpinjong Extension Project, proposed by Peabody Australia Pty Ltd, is approximately 8km north of the proposal site and was approved in April 2017. Construction has commenced and will continue through 2019.
- Bylong Coal Project, proposed by KEPCO Bylong Australia, is approximately 20km east of the proposal site and is still in the approvals phase. Commencement of constructed is proposed for 2019.
- The Mudgee Hospital Redevelopment, approximately 38km south west of the proposal site and is still in the approvals phase. Construction is proposed for 2019.

Construction of these projects may coincide with construction of the proposed Wollar Solar Farm. Influx of workers and increase in road usage due to these projects is considered manageable with the implementation of the mitigation measures presented in this EIS.

Other environmental issues

Eleven lower risk issues were investigated:

1. Water use and water quality.
2. Visual amenity and landscape character.
3. Noise and vibration.
4. Historic heritage.
5. Social and economic impacts.
6. Traffic, transport and safety.
7. Bushfire.
8. Electric and magnetic fields.
9. Air quality and climate.
10. Resource and waste generation.
11. Hazardous materials and development.

These impact were assessed as acceptable and highly manageable.

Management impacts

Impact avoidance and minimisation measures have been incorporated into the design of the proposal. These measures are considered practical and achievable by the proponent. They are set out for each area of investigation in Sections 7 and 8 and summarised in Section 9.2 of this EIS.

All commitments and environmental safeguards would be managed through the implementation of an Environmental Management Strategy, consisting of a Construction Environmental Management Plan, an Operation Environmental Management Plan and a Decommissioning Environmental Management Plan. These plans would be prepared sequentially and submitted to the Department of Planning and Environment (DPE), prior to each stage of works. These mechanisms ensure that the commitments of the EIS are carried through to on ground activities to ensure effective onsite mitigation of impacts for all project stages.

Conclusion

The Wollar Solar Farm would result in a number of benefits, local and regional, and has been developed to ensure the benefits are spread into the longer term, reflecting community expectations specific to this proposal.

The environmental impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Mitigation strategies have been developed with the community and other relevant agencies stakeholders in many cases. On balance, the proposal is considered appropriate to the site's constraints and is therefore, justifiable and acceptable.

1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental and planning issues associated with the construction, operation and decommissioning of the proposed 290 Mega Watt (MW) Wollar Solar Farm. This EIS has been prepared by NGH Environmental on behalf of the proponent, Wollar Solar Development Pty Ltd (WSD).

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 the 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 4.15 of the EP&A Act. The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), provided by DPE on 4 May 2018 (refer to Section 6.1.1).

1.2 PROPOSAL OVERVIEW

WSD proposes to construct, operate and decommission a photovoltaic (PV) solar farm with an estimated capacity of 290MW. The Wollar Solar Farm proposal would be located on a rural property approximately 7 kilometres (km) south of Wollar village.

1.2.1 Proposal locality

The Wollar Solar Farm proposal is located on the western side of Barigan Road, approximately 7km south of Wollar village (Figure 1-1) The proposal site is located within the Mid-Western Regional Local Government Area (LGA). Mudgee is approximately 38km south west from the proposal site and is the closest regional center for residents of Wollar to access services.

The land immediately surrounding the proposal site includes agricultural land predominantly grazed by cattle with limited cropping for feed, Crown Land, coal mining and a 500/330kV TransGrid substation. Coal mining is the main local industry for employment in the Mid-Western Regional Local Government Area (LGA), followed by beef cattle farming and primary education (ABS, 2016). There are three coal mines within the vicinity of the proposal site:

- Wilpinjong Coal mine approximately 11km north west.
- Moolarben Coal mine approximately 21km north west.
- Ulan Coal mine approximately 23km north west.
- Bylong Coal Project, proposed by KEPCO Bylong Australia, is approximately 20km east of the proposal site and is still in the approvals phase. Commencement of construction is proposed for 2019.
- Wilpinjong Extension Project, proposed by Peabody Australia Pty Ltd, is approximately 8km north of the proposal site and was approved in April 2017.

There are also renewable energy projects proposed or present in the region, including:

- Crudine Ridge Wind Farm, proposed by CWP Renewables. It has commenced construction and is located about 80km south-west of the proposal site.

- Uungala Wind Farm, proposed by CWP Renewables, would be located approximately 58km west of the proposal site. The EIS and DA are currently being prepared.
- Beryl Solar Farm, proposed by First Solar, is located 50km north-west of the proposal site and has commenced construction.

One residence that is owned by the current landowner is located on the subject land. No other residences are located within 2km of the proposal site.

Interesting regional features in relation to the site context are:

- Munghorn Gap Nature Reserve, located approximately 9km to the west of the proposal site. Munghorn Gap is the second oldest nature reserve in Australia, covering about 5,934ha. The nature reserve offers recreational uses and holds important Aboriginal heritage values.
- Goulburn River National Park, which is about 13km to the north east of the proposal site. This National Park stretches along 90km of river that offers walking, camping and swimming opportunities, as well as holding significant cultural values including over 300 known Aboriginal heritage sites.

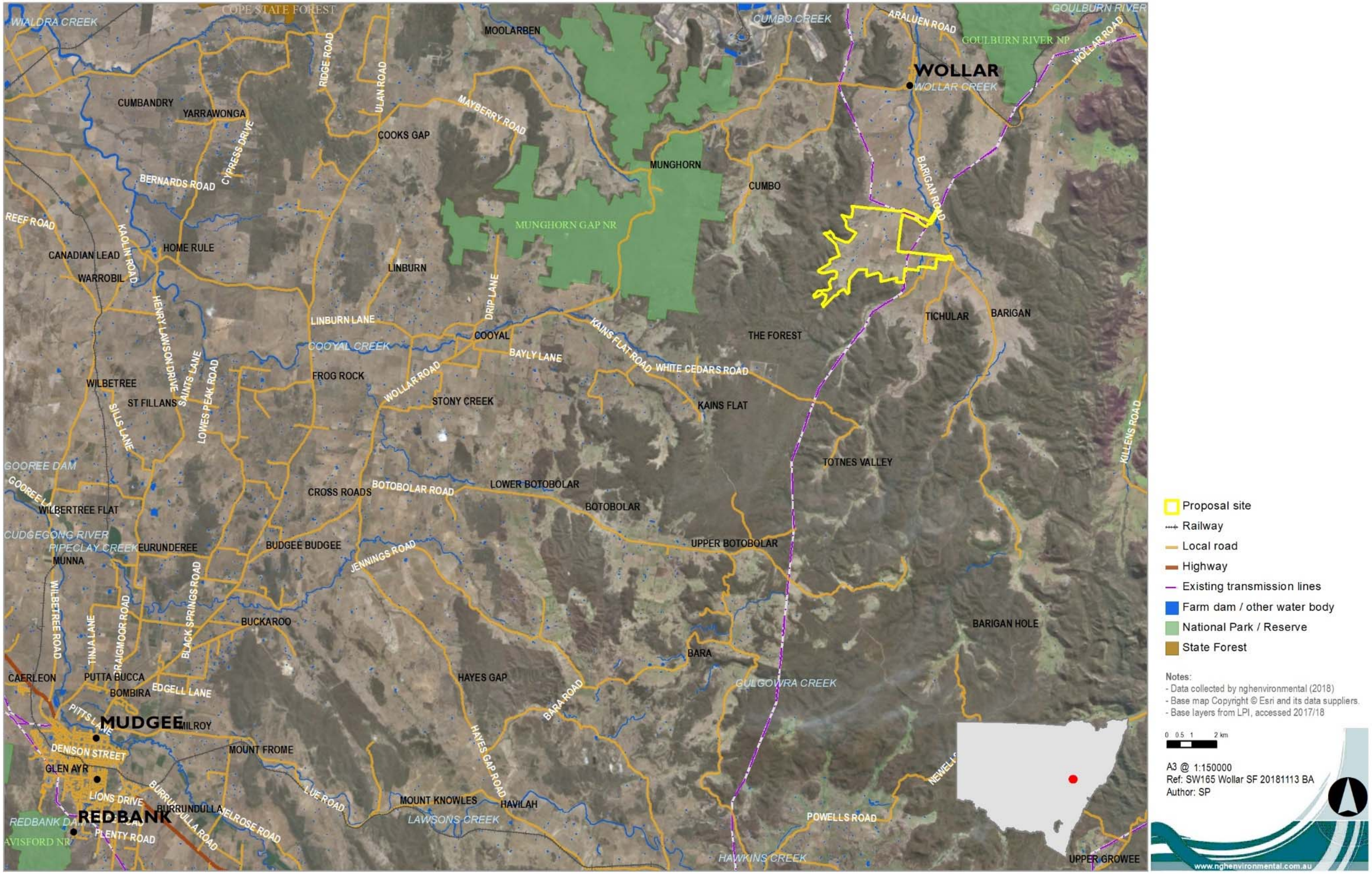

Figure 1-1 Location of the proposal site.

1.2.2 The proposal site

Table 1-1 Affected lots associated with the proposed Wollar Solar Farm.

Referred to in the EIS	Proposed infrastructure	Lots and DP	Owner	Existing use	Ownership arrangements
Proposal site and development footprint	All proposed solar farm infrastructure including solar arrays, connection infrastructure, internal roads and ancillary infrastructure.	Lots 22, 23, 25, 27, 30, 45, 49-51, 60-63, 69-80, 92, 105-107, 119 and 152-154 of DP 755430 and Lot 1 DP650653.	Currently owned by one private landowner (involved landowner).	Agriculture.	WSD would purchase this land.
		Lot 24 DP755430	Currently owned by one private landowner (involved landowner).	Involved landowner residence.	WSD would purchase this land.
		Lot 7303 DP1139558.	Crown Land.	Agriculture.	WSD would lease or purchase this land.
Connection	Connection to existing Transmission line.	Lot 80 DP755430.	One Private land owner (involved landowner).	Agriculture.	Easement would be established.
	Connection to Wollar substation.	Lot 1 DP1090027.	TransGrid.	Electricity generation – substation.	TransGrid.
Northern Access	Up to 1km of access track between the Wollar substation and the solar farm.	Lots 10 and 11 DP1090027.	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.
		Lot 1 DP1090027.	TransGrid.	Electricity generation.	Easement would be established.
	Use of existing TransGrid access road.	Lots 1, 2, 4, 6, 8 DP1090027.	TransGrid.	Access to Wollar Substation.	Right of way would be established.
Southern Access	Use of existing site access via Maree Rd	NA (road reserve)	Mid-Western Regional Council.	Road easement.	Mid-Western Regional Council.

Referred to in the EIS	Proposed infrastructure	Lots and DP	Owner	Existing use	Ownership arrangements
		Lot 84 DP755430	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.
	Use of existing site access via unnamed track.	Lot 46 DP755430.	Peabody Australia Pty Ltd.	Agriculture (Leased to Minamurra Pastoral Company).	Easement would be established.

Figure 1-2 shows the locations of the lots and dps.

Pending project approval, the proposal site is intended to be owned by WSD, excluding Lot 1, 2, 4, 6, 8, 10 and 11 DP1090027, and Lots 46 and 84 DP755430. These lots would remain under the ownership of Peabody Australia (Lots 10 and 11 of DP1090027 and Lots 46 and 84 DP755430) and TransGrid (Lot 1, 2, 4, 6 and 8 of DP1090027). Easements for the Northern Access and Southern Access would be established. The existing Wollar substation, located on Lot 1 DP1090027, is owned by TransGrid.

The proposal site is bound by land zoned E3 Environmental Management at the south west and RU1 Primary Production to the north east under the *Mid-Western Regional Local Environmental Plan 2012* (Mid-Western Regional LEP). Crown Land is located to the south east of the proposal site. The proposal site, associated transmission and accesses are located on land zoned RU1 Primary Production under the Mid-Western Regional LEP.

Fifteen dams occur within the proposal site; four within the south western portion of the proposal site, nine within the central portion and two within the south eastern portion. Two ephemeral watercourses and approximately eight other tributaries traverse the proposal site. The largest of the watercourses, Wollar Creek (Figure 1-4), bisects the proposal site on the eastern edge. Spring Flat Creek traverses the middle of the proposal site in a south-west to north-east direction (Figure 1-3) and discharges into Wollar Creek approximately 2.5km north of the proposal site. Most of the smaller watercourses/overland flow paths are tributaries of Spring Flat Creek.

An existing TransGrid 330kV transmission line transects the proposal site in the north eastern corner.

All land within the proposal site is subject to the following authorities under the *Mining Act* 1992 (NSW):

- Exploration License (EL) 6676 held by Secretary of DP&E.
- Petroleum Exploration License (PEL) 456 held by Hunter Gas Pty Ltd.

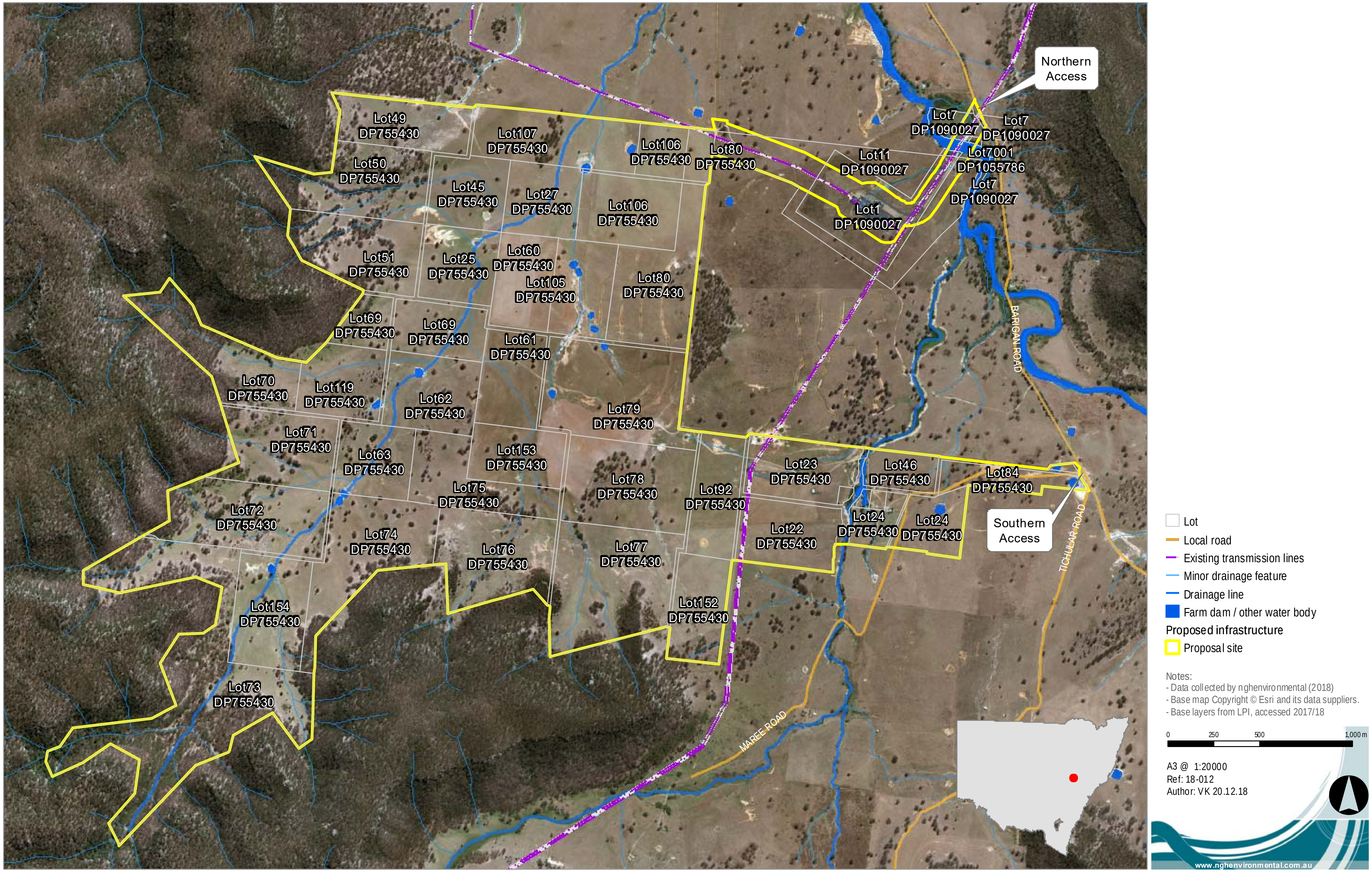

Figure 1-2 Lot and DPs of the proposal site.

Figure 1-3 Ephemeral Spring Flat Creek at central southern boundary of proposal site.

Figure 1-4 Wollar Creek at eastern boundary of proposal site.

1.2.3 Key components of the proposal

The proposed Wollar Solar Farm involves the construction, operation and decommissioning of a ground-mounted PV solar array. Approximately 290MW (AC) of renewable energy would be generated and supplied directly to the national electricity grid. The Wollar Solar Farm would provide enough clean, renewable energy for about 104,926 average NSW homes while displacing approximately 515,564 metric tons of carbon dioxide annually.

Of the 878ha proposal site, approximately 461ha would be developed for the solar farm and associated infrastructure. An existing TransGrid 330kV transmission line transects the proposal site in the north eastern corner and would be used to connect the solar farm to the national electricity grid.

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and results in a Proposal that responds appropriately to the site constraints for the Wollar Solar Farm.

Key infrastructure:

- Approximately 922,432 PV solar panels mounted on either fixed or tracking systems, both of which are considered feasible:
  - Fixed-tilted structures in a north orientation at an angle of 32 degrees or
  - East-west horizontal tracking systems.
- Approximately 58 PCU composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33kV AC energy.
- Steel mounting frames with driven or screwed pile foundations.
- An onsite 330kV substation containing two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 330kV transmission line onsite.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, indoor 33kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- Up to 1km of access track off Barigan Road to the site via the existing TransGrid substation access road, which would require construction of an access road between the Wollar substation and the proposed onsite substation.
- Internal access tracks for construction and maintenance activities.
- An energy storage facility with a capacity of up to 30 MWh (i.e. 30 MW power output for one hour) and comprising of lithium ion batteries with inverters.
- Perimeter security fencing up to 2.3m high.
- Native vegetation planting to provide visual screening for specific receivers, if any are required.

During the construction phase, temporary ancillary facilities would be established on the site and may include:

- Laydown areas.
- Construction site offices and amenities.
- Car and bus parking areas for construction staff.

Further detail on key infrastructure is provided in Section 4.2.

The construction phase of the proposal would take about 12 – 18 months and is anticipated to be operational for 30 years. When the solar farm is no longer viable, all above ground infrastructure, with the possible exception of the onsite substation, would be removed. Any cabling more than 500mm underground may be left in place as it would not impact future agricultural activities following rehabilitation of the site.

The estimated capital investment of the Wollar Solar Farm proposal would be about $430 million.

The design and construction, operation and decommissioning requirements of the proposal are discussed further in Section 4. It is noted that the final infrastructure layout would be determined as part of commercial tendering process, as such, some flexibility is allowed for in the EIS proposal description. The development footprint presented represents the maximum impact areas that would be required. These impact areas have been developed using the outcomes of the Preliminary Environmental Assessment (PEA) completed in April 2018 along with additional detailed specialist assessments presented in this EIS. Notable changes to the layout reflecting the sites constraints included:

- Avoiding all areas within the 'important habitat mapping' for the Regent Honeyeater.
- Buffering waterways in accordance with their classification and the the "Guidelines for Riparian Corridors on Waterfront Land".
- Avoiding four identified high constraint Aboriginal sites.

The layout of the infrastructure components is shown on Figure 1-4. Indicative plans and images of infrastructure components and key areas are described in detail in Section 4.2. The plans and specifications of the components would be subject to detailed design and product selection through a competitive tender process.

1.2.4 The proponent

Wollar Solar Farm is to be developed by Wollar Solar Development Pty Ltd (ABN 88 621 969 266, incorporated in NSW) (hereafter "WSD" or "the Proponent"), an Australian developer of utility-scale solar generation.

The company is a subsidiary of Solar Megawatt Holding Pty Ltd (a company incorporated in Hong Kong). Solar Megawatt Holding Pty Ltd and its subsidiaries (hereafter refer to as "Solar Megawatt Group", or the "Group") was founded by investors with extensive experience in the renewable energy sector in China mainland and Asia-pacific.

The Group has a dedicated management and development team highly experienced in renewable generation project development and operation, transmission network connection, and renewable project transaction and project financing. The core team members have extensive experience in developing, operating and financing utility-scale renewable generation in Australia and internationally.

The proposed Wollar Solar Farm is the first large-scale Solar development proposal by Solar Megawatt Group in Australia. The Group is committed to Australian renewable energy market for the long term. A pipeline of over 1,000 MW of renewable is being assessed and developed.

For Wollar Solar Farm, the Group has recently engaged a listed utility company who has been operating large-scale wind and solar projects in NSW since 2014.

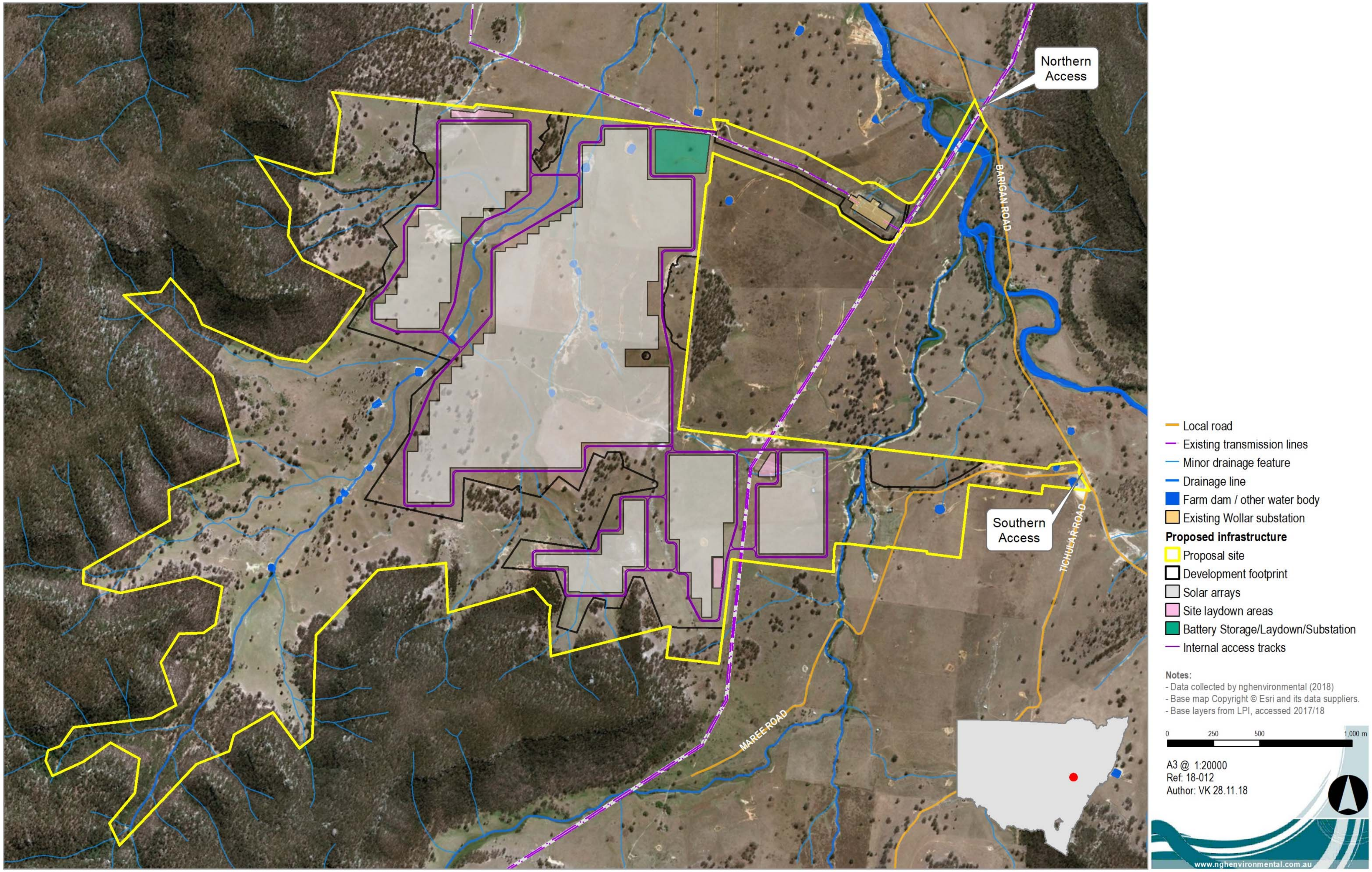

Figure 1-5 Indicative infrastructure layout.

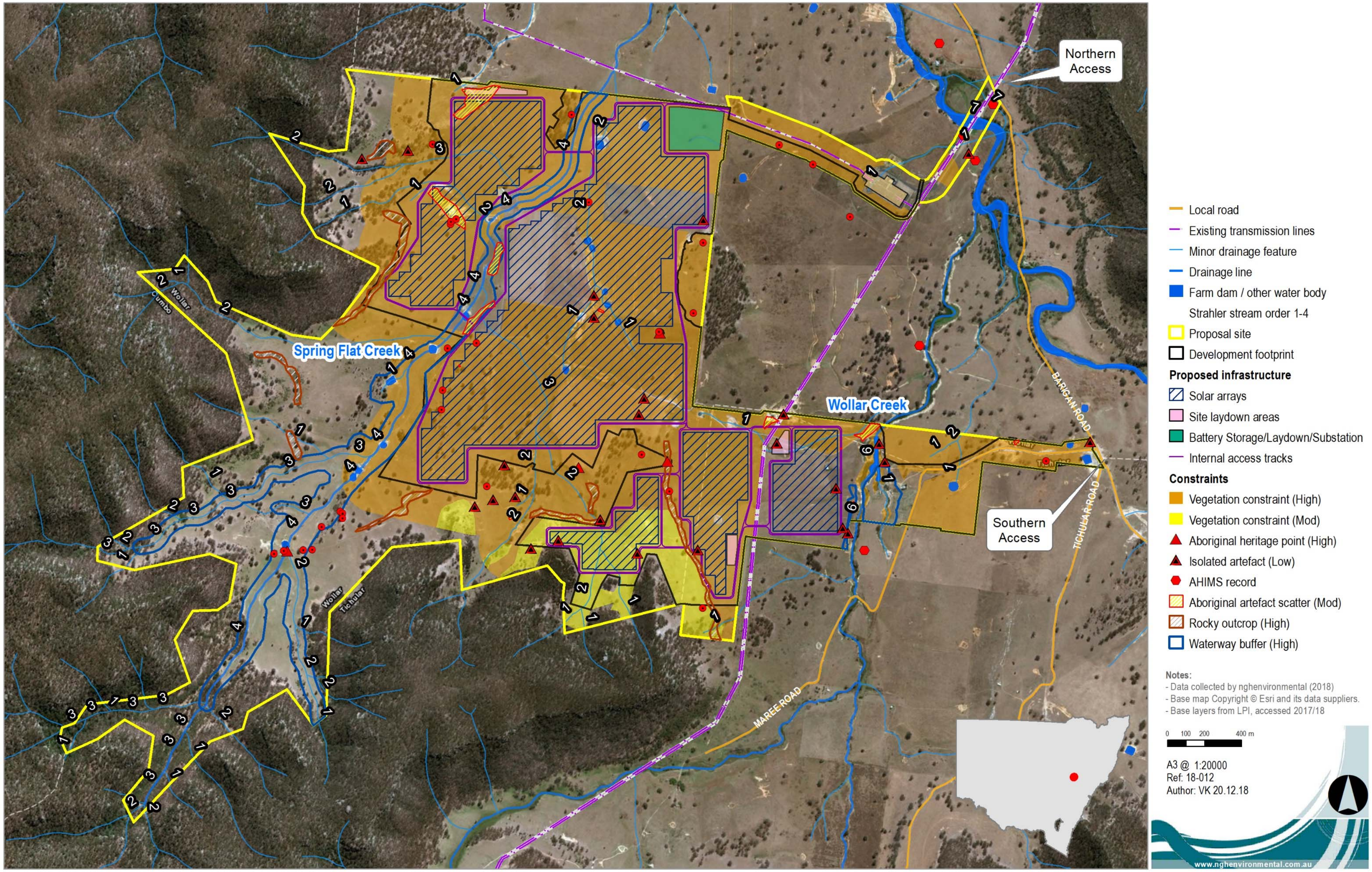

Figure 1-6 Indicative infrastructure layout in context of site constraints.

2 OBJECTIVES, PROJECT NEED AND BENEFITS

2.1 PROPOSAL OBJECTIVES

The objectives of the proposal are to:

- Develop a profitable, commercial scale solar electricity generation proposal with on-site capability of energy storage to support the high voltage transmission network.
- Support efforts to mitigate the effect of climate change through the transition to renewable energy.
- Work collaboratively with key stakeholders to ensure all relevant requirements are considered in the location, design, construction and operation of the proposal.
- Provide local and regional employment opportunities and other social benefits during the construction and operation of the facility.

The renewable source of energy would:

- Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets.
- Provide a clean and renewable energy source to assist in reducing greenhouse gas emissions.

2.2 PROJECT NEEDS AND BENEFITS

2.2.1 Climate change mitigation

The proposed Wollar Solar Farm supports Commonwealth and NSW climate change commitments including:

- United Nations Paris Climate Change Agreements.
- Renewable Energy Target (RET) Scheme.
- National Energy Guarantee.
- NSW Climate change Policy Framework.
- NSW Renewable Energy Target.
- NSW 2021: A Plan to Make NSW Number One.
- NSW Renewable Energy Action Plan.
- Central West and Orana Regional Plan.

Paris Agreement

In December 2015, the Australian Commonwealth Government ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, reinforcing its commitment to action on climate change. Australia has committed to the following greenhouse gas emission reduction targets:

- 5% below 2000 levels by 2020
- 26 to 28% below 2005 levels by 2030
- Net zero emissions in the second half of the century.

Electricity generation is the largest single emitter of greenhouse gas in Australia contributing 35% of total greenhouse emissions. It is to be expected that significant effort will be applied to transition to renewable energy sources of electricity generation.

Solar photovoltaic projects have the capacity to make a significant contribution towards these goals because of the relatively shorter times required to construct and commission.

Renewable Energy Target (RET) Scheme

The Renewable Energy Target Scheme (RET) was established under the Renewable Energy (Electricity) Act 2000. The RET scheme creates a market for renewable energy with the goal of ensuring that by 2020, around 23.5% of electricity will be generated from renewable sources. The RET scheme provides a mechanism to ensure that some portion of the electricity that is sold by electricity retailers is sourced from renewable sources.

The legislated objectives of the Commonwealth Renewable Energy Target (RET) Scheme are:

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

The RET scheme includes a Large-scale Renewable Energy Target (LRET) component aiming to have 6,000 MW of new renewable power generating facilities built by 2020 of which solar farms would provide 25% (Clean Energy Regulator 2015 in Finkel *et al.* 2016).

The proposed Wollar Solar Farm would contribute directly to the RET scheme objectives by generating approximately 290MW.

Renewable Energy Zones (REZ's)

The Australian Energy Market Operator (AEMO) has assessed 34 candidate REZ's across the National Energy Market (NEM) through consideration of a mix of resource, technical and other engineering considerations. The assessment identifies which REZ's are most optimal at present from a range of consideration, in particular the requirements for least-cost integration of REZ's into the transmission system.

AEMO has identified the NSW Central Tablelands as the immediately optimal REZ development area, supported by existing transmission strength and capacity. The proposal site for the Wollar Solar Farm is well placed within the immediately optimal REZ development zone.

National Energy Guarantee

The future of the NEG is not certain in Australia. Nonetheless, the proposal would contribute to the National Energy Guarantee (NEG) as it was proposed, in that it would:

> *"… retain existing resources and encourage new investment in the National Energy Market (NEM) while ensuring that emissions standards are met and the system operates reliably."*

The energy generated from the proposed Wollar Solar Farm would provide opportunities for the electricity sector by supporting two key objectives of the NEG:

1. Increased competition and improving affordability: creating additional competition in the generation sector and providing new low cost electricity options for the retail market.
2. Emissions guarantee: meet defined emissions target for wholesale electricity purchased.

The Energy Security Board (ESB) predicts that 28 – 36% of electricity generation in 2030 will be renewable energy, under the NEG.

NSW goals and policies

The NSW Climate Change Policy Framework (2016) sets out the log-term objectives of the NSW Government. The framework:

- Defines the NSW Government's role in reducing carbon emissions and adapting to the impacts of climate change.
- Sets policy directions to guide implementation of the framework.
- Commits NSW to achieving aspirational long-term objectives of net-zero emissions by 2050 and to help NSW become more resilient to a changing climate
- Sets out next steps for implementation.

The NSW Government has introduced a mandatory NSW Renewable Energy Target (NRET) relating to all electricity consumed in NSW. The scheme sets a target for the proportion of electricity sold by electricity retailers to be generated from renewable sources and imposes penalties where the retailer fails to meet these targets.

The Wollar Solar Farm proposal is consistent with current goals and targets for renewable energy generation in NSW. These include Goal 22 of the NSW 2021: A plan to Make NSW Number One (NSW Government 2011):

> *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*

The proposal is also consistent with the three goals of the NSW Renewable Energy Action Plan (NSW Government 2013) which include:

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

The Wollar Solar Farm is consistent with the vision and goals of Draft Central West Regional Plan (DPE 2016). Achieving the vision of *'the most diverse regional economy in NSW with a vibrant network of centres leveraging the opportunities of being at the heart of NSW'* would be supported by contributing to the following goals:

- The most diverse regional economy in NSW:
    - Increase renewable energy generation.
- A stronger, healthier environment and diverse heritage:
    - Increase resilience to natural hazards and climate change.

The Mid-Western Regional LGA (located within Orana) is considered to have the best access for solar generation with mining and renewables being one of the three top economic opportunities within the LGA (DPE 2016).

The Draft Large-Scale Solar Energy Guideline was released by the NSW Government in 2017. The guideline identifies the key planning and strategic considerations relevant to solar energy State Significant Development (SSD) in NSW. It aims to assist in the site selection and design of proposals and it would be used by the DPE to assist in the assessment of relevant DAs. In December 2018, the Large-Scale Solar Energy Guideline for State Significant Development was published. The Proposal has referenced these guidelines throughout the development assessment process.

2.2.2 Electricity reliability and security benefits

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life (DIS, 2015). Nine coal-fired power stations have closed since 2011-2012, representing around 3,600MW of installed capacity (AER, 2015 in Commonwealth of Australia, 2016). The reduction in energy supply from coal-fired power stations requires the development of reliable and sustainable energy supply.

The renewable energy sector in Australia contributes 14.3% of the country's overall electricity. Large scale solar farm projects such as the proposed Wollar Solar Farm support long-term and stable policies such as the Renewable Energy Target (RET) and have the potential to benefit average household electricity bills substantially and reduce power disruptions providing alternative generation sources for the energy sector.

The high average daily solar exposure of 18MJ/m^2 (DPE, 2016) and the site's proximity to the existing Wollar 500/330kV substation greatly reduces the transmission and distribution loss factor risk and represents an ideal location for a solar farm. In this way the solar farm would enhance the reliability, security and affordability of the NSW electricity supply.

2.2.3 Socio-economic benefits

Employment and local economic benefits

The project would generate around 500 construction jobs during the peak construction phase. Once the project is operational, around 5 equivalent full time staff would be employed.

Employment opportunities would extend through the local supply chain to fuel supply, vehicle servicing, hotels/motels, cafes, hotels catering and cleaning companies, tradespeople, tool and equipment suppliers and many other businesses.

In summary, the project would provide significant local economic benefits including:

- Direct and indirect employment opportunities during the construction and operating phases of the project.
- Injection of expenditure in the local area.
- Development of a new land use thereby diversifying the local land use within the region.

In 2015-2016, 11,500 Australians were employed directly in the renewable energy sector and the industry is anticipated to generate 18,400 new jobs by 2020 (CEC, 2014; CEC, 2016). These benefits would mostly be during construction. A smaller proportion would occur during operation mainly in relation to the maintenance and upgrade of infrastructure over the lifetime of the Proposal.

Electricity prices

The Australian Electricity Market Commission (AEMC) predicts residential electricity prices will fall 6.2% on average over the following two years as more wind and solar generation comes online (CEC, 2018). The commissioning of new renewable energy facilities will increase competition in wholesale energy marked and, as with any market, increased competition will tend to reduce prices. Photovoltaic solar farms operate with no fuel costs and can, with the correct policy framework, be used to reduce the overall wholesale prices of electricity. Both the Commonwealth and State Governments have established frameworks to support this objective.

3 SELECTION OF THE PREFERRED OPTION

3.1 EVALUATION OF ALTERNATIVES

The Wollar Solar Farm proposal site was selected after an extensive review of alternative sites by the proponent. This section outlines the alternatives that were considered and justification for the proposed option that is the subject of this EIS.

3.2 THE 'DO NOTHING' OPTION

The 'do nothing' option must always be considered in any evaluation of options. It represents the status quo situation; avoiding all development impacts but similarly not realising a proposal's potential benefits.

The direct consequence of not proceeding with the Proposal would be to forgo the benefits outlined in Section 2.2. This would include no contribution to:

- Climate change mitigation.
- Electricity reliability and security benefits.
- Direct or indirect socio-economic benefits.
- Providing additional generation in close proximity to high voltage networks.

The environmental impacts associated with the development and operation of the proposed solar farm would be avoided if the 'do nothing' option was selected. Such environmental impacts would include construction noise, traffic and dust and impacts to biodiversity. The land would remain as agricultural land with grazing and intermittent cropping. These impacts are discussed in Sections 6 and 8 of this EIS and are considered to be manageable. It is unlikely these impacts would result in medium to long term negative impacts to the environment and community.

The potential benefits and contributions of the proposed solar farm are considered to outweigh those of the 'do nothing' option. As such, the 'do nothing' option is not the preferred option.

3.3 ALTERNATIVE SITE LOCATIONS

WSD reviewed a large number of sites on which to build a solar farm before selecting the Wollar Solar proposal site. While it would have been possible to construct and operate the solar farm at some of the sites investigated, WSD considers the Wollar proposal site to be the most suitable for the construction of a solar farm due to the following factors:

- Connection and capacity:
  - o The site is located approximately 1km from the Wollar 500/330 kV substation which is identified as a Connection Opportunity (Figure 3-1), and as such, a suitable location for connecting new energy generation.
  - o An existing 330 kV transmission line traverses the site which means the that the connection to the high voltage network can be made without the need to construct any transmission lines.
- Solar exposure:
  - o The site has high solar exposure measuring 18MJ/m^2 (DPE, 2016).
  - o WSD are monitoring relevant weather, including irradiance, with the aim of gathering one year of comprehensive data.

- Stakeholder interest:
    - o Very few non-involved dwellings would be impacted by the development.
    - o Substantial community support in the area for renewable projects.
- Land suitability:
    - o The site has already been cleared and heavily disturbed by cultivation and grazing.
    - o The terrain is relatively flat.

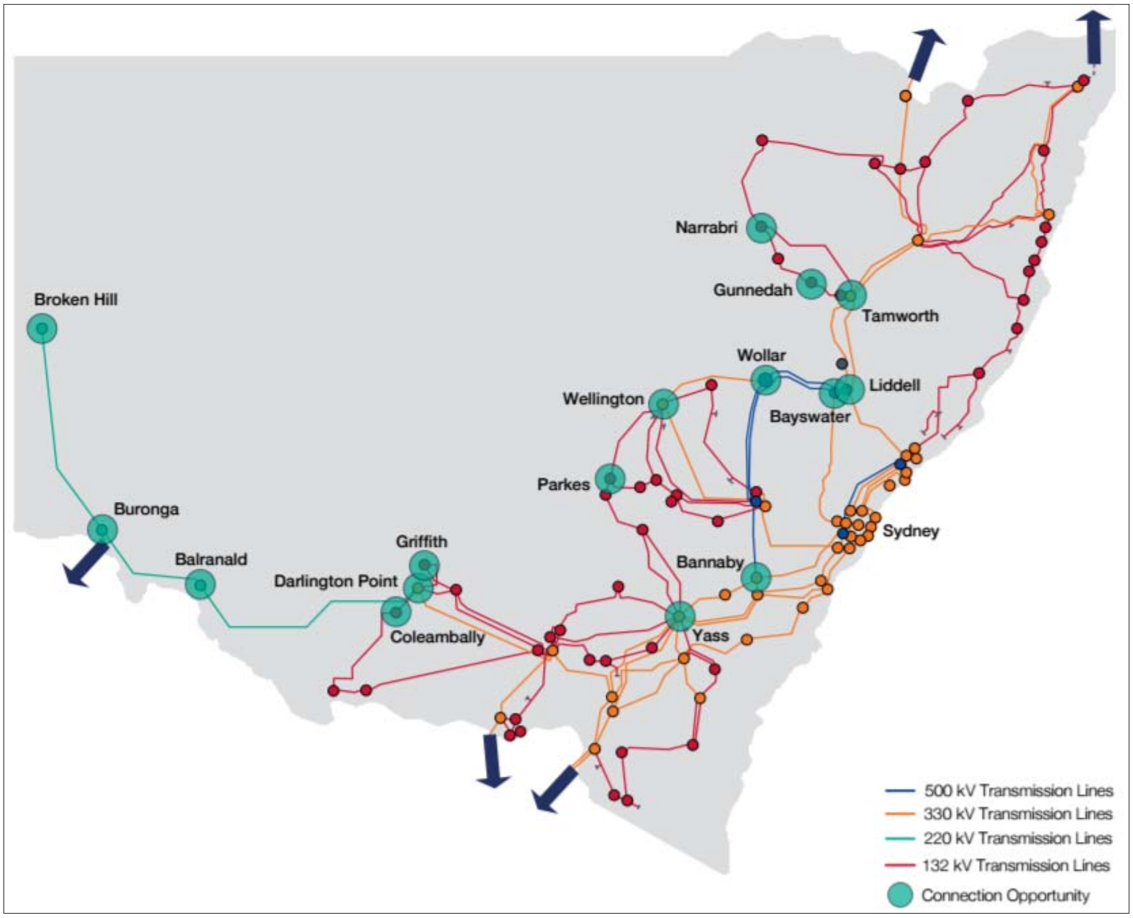

Figure 3-1 Connection Opportunities identified by TransGrid including the Wollar substation (TransGrid 2018)

3.3.1 Site evaluation

The site has been evaluated in terms of the Draft Large Scale Solar Energy Guideline for State Significant Development (SSD) 2017 and the Large Scale Solar Energy Guideline for SSD 2018 which provides recommendations regarding selection of suitable proposal sites and areas of constraint that should be identified. This assessment is described in Table 3-1 below.

Table 3-1 Evaluation of preferable conditions associated with the proposal site

Preferable Site Condition	Observation
Optimal solar resources	Good solar irradiance observed.
Suitable land	Mostly undulating land with some flat area. Far from existing developments. The land is not mapped as Biophysical Strategic Agricultural Land (BSAL). No

Preferable Site Condition	Observation
	residential receivers within 2km of the proposal site. The nearest residential receiver is 2.8km from the site.
Capacity to rehabilitate	Proposal would involve minimal site disturbance and has potential to improve land by giving the site a rest from grazing.
Community support	Community consultation is underway. Support from local community and environmental groups has been positive and ongoing. No significant objections have been encountered to date.
Proximity to electrical network	Close to Wollar 500/330kV substation and an existing 330kV transmission line traverses the site.
Connection capacity	Connection to the 330kV transmission line traversing the site is an ideal point of connection to the high voltage network.

3.4 ALTERNATIVE TECHNOLOGIES

The critical components of a solar farm include:

- Solar panels to generate DC electricity from sunlight.
- Inverters to convert the DC electricity into AC electricity.

In both cases, over recent years, the underlying technology has been developing at an increasingly rapid rate. WSD would utilise the latest equipment which best meets the requirements of the proposal.

3.5 SCALE OF THE PROPOSAL

The scale of the proposal has been determined after considering the following factors:

- A desire to make a worthwhile contribution to the electricity market using renewable energy sources.
- A need to ensure that the proposal was commercially viable.
- The capacity of the electricity grid to absorb the energy generated by the proposal.
- The desire to make maximum use of the land within the proposal site.
- The opinions expressed by land owners and the local community.
- The constraints identified during the preparation of this EIS.

The ability to connect to the high voltage network via a 330kV transmission line which traverses the site brings significant benefits as the network has the capacity to absorb the total output of the solar farm and deliver it anywhere in the network. Additionally, it would not be necessary to construct a new transmission line in order to make the connection.

On balance, it is considered appropriate to develop the solar farm with a capacity of approximately 290MW which is expected to generate around 621,162MWh of energy each year.

3.6 CONSIDERATION OF OTHER LAND USES IN SITE SELECTION

The proposal site is located on rural land which has been under agricultural cultivation since the early 1900s and is predominately cleared of overstorey vegetation. The proposal site is currently grazed by approximately

500 cattle and a small number of horses and sheep. Stock feed is occasionally cropped onsite, although the recent drought has impacted the capability of the land to produce crops.

The land immediately surrounding the proposal site includes grazed (cattle) and Crown Land. Coal mining is the main local industry for employment in the Mid-Western Region followed by beef cattle farming and primary education. The nearest mine is approximately 11km north west of the proposal site.

It is noted that the proposal involves minimal earthworks, and as such when the solar farm reaches end of life, it would be relatively easy to remediate the land to its existing condition so that grazing and occasional cropping can be resumed.

The fact that other renewable generating facilities (wind and solar) are being established in the region is an indication that the renewable energy industry as well as the community in general, accepts the need to allocate land for the generation of renewable energy in preference to other uses.

Considering all of the factors involved, the proposal described in Section 4 is the preferred option.

The preferred option is commercially viable and feasible in terms of technological requirements. The proposal would have a low environmental impact and take advantage of the land and solar exposure represented by the proposal site.

3.7 PROJECT JUSTIFICATION

The Wollar Solar Farm proposal involves the construction and operation of a 290MW solar farm on agricultural land that is currently used for grazing and intermittent cropping. The proposal site is already disturbed and is considered to have very low – moderate land capability. As such, the potential impacts on the existing environment are considerably reduced.

The proposal has been designed to minimise environmental impacts to the proposal site and surrounding locations by minimising the extent of land disturbance. At the end of the life of the solar farm, the site would be returned its pre-solar conditions and improved where possible.

The construction and operation of the Wollar Solar Farm proposal would contribute to, Australia’s efforts to meet its greenhouse gas commitments while continuing to provide a reliable supply of electricity for industry and consumers.

4 THE PROPOSAL

4.1 PROPOSAL SUMMARY TABLE

The key features of the Proposal are summarised in Table 4-1 below. The component specifications are subject to change. Where required, upper limit quantities and power level estimates are provided to ensure the assessment and any subsequent approval maintains the flexibility required in the detailed design in the Engineering Procurement and Construction (EPC) stage.

Table 4-1 Summary of key features of the proposal

Proposal element	Description
Proposal	Wollar Solar Farm.
Proponent	Wollar Solar Development Pty Ltd. (WSD).
Capacity	Approximately 290MW (AC).
Proposal site area	Approximately 878ha.
Development footprint area	Approximately 461ha.
Site description	**Proposal site:** Lots 22-25, 27, 30, 45, 46, 49-51, 60-63, 69-80, 84, 92, 105-107, 119 and 152-154 of DP 755430, Lot 1 of DP 650653, Lot 7303 DP1139558. **Wollar substation:** Lot 1 DP1090027. **Northern Access:** Lots 1, 2, 4, 6, 8, 10 and 11 DP1090027. **Southern Access:** Lots 46 and 84 DP755430. All land zoned as RU1 Primary Production under *Mid-Western Regional Local Environmental Plan 2012.*
Local Government	Mid-Western Regional Council.
Subdivision	Not intended.
Solar array	Number of panels: 922,432. Area of panels: 2,508,435m^2 Row spacing: approximately 6m. Height: 3 – 4m (less if fixed).
Substation	Approximately 6ha. 330kV outdoor substation. 2 x 330/33kV transformers.
Battery storage	Located within the north western portion of the site with the substation and laydown area. With an electricity storage capacity of up to 30 MWh (i.e. 30 MW power output for one hour) and comprising of lithium ion batteries with inverters. 15 containers (40 foot).
Access tracks	External access tracks: unsealed gravel suitable for all weather conditions. Internal access tracks: up to 50km of 6m wide unsealed gravel
Operations and maintenance buildings	Steel framed, ColorBond finish demountable buildings to accommodate: • 33kV switch gear. • Control and protection equipment. • Site office.

Proposal element	Description
	• Staff amenities. • Warehouse.
Security fencing, lighting and CCTV	Steel security fence 2.3m high with barbed wire topping. Security system with CCTV and local flood lighting.
Construction hours	Standard daytime construction hours would be 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays. Any construction outside of these standard construction hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g. to make work safe.
Construction timing	12 to 18 months commencing Q3 2019.
Workforce	Construction – approximately 500 staff during peak construction (approximately 6 – 9 months). This is the maximum amount workers required, it is likely to be less. Operation – 5 full time equivalent staff.
Operation period	Up to 30 years.
Decommissioning	The site would potentially be returned to its pre-works state. All above ground infrastructure would be removed to a depth of 500mm. The site would be rehabilitated consistent with land use requirements. All infrastructure would be removed with the exception of the substation. The site would be rehabilitated consistent with future land use requirements.
Capital investment	Estimated $430 million.

4.2 PROPOSAL LAYOUT

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders. This process aims to avoid or minimise potential impacts wherever practicable and results in a proposal that responds appropriately to the site constraints for the Wollar Solar Farm.

To inform the development of the most appropriate proposal, a Preliminary Environmental Assessment (PEA) of the proposal site was undertaken in the early planning stages to determine environmental constraints associated with the site. The PEA was used to assist with designing the solar farm layout and planning the detailed methodologies for the Environmental Impact Statement. Environmental constraints can be defined as factors which affect the 'developability' of a site and include physical, ecological, social and planning factors. A map of these constraints was prepared for the PEA (NGH Environmental, 2018). Following the detailed field investigations, the mapping has been further refined and is presented in Figure 1-5. This process demonstrates how the proposal has appropriately responded to the site's constraints. With reference to the site's key constraints, the proposal assessed in this EIS has:

Biodiversity:	• Avoided most areas of good condition White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community (EEC).

	• Minimised impacts to rocky outcrops. • Minimised impacts to hollow-bearing trees.
Aboriginal heritage:	• Avoided a grinding groove within the proposal site. A 15m buffer would be applied to ensure no indirect impacts. • Avoided a modified tree and a possible modified tree within the proposal site. A 15m buffer would be applied to ensure no indirect impacts. • Avoided a possible cultural site within the proposal site. A 20m buffer would be applied to ensure no indirect impacts.
Waterways:	• Buffered two waterways in accordance with their classification and the “Guidelines for Riparian Corridors on Waterfront Land” to minimise impacts on hydrology and water quality. This includes a 40m buffer along each 4th order waterway.

PROPOSED INFRASTRUCTURE

The proposed Wollar Solar Farm comprises of the following key items of infrastructure:

- Approximately 922,432 PV solar panels mounted on either fixed or tracking systems, both of which are considered feasible:
  - Fixed-tilted structures in a north orientation at an angle of 32 degrees or
  - East-west horizontal tracking systems.
- Approximately 58 PCU composed of two inverters, a transformer and associated control equipment to convert DC energy generated by the solar panels to 33kV AC energy.
- Steel mounting frames with driven or screwed pile foundations.
- An onsite 330kV substation containing two transformers and associated switchgear to facilitate connection to the national electricity grid via the existing 330kV transmission line onsite.
- Underground power cabling to connect solar panels, combiner boxes and PCUs.
- Underground auxiliary cabling for power supplies, data services and communications.
- Buildings to accommodate a site office, 33kV switchgear, protection and control facilities, maintenance facilities and staff amenities.
- Up to 1km of access track off Barigan Road to the site via the existing TransGrid substation access road, which would require construction of an access road between the Wollar substation and the proposed onsite substation.
- Internal access tracks for construction, operation and maintenance activities.
- An energy storage facility with a capacity of up to 30 MWh (i.e. 30 MW power output for one hour) and comprising of lithium ion batteries with inverters.
- Perimeter security fencing up to 2.3m high.
- Native vegetation planting to provide visual screening for specific receivers, if any are required.

During the construction phase, temporary ancillary facilities would be established on the site and may include:

- Laydown areas.
- Construction site offices and amenities.

- Car and bus parking areas for construction staff.

4.2.1 Solar arrays

The solar arrays would consist of PV solar panels that would be grouped into arrays. Fixed and tracking systems are both considered feasible and would include the following:

1. Fixed tilted array: solar panels would be configured in a north facing orientation and at an angle of 32 degrees; or
2. East-west horizontal tracking systems: solar panels would be mounted on single axis trackers that would track sun from east-west (approximately 13,000 tracking units would be installed).

It is anticipated that 922,432 solar panels would be installed with the capacity to generate 290MW (AC). The individual solar panel dimensions would measure approximately 2m x 1m, providing a surface area of 2m^2 per solar panel.

The fixed tilt solar arrays would be 3 – 4m high at most (reflecting the taller tracking option) with a row spacing of approximately 6m. The solar arrays would be installed on steel piles that are driven or screwed into the ground at a depth of approximately 2 - 3m. Excluding mounts, the array would be installed not less than 1.5m in height at its lowest point to ensure placement above 1% AEP flood levels.

Detailed design, availability and commercial considerations at the time of construction would inform the final quantity of solar panels and layout configuration.

Figure 4-1 Typical proposal site

Figure 4-2 Typical fixed tilted system.

Figure 4-3 Typical single-axis tracking system.

4.2.2 Power Conversion Units (PCUs)

Array blocks consisting of approximately 16,000 solar panels would be connected to a PCU (Figure 4-4). Each array block would each generate approximately 5MW (AC). This would allow for approximately 58 PCUs that would convert DC energy generated by the solar panels to AC energy. Each PCU consists of two inverters, as transformer and associated control equipment. The PCUs may be housed in a container measuring up to 10m long, 4m high and 3m wide (Figure 4-5). The containers would be mounted on concrete footings or piles to raise them above potential flood levels.

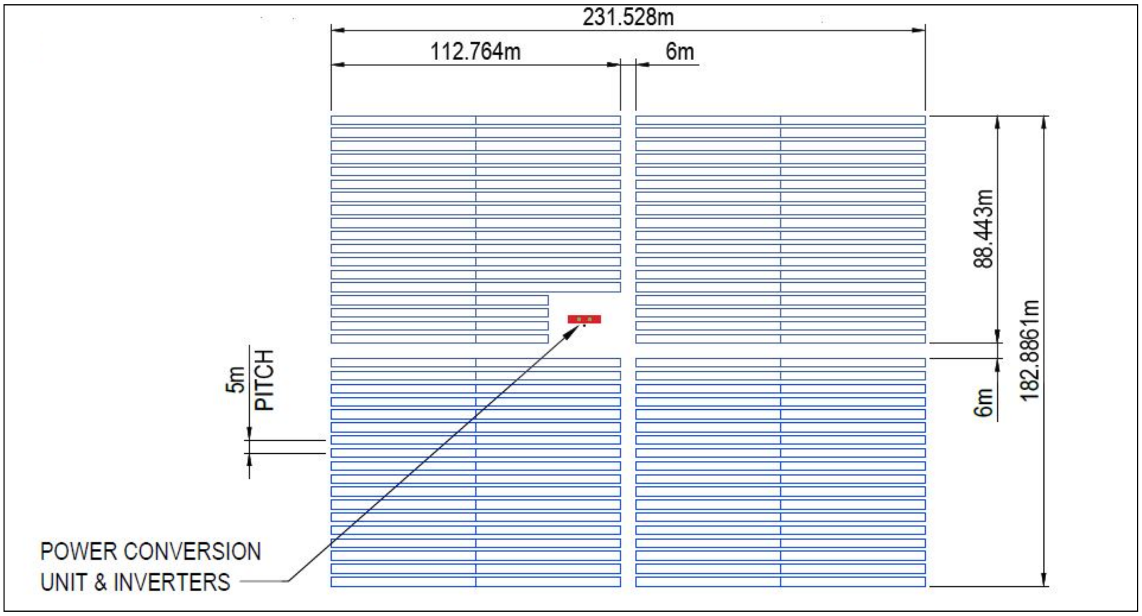

Figure 4-4 Typical array block showing location of PCU.

Figure 4-5 Typical illustration of a PCU within the array.

Distributed inverters

During the detailed design phase of the solar farm, consideration would be given to an alternative configuration whereby the inverting equipment is distributed throughout the array block rather than centralising it in the PCU.

If this option is adopted, inverters would be installed at the end of each row of solar cells with the AC output being connected to transformers located within the middle of each array block. The inverters would be housed in weather proof containers approximately 1.0 x 0.6 x 0.3m in size. With this arrangement, the PCU would be replaced with a smaller cabinet which would contain only a transformer and certain control and protection equipment.

4.2.1 Transmission network connection

The proposal site is traversed by a TransGrid owned and operated 330kV transmission line (Figure 4-7) that connects to the Wollar 500/330kV substation (Figure 4-6). The Wollar substation, located approximately 1km to the east of the site, connects to the Wellington 330/132kV substation. The solar farm would connect to the national grid via a new substation constructed in the north-east corner of the proposal site. TransGrid would maintain and operate the proposed new substation to be constructed onsite for connection of the solar farm to the national grid by diverting the existing 330kV transmission line to the new substation.

Two transformers would be used to transform the 33kV energy from the PCUs to 330kV in order to connect to the national grid. The transformers would be oil-fill, with waterproof bunds and other containment measures to ensure that in the event of an oil leakage, the oil is contained and cannot leak into the surrounding environment. The transformers would be located close to the connection point and would be approximately 470m from the nearest waterway (an ephemeral tributary of Spring Flat Creek).

Figure 4-6 Wollar 500/330kV substation.

Figure 4-7 330kV transmission line within 60m easement traversing the proposal site and connecting to the Wollar substation.

4.2.2 Underground cabling

Underground cabling on the site would be designed in accordance with Australian and International standards and the cable routes would be designed to minimise ground disturbance. Underground cabling would be required for:

- Connection of solar panels via a DC cable to a PCU.
- Connection of approximately 5 – 10 PCUs into a grouping.
- Connection of PCU grouping to the 33kV switchboard via a single 33kV feeder cable.
- Provision of auxiliary power, data services and communication facilities.

The cables would be installed in trenches approximately 900mm deep and the cables may be protected by conduits. A marking tape would be provided to reduce the possibility of accidental damage and ground markers would be provided to identify the cable routes.

Copper conductors would be used wherever necessary to electrically bond the metal structures to earth to protect personnel and equipment in the event of lightning strikes and electrical faults.

4.2.3 Ancillary infrastructure

Onsite substation

There would be one substation constructed within the proposal site.

The onsite 330kV substation would contain two transformers, three or four 330kV circuit breakers, current transformers and high voltage conductors to facilitate connection to the national electricity grid. The substation would be outdoors and built in accordance with Australian and TransGrid standards.

Site buildings and water infrastructure

One or more buildings would be constructed to accommodate the following:

- Control and protection equipment.
- Staff amenities including kitchen and bathroom.
- Workshop and storage facilities.
- Water tanks.
- Wastewater system.
- 33kV switchgear.

4.2.4 Site access and internal tracks

Two vehicular access points to the solar farm are proposed and discussed in detail below.

Northern access

Northern access is proposed along the existing TransGrid Wollar substation access road via Barigan Road. The TransGrid access road is 1km in length and incorporates a concrete causeway to cross Wollar Creek. No upgrade to this portion of the road is proposed.

Construction of an access road (up to 1km in length) would be required between the Wollar substation and the proposed onsite substation.

The Northern Access would be used during construction and operation and would be suitable for all vehicles including heavy and oversized vehicles.

Figure 4-8 Existing TransGrid access to Wollar substation.


Figure 4-9 Wollar Creek causeway along existing TransGrid access (left) and 330kV TransGrid transmission line between Wollar substation and proposed new substation location (right).

Southern access

Access to the solar farm during operation would be off Barigan Road via Maree Road and an unnamed track. Maree Road is approximately 7km along Barigan Road, both of which are owned by Mid-Western Regional Council. The unnamed track is partially located within Lot 46 DP755430 (owned by Peabody Australia Pty Ltd) and the proposal site. The unnamed track currently provides access to the residence and farm.

The Southern Access would be used during construction and operation and would likely be limited to the use of light vehicles. As such, road upgrades to this access route would not be required as the estimated number of light vehicles that would utilise the track is low and would not exceed the capacity of the road.

Should the southern access be necessary for use by heavy vehicles, upgrades would be required to Maree Road and Barigan Road. Additional assessment and approval would be needed in this case.

Figure 4-10 Existing access to proposal site along Maree Road (left); Existing access to Maree Road via Barigan Road (right).

Internal access

Internal access tracks would be constructed to each PCU and to the substation for use during the construction of the proposal and to facilitate ongoing maintenance. The tracks would be up to 6m wide and constructed in accordance with the AustRoad requirement.

The internal roads would be approximately 6m wide to facilitate transport, unloading and mounting of the PCUs. The actual locations of the roads would be determined during the detailed design phase of the solar farm.

Internal access tracks would require up to two waterway crossings associated with Spring Flat Creek. Erosion and waterway protection would be ensured by designing waterway crossings in accordance with the following:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge, 2003).*
- *Policy and Guidelines for Fish Friendly Waterway Crossings (NSW DPI, 2003).*
- *Guidelines for Watercourse Crossings on Waterfront Land (NSW DPI, 2012).*

4.2.5 Energy storage

Solar farms are a renewable source of energy, but they do not operate continuously. The extensive use of such energy sources can lead to problems on the supply network as the available generation capacity can sometimes be inadequate to meet the demand. This issue can be mitigated by installing energy storage systems to store energy during periods of excess generating capacity. Where there are shortfalls in capacity, this stored energy can then be used to even out the load. Additionally, these storage facilities may be used to provide ancillary services to the grid.

The proposed Wollar Solar Farm would include an energy storage facility with a capacity of up to 30 MWh (i.e. 30 MW power output for one hour) consisting of approximately 15 containers (40 foot). The energy storage infrastructure would be installed once the solar farm is in operation and would consist of power packs comprising of lithium ion batteries with inverters (Figure 4-11). They would be installed in one location near the substation (refer to Figure 1-5), and not distributed through the site. The exact location of the future energy storage would be determined during detailed design.

Figure 4-11 Typical battery storage units, located together.

4.2.6 Security and fencing

The following security measures would be established within the proposal site:

- The infrastructure on the site would be enclosed by a 2.3m high chain wire fence with barbed wire strands. This fence would be constructed early in the construction phase.
- The 330kV substation would be enclosed by a security fence in accordance with TransGrid requirements.
- An electronic security system would be established prior to commissioning of the solar farm.
- Security lighting would be installed around the entrance gates and main building areas.

4.2.7 Temporary construction facilities

Temporary facilities would be located within the site boundary during the construction phase and would include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking for construction worker's transportation. When the construction work is completed, a small car park would be retained for maintenance staff and occasional visitors.
- Temporary staff amenities.

The staff amenities would be designed to cater for the peak number of construction staff expected to be onsite and would include:

- Sanitary modules with water flush systems connected to holding tanks. The tanks would be fitted with high level alarms and they would be pumped out regularly.
- Water tanks.
- Changing rooms.
- Lunch rooms.
- Administrative offices.
- Covered walkways.
- Emergency muster point.
- Generator – if required.
- Electrical, data and water reticulation.

A steel or concrete water storage tank would be installed near the entrance to the site for firefighting and other non-potable water uses. Rainwater tanks to be installed beside the site buildings for staff amenities. Suitable fire extinguishers would be maintained at site buildings.

4.3 PRECONSTRUCTION WORKS

The proposed Wollar Solar Farm may include works prior to construction including upgrade of construction site access road, installation of fencing, artefact salvage, geotechnical drilling and / or surveying and preparation of construction compounds and site facilities.

4.4 CONSTRUCTION

4.4.1 Construction activities

Construction is anticipated to take approximately 12 – 18 months. The main construction activities would include:

- Geotechnical investigations and survey.
- Site establishment: site office, staff amenities, parking, fencing, laydown areas, access road and tracks.
- Earthworks.
- Installation of drainage.
- Installation of footings: steel post foundations for solar panels and concrete foundations for buildings and equipment.
- Installation of cabling: trenching and backfilling.
- Installation of solar panels and associated frames.
- Construction of buildings.

- Installation of PCUs.
- Installation of high voltage equipment, switchboards.
- Cable termination.
- Testing and commissioning.
- Removal of construction facilities and rehabilitation.

4.4.2 Site preparation and earthworks

Soils within the development envelope have been heavily disturbed by farming activities. Ground disturbance resulting from earthworks associated with the proposal would be minimal and limited to:

- The installation of piles supporting the solar panels which would be driven or screwed into the ground.
- Establishment of external access road.
- Decommissioning of dams currently within the development footprint which would involve filling the dams with soil excavated from other parts of the site.
- Removal of existing fences.
- Cleaning and levelling the ground for buildings and structures and arrays.
- Localised areas of earth works (cut and fill, grading and compacting) may be required in areas where there is sudden, significant changes in ground slope.
- Construction of internal access roads.
- Excavating cable trenches.

Topsoil under the footprint of the array area would remain in-situ during the construction of the solar farm. Topsoil salvaged from the construction of the access tracks and other works would be securely stored for use in site rehabilitation.

Where required weed treatments would be undertaken prior to earth works commencing in order to reduce the potential for spread of these species within the proposal footprint.

Impacts to soils and land capability are discussed in detail in Section 7.3.

4.4.3 Materials and resources

The main construction materials would include:

- Aggregates, road base and concrete.
- Fencing materials.
- Steel footings and frames to support the solar arrays.
- Cables, conduits, junction boxes.
- Steel framing and ColorBond sheeting for permanent buildings.
- Timber and fixtures for building fit-out.

Estimated quantities of required resources are shown in Table 4-2 and would be confirmed during the detailed design stage.

Table 4-2 Estimated resources required.

Resource	Estimated Quantity
Gravel (access tracks)	90,400m^3
Sand (bedding for cables)	10,800m^3
Concrete (PCU and buildings)	500m^3
Estimated number of solar panels	922,432

Water requirements

Non-potable water requirements are anticipated to be an upper limit of 600kL/day and total 150ML to 180ML for the construction phase in its entirety. Potable water requirements are anticipated to be approximately 0.5ML during the construction phase. Detailed water requirements would be determined by EPC contractors.

Non-potable water would likely be sourced from rain water tanks and a local water holder and potable water would be sourced from a commercial potable water supplier. Water sources would be subject to determination by EPC contractors.

Water use and water quality is discussed in detail in Section 8.1.

Labour, machinery and equipment

It is anticipated that up to 500 construction staff comprising of supervisors, tradesmen and labourers would be engaged to complete the work during the peak construction phase (6 – 9 months). Up to 500 workers is a maximum estimation, the amount of workers required for proposal would likely be less. Every effort would be made to hire staff locally.

Staff would be accommodated in Mudgee or nearby surrounding areas.

Plant to be used during construction would include:

- Small pile driving rig.
- Crane.
- Drum roller.
- Padfoot roller.
- Wheeled loader.
- Dump truck.
- 30t excavator.
- Grader.
- Chain trencher.
- Water truck.
- Telehandler.
- Forklift.

4.4.4 Transport and access

Road transport is the preferred option for delivery of construction infrastructure as opposed to rail transport options.

It is expected that the haulage route for most vehicles, including heavy and dimensional vehicles, during construction would be from Mudgee then north to the site via Castlereagh Highway, Wollar Road and Barigan Road. It is expected that the equipment would be transported from port facilities in either Sydney or Newcastle and delivered to the site in 12m shipping containers. The larger transformers would likely be delivered by low loaders on up to four occasions.

Materials would generally be transported to the site on heavy vehicles up to B-double and would include, but not limited to the following:

- PV solar panels.
- Piles, mounting structures and frameworks.
- Electrical equipment and infrastructure including cabling, auxiliary electrical equipment and machinery, inverters, switchgear, and the onsite substation (and transformer).
- Construction and permanent buildings and associated infrastructure.
- Earthworks, grading and lifting machinery and equipment.

Two access points are proposed for site access, the Northern Access being most suitable for larger heavier vehicles and the Southern Access being limited to access by light vehicles only.

Specialist oversize equipment including the grid connection transformer and 200 Tonne cranes would require oversized vehicles to transport them to the proposal site. This equipment would have 'Oversize' transport management in place to transport these items to site. A Construction Traffic Management Plan would be prepared following project approval to manage haulage traffic during the construction phase.

Transport and access impacts are discussed in detail in Section 8.6.

Intersection upgrades

It is expected that some upgrade of Barigan Road would be required to facilitate safe transport requirements. Intersection upgrades are not anticipated to be required for this proposal. Road upgrade requirements are discussed in detail in Section 8.6.

Traffic movements

Estimated total and maximum daily traffic movements during construction and peak construction are shown in Table 4-3, and detailed traffic volumes and requirements are shown in Table 4-4.

Table 4-3 Estimated traffic volumes and requirements for the Wollar Solar Farm

Type of vehicle	Estimated Vehicles over construction duration	Estimated peak maximum daily number of trips (one way)
Semi-Trailers	923	23
B Double	736	2
Oversized vehicles	2	1
Standard truck	2000	5
Water tankers	7920	15
Buses	7296	20
Cars	8880	30
Total	**27,757**	**96**

Table 4-4 Estimated detailed traffic volumes and requirements

Item	Type of vehicle	Estimated number of vehicles during construction
Equipment		
Solar Panels	B Double	736
PCU's	Semi-Trailer	118
Switchboards	Semi-Trailer	2
Transformer and 200 Tonne Crane	Oversize vehicles	2
Total cables	Semi-Trailer	130
30 MWh battery storage	Semi-Trailer	30
Auxiliary electrical equipment and machinery	Semi-Trailer	NA
Steel posts, tables and brackets	Semi-Trailer	590
Buildings		
Control room	Semi-Trailer	3
Warehouse	Semi-Trailer	1
Offices	Semi-Trailer	6
Water tanks	Semi-Trailer	4
Fences		
Posts and wire mesh	Semi-Trailer	5
Earthworks and grading machine	Semi-Trailer	3
Heavy Machineries		
Telehandler	Semi-Trailer	30
Tractors/bulldozers	Semi-Trailer	3
Miscellaneous trucks	Standard truck	2000
Water Tankers	20000L Tanker	7920
Construction personnel		
Construction workers	Shuttle buses	7296

Item	Type of vehicle	Estimated number of vehicles during construction
	Cars	8880

During peak construction, it is anticipated that up to 500 site personnel would be required to undertake the works. A shuttle bus system would likely be implemented to transport personnel to the site on 25 seater buses. This would generate up to 20 vehicle movements (10 to the site/10 from the site) equating to 40 daily vehicle movements. Additionally, extra allowance has been made for up to 60 daily light vehicle movements for workers to access the site.

It is expected that up to four one-way movements of oversized vehicles would be required for transport of the transformer and 200 Tonne cranes.

4.4.5 Hours of operation during construction

During the construction phase of the solar farm, work would be undertaken during the following hours:

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

There may, however, be a need to work outside these hours due to, for example:

- To avoid disrupting traffic when delivering bulky equipment.
- To avoid taking outages of existing high voltage transmission lines during periods of high load.
- To undertake emergency work to avoid serious injury or loss of property.

Any construction outside of these standard construction hours, if required, would only be undertaken with prior approval from relevant authorities.

4.5 OPERATION

4.5.1 Activities during operation

The solar farm would be in operation continuously. The solar farm would only generate electricity during sunlight hours but the energy storage system could be activated at any time.

The solar farm would operate automatically but there would be provision to both locally and remotely monitor the performance of the equipment and to activate the energy storage system.

Activities undertaken during operation would include:

- Solar panel maintenance.
- Monitoring the performance of the solar farm.
- Inspection of the installation.
- Routine preventative maintenance.
- Emergency repair response (24 hours).
- Site security response (24 hours).

- Vegetation management within the development footprint in accordance with the fire management and biodiversity management plans.

4.5.2 Water requirements

Cleaning materials and spare parts would be made available on site for use by the maintenance staff. Panel cleaning may be required during drought conditions. As such, additional panel cleaning may also be required on occasion. As a 'worst case' upper limit, it is estimated that up to 700kL of water would be required per year.

It is estimated that up to 21.7ML would be required per year and if insufficient water is collected on site from rain water tanks and dams, water would be obtained commercially.

4.5.3 Transport and access

The travel demand during the operation phase of the proposal is anticipated to be significantly less than the construction phase. It is estimated that the daily peak travel demand during operation would be approximately 8 vehicles movements a day.

4.5.4 Personnel and work hours

A total of five equivalent full time staff would be employed onsite when the solar farm is operational. Associated work would be undertaken during the standard working hours of:

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

Work would only be undertaken outside of these hours in an emergency and would be kept to a minimum.

During the life of the solar farm, it may be necessary to engage contract staff to undertake specific major tasks at which time there could be greater numbers of people onsite. Such work would most likely relate to the replacement/refurbishment of the energy storage system, as it is assumed that the batteries would have to be replaced at least once during the life of the solar farm.

It is anticipated that the staff would drive light vehicles to the site each working day.

As noted in Section 4.2.1, TransGrid would be responsible for the operation and maintenance of the 330kV substation and TransGrid staff would require access to that part of the site.

The TransGrid owned Wollar Substation is less than 1km from the proposal site so it is expected that the maintenance of the two sites would be coordinated and, in respect of TransGrid staff, the presence of the new substation would have minimal impact on traffic in the area.

The standard working hours for TransGrid staff are:

- Monday – Friday: 7am – 6pm

4.5.5 Lighting and CCTV

Under normal circumstances, there would be no night lighting located on site.

External lighting would be provided around the buildings, and in the high voltage substation but they would only be used on the rare occasions that staff are working on the site during the hours of darkness.

There may be some security lighting at critical locations around the perimeter of the site, but these would only be activated when the automatic security system senses an unauthorised site entry. Task lighting would be provided at PCU's.

CCTV security cameras would be located at the entrance gate and around the substation and battery storage, and O&M facilities and office areas.

4.5.6 Refurbishment and upgrading

It is estimated that the solar equipment would have a life of 30 years and the benefits of refurbishing the equipment would be considered as this time draws near.

It is anticipated that the batteries that would be used in energy storage system would have a life of 15 years, it is anticipated that they would need to be replaced at least once during the life of the solar farm.

4.6 DECOMMISSIONING AND REHABILITATION

The expected life of the proposed Wollar Solar Farm is 30 years with the exception of the energy storage equipment which, because of the battery technology, is expected to have a life of approximately 15 years. It is anticipated that after 15 years the batteries would be replaced. Similarly, after 30 years, other solar farm infrastructure may be refurbished to continue operations.

When the solar farm is no longer viable, all above ground infrastructure, with the possible exception of the 330kV substation, would be removed and decommissioning and rehabilitation of the site would commence. It is noted that the 330kV substation would at that time form part of TransGrid's transmission link between Wollar and Wellington. Other works would need to be carried out to re-establish the link if the substation were to be removed.

The solar arrays would be removed and the steel piles on which they are supported, would be removed. Both the steel piles and the solar panels would be recycled, where possible.

All buildings would be removed, including the PCUs together with the associated footings.

Cabling would be removed where practical and recycled. Any cabling greater than 500mm below the ground may be left in place since this would not impact on future agricultural activities on the site once the restoration is complete.

The objective of this stage is to return the site to its existing land capability, for continued agricultural or other compatible land use options.

4.7 INDICATIVE TIMELINE

Table 4-5 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	Q3 2019	12 - 18 months
Operation	Q1 2021	30 years
Decommissioning	2051	9 months

4.8 CAPITAL INVESTMENT

The Wollar Solar Farm would have an estimated capital investment of $430 million (including storage). A quantity surveyor's report confirming the capital investment has been provided to DPE.

4.9 VOLUNTARY CONTRIBUTION

The proposed Wollar Solar Farm would share the benefits of the proposal with the local community in a number of ways. The following proposed benefits are being offered:

- Maximise the participation of local businesses in the construction and operation of the solar farm.
- Opportunities for relevant skills training, up-skilling and scholarships for local community.
- A Community Fund would be set up by Wollar Solar Farm for the local community. The community would be invited to provide ideas on how this fund would be best used at our community information drop-in session to be held during the EIS exhibition period.

5 PLANNING CONTEXT

The legislative planning context for the Wollar Solar Farm proposal is covered in this section and includes:

- Clarification of the status of the proposal as a NSW State Significant Development (SSD).
- The permissibility of the proposal under relevant State Environmental Planning Policies (SEPPs).
- Evaluation of the proposal against relevant local, NSW and Commonwealth law (Acts and Regulations).

5.1 ASSESSMENT CONTEXT

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulations and instruments set the framework for development assessment in NSW.

Development assessment provisions are contained in Part 4 of the Act. Section 4.36 of the EP&A Act provides that a development would be SSD if it is declared to be SSD by a State Environmental Planning Policy (SEPP).

The *State Environmental Planning Policy (State and Regional Devel*opment) *2011* (SRD SEPP) declares the Wollar Solar Farm to be SSD as it is development for the purpose of electricity generating works with a capital investment value of greater than $30 million (Clause 20, Schedule 1).

Section 4.12 (8) of the EP&A Act requires a SSD development application to be accompanied by an EIS prepared in accordance with the EP&A Regulation. This EIS is intended to meet the objects and assessment requirements of the EP&A Act, the Regulation and *State Environmental Planning Policy (State and Regional Development) 2011*.

The proponent made a written application to the Secretary requesting Secretary's Environmental Assessment Requirements (SEARS) for the proposed Wollar Solar Farm as required by Clause 3 of Schedule 2 of the EP&A Regulations. The proponent's application was accompanied by a Preliminary Environmental Assessment, which provided detailed information about the proposed Wollar Solar Farm including key environmental issues.

On 4 May 2018, the Secretary issued the SEARs for the Wollar Solar Farm (Appendix A). In formulating the environmental assessment requirements, the Secretary consulted with relevant public authorities and agencies and considered key issues raised by those authorities. Section 6.1.1 outlines the SEARs and provides a cross reference to where each item is addressed within this EIS. This EIS complies with the SEARs and the environment assessment requirements contained in Schedule 2 of the EP&A Regulation.

The proposal was referred to the Department of Environment and Energy (DoEE) on the basis of potentially significant impacts to White box- yellow box- Blakely's red gum grassy woodland and derived native grassland (Box Gum Woodland). The proposal was determined to be a controlled action on 3 October 2018 and Supplementary SEARs were issued on 6 November 2018 reflecting the potential for impacts on a Matter of National Environmental Significance.

5.2 ENVIRONMENTAL PLANNING INSTRUMENTS

Environmental planning instruments (EPIs) are legal documents that are prepared under the EP&A Act to regulate land use and development. EPIs determine the relevant part of the EP&A Act under which a development proposal must be assessed and therefore determine the need or otherwise for development consent. EPIs consist of SEPPs, regional environmental plans (REPs), and local environmental plans (LEPs).

5.2.1 State environmental planning policies

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, which are major projects that require approval from the Minister for Planning and Environment or delegate (Planning Assessment Commission, Secretary or other public authority).

Clause 20 of Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* defines SSD as including:

> *Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:*
>
> *(a) has a capital investment value of more than $30 million, or*
>
> *(b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance.*

The Wollar Solar Farm would have an estimated capital investment cost greater than $30 million and is therefore considered SSD under Part 4 of the EP&A Act.

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.

Clause 34(7) of the ISEPP states that development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed residential zone if the system has the capacity to generate more than 100kW). A ‘solar energy system’ includes a photovoltaic electricity generating system.

The proposed Wollar Solar Farm would be located within a rural zone (RU1 Primary Production), under the Mid-Western Regional LEP. The proposal is therefore permissible with consent under the ISEPP.

State Environmental Planning Policy (Rural Lands) 2008

Clause 13 of this SEPP identifies land as being State significant agricultural land if it is listed in Schedule 2. Schedule 2 does not currently identify any land.

The site surveys suggest that sustained high productivity (such as annual cropping) would not be supported at the site. Section 7.4 outlines the potential impact of the proposal to land use.

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

This SEPP defines and regulates the assessment and approval of potentially hazardous or offensive d evelopment. The SEPP defines ‘potentially hazardous industry’ as:

“…development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

(a) to human health, life or property, or

(b) to the biophysical environment,

and includes a hazardous industry and a hazardous storage establishment"

'Potentially offensive industry' defined as:

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

SEPP 33 provides for systematic assessment of potentially hazardous and offensive development for the purpose of industry or storage. For development proposals classified as 'potentially hazardous industry' the policy requires a preliminary hazard analysis (PHA) to determine risks to people, property and the environment.

A checklist and a risk screening procedure developed by DPE is used to help determine whether a development is considered potentially hazardous industry (DOP, 2011). Appendix 3 of the Applying SEPP 33 guidelines lists industries that may fall within SEPP 33; the lists do not include solar farms and energy storage facilities. The hazardous development status of the proposal is assessed in Section 8.11.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

This SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

Koalas are listed under the *Biodiversity Conservation Act 2016* as a vulnerable species. The SEPP applies to each local government area listed in Schedule 1. Mudgee is listed in Schedule 1 of SEPP 44 and the proposal site has potential Koala habitat. Appendix F and Section 7.1 outlines the potential impact of the proposal on Koala Habitat.

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.

Clause 7 of the SEPP 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, 2018a) was undertaken for contaminated sites within the Mid-Western LGA on 7 June 2018. One recorded site was returned for the LGA and is not in the vicinity of the proposal site. The online list of NSW contaminated sites notified to the EPA (NSW Government, 2018b) was also searched on 6 June 2018. There are several sites listed in Mudgee and surrounding areas but none area in the vicinity of the proposal site.

There may be a risk of contamination associated with agricultural activities (e.g. pesticides, petrochemicals, hydrocarbon contamination) or asbestos construction or insulation materials on the proposal site. However, there was no evidence of this during the site assessment.

5.2.2 Local Environmental Plans

Mid-Western Regional Local Environmental Plan 2012

The proposal site is located within the Mid-Western Regional LGA and is subject to the provisions of the *Mid-Western Regional Local Government Plan 2012* (Mid-Western LEP).

The proposed solar farm and transmission line route is located across the land zone RU1 Primary Production.

Electricity generation is prohibited within the RU1 zone, however the ISEPP allows the development for the purpose of a solar energy system on any land with consent, which overrides the local provisions. The LEP states that the consent authority must have regard to the objectives for development in a zone when determining a development application. The objectives of this zone are as follows:

- *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.*
- *To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.*
- *To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.*

The proposal would harness a natural resource (solar energy) for the life of the solar farm. While activities associated with the solar farm would impact on land available for primary production, it would diversify the current land use to include electricity generation. The reversibility of the proposal and limited ground disturbance would result in the availability of the land for primary production or other alternative permissible rural land use at the end of the life of the proposal (expected to be 30 years).

5.3 NSW LEGISLATION

5.3.1 Legislation to be applied

Under Section 4.42 of the EP&A Act, several authorisations cannot be refused if they are necessary for and consistent with an approved SSD, these are outlined below.

- An aquaculture permit under Section 144 of the *Fisheries Management Act 1994*.
- An approval under Section 15 of the *Mine Subsidence Compensation Act 1961*.
- A mining lease under the *Mining Act 1992*.
- A production lease under the *Petroleum (Onshore) Act 1991*.
- An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in Section 43 of that Act).
- A consent under Section 138 of the *Roads Act 1993*.
- A licence under the *Pipelines Act 1967*.

Only two acts are relevant to the proposal, these are discussed below.

Roads Act 1993

The *Roads Act 1993* (Roads Act) is administered by Roads and Maritime Services, local councils or the Department of Industry - Land. Roads and Maritime Services has jurisdiction for classified roads, local councils for non-classified roads and the Department of Industry - Land for road reserves or Crown roads.

The Roads Act regulates the carrying out of various activities in, on and over public roads. Under Section 138, the consent of the appropriate roads authority is required to:

- *(a) erect a structure or carry out a work in, on or over a public road*
- *(b) dig up or disturb the surface of a public road*
- *(c) remove or interfere with a structure, work or tree on a public road*
- *(d) pump water into a public road from any land adjoining the road*
- *(e) connect a road (whether public or private) to a classified road.*

The proposal includes two potential primary access routes for its operation and construction as discussed in Section 1.2.3. Consent would be required from Mid-Western Regional Council (Barigan Road and Maree Road) and Department of Industry for Crown roads.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides an integrated system of licensing for certain polluting activities within the objective of protecting the environment. Schedule 1 of the POEO Act describes activities for which an Environment Protection Licence is required.

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, however does not include solar power. The proposal would not be a scheduled activity under the Act and an EPL is not required.

5.3.2 Approvals that do not apply

Under Section 4.41 of the EP&A Act, SSD developments do not require the following authorisations:

- *(a) concurrence under Part 3 of the Coastal Protection Act 1979.*
- *(b) a permit under Section 201, 205 or 219 of the Fisheries Management Act 1994.*
- *(c) an approval under Part 4, or an excavation permit under Section 139, of the Heritage Act 1977.*
- *(d) an Aboriginal heritage impact permit under Section 90 of the National Parks and Wildlife Act 1974.*
- *(e) an authorisation referred to in Section 12 of the Native Vegetation Act 2003 to clear native vegetation or state protected land.*
- *(f) a bush fire safety authority under Section 100B of the Rural Fires Act 1997.*
- *(g) a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the Water Management Act 2000.*

Even though the proposal doesn't require these authorisations, the potential impact of the proposal on these items such as heritage, waterways and native vegetation are assessed in this EIS.

5.3.3 Other relevant State legislation

Biodiversity Conservation Act 2016

The _Biodiversity Conservation Act 2016_ (BC Act) establishes a new regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments and activities. The Act contains provisions relating to flora and fauna protection (repealing parts of the _National Parks and Wildlife Act 1974_), threatened species and ecological communities listing and assessment (repealing the _Threatened Species Conservation Act 1995_ and section 5A of the EP&A Act), a biodiversity offsets scheme (BOS), a single biodiversity assessment method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The Act is supported by the _Biodiversity Conservation Regulation 2017._ This Act has been considered in the preparation of this EIS and in the provision of a BDAR and BOS.

Biosecurity Act 2015

The _Biosecurity Act 2015_ repealed the _Noxious Weeds Act 1993_ and provides a framework for the prevention, elimination and minimisation of biosecurity risks. The Act and supporting _Biosecurity Regulation 2017_ provide for the establishment and functions of Local Control Authorities for weeds (LGA or County Councils), and weed control obligations on public and private land. The EIS provides for the control of priority weeds occurring at the proposal site as part of the proposed works (refer Section 7.1 and 7.3).

Mining Act 1992

The main objective of the _Mining Act 1992_ is to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage ecologically sustainable development.

The proposal site is subject to the following authorities under the _Mining Act 1992_ (DPE, 2018):

- EL 6676 – held by Department of Planning and Environment.
- PEL 456 – Hunter Gas Pty. Ltd.

No activities authorised by the exploration licenses have been carried out on land within the proposal site.

WSD have consulted with the authority holders and the details and outcomes of the consultation are provided in Section 5. There is a potential to impact future exploration activities under each authority. However, exploration of mineral resources which could resume at the end of the life of the solar farm, if this becomes a preferred land use option at this later stage.

Crown Lands Act 1989

The objective of the Crown Lands Act is to ensure that Crown land is managed for the benefit of the people of NSW. The Catchments and Lands Division, DPI is responsible for the sustainable and commercial management of Crown Land.

The proposal site is bound by Crown Land along the west and south. Numerous Crown Roads are located across the site and the portion of Wollar Creek that transects the proposal site to the east is Crown Land.

The identified paper roads are confirmed to be Crown Land by Dubbo Land Office. WSD have consulted with DPI and intend on purchasing this land. A licence to use this land for the proposed development prior to purchasing would be applied for concurrently.

Waste Avoidance and Resource Recovery Act 2001

Waste management during the proposed works would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). Waste minimisation and management is addressed in Section 8.10 of the EIS.

5.4 COMMONWEALTH LEGISLATION

5.4.1 Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act provides an assessment and approval process for actions likely to cause a significant impact on Matters of National Environmental Significance (MNES). The nine MNES are:

- World Heritage properties.
- National Heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- Nuclear actions (including uranium mines).
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- A water resource, in relation to coal seam gas development and large coal mining development.

Approval by the Commonwealth Environment Minister is required if an action is likely to have a significant impact on MNES. Assessments of significance based on criteria listed in Significant Impact Guidelines 1.1 issued by the Commonwealth (Commonwealth of Australia, 2013) are used to determine whether the proposed action is likely to have a significant impact (i.e. is likely to be considered a 'controlled action').

A search of the Commonwealth Protected Matters Search Tool (coordinate search, undertaken on 25 January 2018 indicates that there are no World Heritage or National Heritage areas or items within the proposal site. No areas of Commonwealth land were identified, and no Commonwealth heritage places were identified.

The potential impacts to listed threatened species and communities including, those specified in Attachment A of the Supplementary SEAR's are assessed in the Biodiversity Development Assessment Report (Appendix F) and summarised in Section 7.1. Assessments of Significance under the EPBC Act for affected species are provided in Appendix D.

A summary of the EPBC Act search report is provided in Table 5-1. The full search report is provided in the Biodiversity Development Assessment Report (Appendix F).

Table 5-1 Summary of EPBC Act Protected Matters Report search results

Protected Matter	Entities within the 10km search area
World Heritage Properties	0
National Heritage	0
Wetlands of International Importance (Ramsar)	5
Threatened Ecological Communities	3
Threatened Species	33
Migratory Species	12
Listed Marine Species	18

Protected Matter	Entities within the 10km search area
Commonwealth land	0
Commonwealth Heritage places	0
Critical habitats	0
Commonwealth reserves (terrestrial)	0
State and Territory reserves	2
Regional Forest Agreements	0
Invasive species	30
Nationally Important Wetlands	0

5.4.2 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 practice 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 proposal 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 leases.
- 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 National Native Title Tribunal Registers on 20 December 2018 found no Native Title Claims, however there is currently three active applications within the Mid-Western Regional LGA. One recent application, Warrabinga Wiradjuri #7 (NC2018/002) covers a wide area including the proposal site. The claim is yet to be determined.

5.4.3 Renewable Energy (Electricity) Act 2000

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

- Encourage the additional generation of electricity from renewable sources.
- Reduce emissions of greenhouse gases in the electricity sector.
- Ensure that renewable energy sources are ecologically sustainable.

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth Government's RET. 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 RET scheme.

The Wollar Solar Farm would need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

5.5 OTHER RELEVANT POLICIES AND MATTERS

5.5.1 Matters of consideration

Under Section 4.15 of the EP&A Act, the consent authority is required to consider a number of matters when determining a development application under Part 4. These matters are listed in Table 5-2 and assessed in terms of their relevance to the proposal.

Table 5-2 Matters of consideration.

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant environmental planning instruments (EPIs) are discussed in Section 5.2.1. They include: • *State Environmental Planning Policy (State and Regional Development) 2011.* • *State Environmental Planning Policy (Infrastructure) 2007.* • *State Environmental Planning Policy (Rural Lands) 2008.* • *State Environmental Planning Policy No. 55 - Remediation of Land.* • *State Environmental Planning Policy No. 44 – Koala Habitat Protection.* • *Mid-Western Regional Local Environmental Plan 2012.*
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;	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 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4;	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.

Provision	Relevance to the proposal
	• The provisions of AS 2601 for development applications involving the demolition of structures. • The provisions of a subdivision order and any development plan for development of land that is subject to a subdivision order. • The provision of development under the *Dark Sky Planning Guideline.* The Wollar Solar Farm is located on land that is under the provisions of the *Dark Sky Planning Guideline.* This guideline is addressed in the Visual Impact Assessment Section 8.2. The proposal does not involve any other types of development and therefore the other provisions provided by the EP&A Regulation are not relevant 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 Section 2 and 8.5 of this EIS. This EIS demonstrates that the environmental impacts of the proposal have to the extent, reasonably and feasibly possible, been avoided or minimised through careful proposal design and through the implementation of mitigation measures provided within this EIS.
The suitability of the site for the development;	As discussed in Section 3.3, various options were considered when selecting an appropriate site for the proposal. The proposal site has a number of characteristics that make it suitable for the development of a solar farm. Most notably, its location is within close vicinity to an existing transmission line and electricity substation with good connection capacity. Other characteristics include: • Excellent solar exposure. • Excellent access to local and major roads. • A low number of non-involved dwellings. • Low relief terrain. Further, the Wollar Solar Farm is largely reversible; at the end of the life of the solar farm, all above ground infrastructure would potentially be removed and agricultural land use activities could resume.
Any submissions made in accordance with this Act or the regulations; and	WSD would consider and, as necessary, respond constructively to any submission made in relation to the Wollar Solar Farm. Consultation with stakeholders that has been undertaken during the planning stages including the preparation of this EIS is summarised in Section 6.
The public interest	The Wollar Solar Farm is in the public interest for several reasons. The farm would produce up to 290MW. On an annual basis, the proposed Wollar Solar Farm would provide enough clean, renewable energy for about 104,926 average NSW homes while displacing approximately 515,564 metric tonnes of carbon dioxide. The solar farm would provide the following benefits: • Directly contribute to helping Australia in meeting the Renewable Energy Target. • Reduce greenhouse gas emissions required to meet Australia's international climate conditions.

Provision	Relevance to the proposal
	• Assist in the transition towards cleaner electricity generation. • Generate economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. WSD has undertaken community consultation to inform the community and stakeholders about the proposal and their opportunities to provide input into the assessment and development process. Consultation to date has been in favour of the proposal. Further details on the consultation process is provided in Section 6.

5.5.2 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In NSW, the concept has been incorporated into legislation including the *Environmental Planning and Assessment Act 1979* and Regulation and the *Protection of the Environment Administration Act 1991*.

Based on the likely costs and benefits of the proposed solar farm, the proposal is considered to comply with the principles of Ecologically Sustainable Development. ESD principles and their relationship to the design, construction and ongoing operations of the proposal are identified in Table 5-3.

Table 5-3 Assessment of the proposal against the principles of Ecologically Sustainable Development

(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 impact; all potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been included to address the uncertainty. A 'worst case' impact assessment has been undertaken to account for the uncertainty in the final impact footprint.
(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 Wollar 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 Wollar Solar Farm 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. The Wollar Solar Farm would potentially be decommissioned at the end of its operational life, removing all above ground infrastructure. Decommissioning would therefore result in returning the site to its existing land capability for future generations.
(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 Wollar Solar Farm on biodiversity, including EPBC listed species, have been assessed in detail in the Biodiversity Assessment in Appendix F and are summarised in Section 7.1. This has included avoidance of areas of higher conservation value and management prescriptions to minimise and manage residual impacts.

(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, and***
- ***(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, and***
- ***(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 site such as the existing native vegetation, land capability, 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 these ESD principles. The mitigation measures in Section 9 provide an auditable set of environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the Wollar Solar Farm at a local and broader 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.

5.6 APPROVALS AND LICENCES

The approvals and licence requirements for the proposal are summarised in Table 5-4. Any additional licences or approvals that may be required would be obtained prior to the commencement of relevant activities.

Table 5-4 Summary of licences and approvals required for the proposal.

Legal instrument	Approving authority	Approval or licence
Environmental Planning and Assessment Act 1979 (Part 4)	DPE	State significant development applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.
Roads Act 1993 (Section 138)	Mid-Western Regional Council, DPI	Any works to public or classified roads require consent under this Act from the roads authority. Mid-Western Regional Council is the roads authority for Barigan Road and Maree Road.

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

6 CONSULTATION

6.1 AGENCY CONSULTATION

6.1.1 Secretary's environmental assessment requirements (SEARs)

As the proposal is classified as State Significant Development (SSD), a PEA was prepared, and SEARs were requested. These were provided by DPE on 4 May 2018 (Appendix A). The SEARs are intended to guide the structure and content of this 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.

Table 6-1 SEAR's and section they are addressed in this EIS.

Issue summary	Addressed in this EIS
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* The EIS must include the following:	
• a stand-alone executive summary	An executive summary is provided at the beginning of this EIS.
• 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 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	The proposal is described in Section 4. • A site plan is included as Figure 1-4. No infrastructure within this plan is part of a separate approvals process. • A detailed constraints map updated throughout the assessment process and used to inform the design is provided as Figure 1-5. Additional consultation was undertaken with DPE: • On 11 January 2018 to provide proposal briefing and seek feedback. • On 26 March to provide proposal update and seek feedback. • Onsite on 31 May 2018 to discuss the proposal in context of the site. • On 14 June to discuss the assessment process.

Issue summary	Addressed in this EIS
• a strategic justification of the development focusing on site selection and the suitability of the proposal site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential)	A strategic justification of the proposal is provided in Section 3.

• 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), including any cumulative impacts of the site and existing or proposed developments (including Wilpinjong mine, Ulan mine and Moolarben mine), 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)
	• Site context is provided in Section 1.2.2, and the existing environment of the site is described in Sections 7 and 8.
	• Detailed information regarding environmental legislation relevant to the proposal is included in Section 5.
	• Commensurate with the level of impact, detailed assessment, mitigation and monitoring are included in Sections 7 and 8.

• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS	• A consolidated set of mitigation measures is included in Section 9.2

• the reasons why the development should be approved having regard to:
  • relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development;
  • the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and
  • feasible alternatives to the development (and its key components), including the consequences of not carrying out the development
	• Key matters under the EP&A Act and ESD principles are addressed in Section 5.5.
	• A summary of feasible alternatives and why the proposal should be approved is included in Section 3.
	• A summary of suitability of the proposal with respect the potential land use conflicts and surrounding land use is included in Section 2

• A detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter	• Consideration of the proposals capability to contribute to the National Electricity Market is addressed in Section 2.
The EIS must also be accompanied by a report from a suitably qualified person providing:	

Issue summary	Addressed in this EIS
• a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived	• The Capital Investment Report has been provided separately.
• certification that the information provided is accurate at the date of preparation	• Certification of information accuracy has been provided separately.
• The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).	• Landowners consent has been provided separately.
The EIS must address the following specific issues:	

• **Biodiversity** – including an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the Biodiversity Conservation Act 2016 (NSW).	• A Biodiversity Development Assessment Report (BDAR) has been completed and is summarised in Section 7.1. The BDAR is provided in full in Appendix F.
	• Additional consultation was undertaken with DPE including:
	  • On 6 June 2018 regarding intention to lodge an EPBC Referral based on likely significant impact on a CEEC.
	  • On 14 June 2018 regarding decision to lodge and EPBC referral.

• **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community;	• An Aboriginal Cultural Heritage report (ACHA) has been completed and is summarised in Section 7.2. The ACHA is provided in full in Appendix G. • Consultation undertaken as part of the ACHA is included in Section 6.2. • Historic heritage is addressed in Section 8.4.

• **Land** – including:
  • an assessment of the impact of the development on agricultural land (including possible cumulative impacts on agricultural enterprises and landholders) and flood prone land, an assessment of any impacts to Crown lands, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines including Wilpinjong mine,
	• An assessment of agricultural land impacts is included in Section 7.4.
	  • An assessment on the impact of flood prone land is included in Section 7.5 and Appendix H.
	  • An assessment of the impacts on Crown Lands has been included in Section 7.4.
	  • An assessment of the potential for erosion to occur

ngh environmental

Issue summary	Addressed in this EIS
Ulan mine and Moolarben mine, extractive industries, aerial spraying, dust generation, and biosecurity risk) during operation and after decommissioning, with reference to the zoning provisions applying to the land, including subdivision; • an assessment of potential land use conflicts, including completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and • measures to remediate the land following decommissioning in accordance with State Environmental Planning Policy No 55 - Remediation of Land.	is included in Section 7.3 and a soil survey is committed to prior to construction. • A Land Use Conflict Risk Assessment is included in Section 7.4 • Land remediation following decommissioning is addressed in Sections 7.3 and 7.4.
• **Visual –** including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners;	• An assessment of visual impact has been included in Section 8.2. • The Dark Sky Planning Guideline is addressed within the visual assessment in Section 8.2.
• **Noise –** including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry 2017 and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	• A noise impact assessment has been completed and has been summarised in Section 8.3. The full noise assessment is provided as Appendix I.
• **Transport** – including an assessment of the site access route (including Barigan Road, Maree Road, Wollar Road, Ulan Road and Castlereagh Highway), site access point, rail safety issues and likely transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction (including cumulative impacts from nearby developments), and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);	• A Traffic Impact Assessment (TIA) was completed and is summarised in Section 8.6. The full TIA is provided as Appendix J.
• **Water** – including: • an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Spring Flat Creek, Wollar Creek, drainage channels, wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils),	• An assessment if water impacts is provided in Sections 8.1 and 8.1. • Details of water requirements and supply are detailed in Section 4 and 8.1.

Issue summary	Addressed in this EIS
related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; • details of water requirements and supply arrangements for construction and operation; and • a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004);	• A description of erosion and sediment control measures are provided in Section 7.3.

• **Hazards and Risks** including:
  • a preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), and if the preliminary risk screening indicates the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011); and
  • an assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure (including the proposed transmission line and substation) against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields;
	• A preliminary risk screening is provided in Section 8.11.
	• An assessment of bushfire risks is included in Section 8.7.
	• An assessment of Electromagnetic fields is included in Section 8.8.
	• An assessment of potential hazards is included in Section 8.11.

• **Socio-Economic** – including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.	• An assessment on potential socio-economic impacts of the proposal is included in Section 8.5.
The EIS consultation process includes:	
• During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, proponents of the Wilpinjong mine, exploration licence holders (specifically including, but not limited to, holder of PEL456 and EL6676), quarry operators and mineral title holders.	• Consultation is summarised in Section 6.
• In particular, you must undertake detailed consultation with affected landowners surrounding the development and Mid-Western Regional Council.	

Issue summary	Addressed in this EIS
• The EIS must describe the consultation process and the issues raised, and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	• Issues raised during consultation and how they are addressed in this EIS are included in Section 6.3.2.
• If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS.	Noted.

6.1.2 Supplementary SEARs

On 3 October 2018, the proposed Wollar Solar Farm was determined to be a controlled action for impacts on the following matter of national environmental significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Threatened species and communities

The proposal will be assessed by NSW under an accredited assessment in accordance with section 87 of the EPBC Act. These requirements are a supplement to the NSW Secretary's Environmental Assessment Requirements (SEARs) issued on 4 May 2018 and should be addressed in conjunction with those requirements.

Table 6-2 Supplementary SEARs and where they are addressed in this EIS

Issue summary	Addressed in this EIS
Assessment documentation prepared for the purposes of approval under the EPBC Act must address the statutory requirements outlined in Schedule 4 of the ***Environment Protection and Biodiversity Conservation Regulations 2000*** (Cwth) (EPBC Regulations).	Consultation with DoEE occurred on 13 June 2018 regarding the requirement for lodgement of an EPBC referral. Specific matters required by Schedule 4 were included in the EPBC referral which was publicly exhibited: EPBC 2018/SSD 9254. On October 3, the project was deemed a controlled action.
The EIS must include an assessment of all protected matters that may be impacted by the proposed action under the controlling provision identified in paragraph 1, noting that: • Protected matters that the Department considers are likely to be significantly impacted by the proposed action are listed at Attachment A. • This list is not exhaustive and it is the proponent's responsibility to ensure any relevant protected matters under this controlling provision are adequately assessed for the Commonwealth decision-maker's consideration.	Protected matters are addressed in the BDAR provided as Appendix F. Specifically: • Sections 5.1 to 5.4 of the BDAR set out relevant matters to be considered under the Act. • Section 7.4 of the BDAR examines MNES impacts in detail, with reference to the additional surveys undertaken in October 2018

Issue summary	Addressed in this EIS
	to address additional MNES requirements of the Supplementary SEARs. • Section 7.4 of the BDAR is supported by Appendix D of the BDAR; EPBC Habitat Assessment Evaluations. This evaluation considers all entities returned in the MNES search and included in the Supplementary SEARs. In consideration of entity habitat requirements, the surveys undertaken onsite, the habitat that is available onsite and the likelihood of occurrence, the potential for impact is determined in this table. • Where entities are deemed to have less than a low risk of impact, an EPBC Assessment of Significant Impact is undertaken, Appendix E. The assessments also assist to target mitigation strategies as required. • Only for those entities where significant impact is evaluated likely to occur, are Commonwealth offsets required. Appendix F sets out the quantification of offsets for relevant entities. • Section 10.1.4 of the BDAR provides an offset strategy for relevant entities, as determined above.
Project description • The title of the action, background to the development and current status. • The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES. • How the action relates to any other actions that have been, or are being taken, in the region affected by the action.	The project description is provided in Section 4 of this EIS.

Issue summary	Addressed in this EIS
Identification of threatened species and communities • The EIS must identify each EPBC Act-listed species and community likely to be significantly impacted by the proposed action and provide evidence as to why other EPBC Act-listed species and communities likely to be located in the project area or in the vicinity are unlikely to be impacted. • For each of the relevant EPBC Act-listed species and communities likely to be impacted, the EIS must provide: o A description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans; and o Details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Commonwealth guidelines and policy statements.	As above, threatened species and communities are addressed in Section 7.4 of the BDAR. Relevant species and communities considered likely to be impacted we determined to be: • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC). • Regent Honeyeater • Large-eared pied bat • Pink-tailed worm lizard Appendix E of the BDAR contains the Assessments of Significance for these entities, which set out habitat requirements and how these are met onsite, references relevant policies and plans, and concludes with a determination of the significance of the impacts proposed. Impacts on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC) were deemed likely to be significant. Survey methodology is included in Section 4.3 of the BDAR.
Impacts • The EIS must include a comprehensive assessment of impacts on any relevant EPBC Act-listed species and communities. The assessment must address the nature, geographic extent, magnitude, timing and duration of any likely direct, indirect and consequential impacts. The description of impacts must have regard to the full national extent of the species or community's range (i.e. not just NSW).	Impacts on relevant EPBC Act listed species and communities are addressed in Section 7.1 and the BDAR (Appendix F).
Avoidance and mitigation • For each of the EPBC Act-listed species and communities that are likely to be impacted by the development, the EIS must provide information on proposed avoidance and mitigation measures to deal with the impacts of the action, and a description of the predicted effectiveness and outcomes that the avoidance and mitigation measures will achieve.	Proposed avoidance and mitigation measures to deal with the potential impacts of the proposal are addressed in Section 7.1 of the BDAR. Indirect impacts are included in Section 7.2 of the BDAR. All impacts and measures are relevant to: • White Box-Yellow Box-Blakely's Red Gum

Issue summary	Addressed in this EIS
	Grassy Woodland (CEEC). • Regent Honeyeater • Large-eared pied bat • Pink-tailed worm lizard
Offsets • Where a significant residual adverse impact to EPBC Act-listed species or communities is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy, how offsets will be secured, and timing of protection. • For each EPBC Act-listed species and community likely to be significantly impacted by the action, the EIS must provide reference to, and consideration of, relevant approved conservation advice or recovery plan for the species or community.	An offset strategy for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland (CEEC) is provided in Section 10.1.4. of the BDAR.
Environmental Record of the person proposing to take action • Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.	Information about the proponent is provided in Section 1.3 of the EIS and the EPBC referral which was publicly exhibited: EPBC 2018/SSD 9254.
Information sources • For information given in the EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	Information sources are provided in the references list of the BDAR provided in Appendix F and Section 11 of this EIS. Reference citation makes clear published from non-published (i.e. website) sources. Areas of uncertainty, specifically around the impacts of shading, are stated clearly and conservative assumptions made in place of reliable data.

6.1.3 Relevant guidelines

Table 6-3 Guidelines and section they are addressed in this EIS.

Guideline	How the guideline has been addressed?
Biodiversity	
Biodiversity Assessment Method (OEH)	

Guideline	How the guideline has been addressed?
Threatened Species Assessment Guidelines - Assessment of Significance (OEH)	Biodiversity Assessment, Section 7.1 and Appendix F.
Biosecurity Act 2015	
Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DoI – L&W)	Water assessment and mitigation measures, Sections 7.5 and 8.1.
Policy and Guidelines for Fish Habitat Conservation and Management (DoI – L&W)	
Fisheries Management Act 1994	
Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)	Heritage assessment, Sections 7.2 and 8.4 and Appendix G.
Code of Practice for Archaeological Investigations of Objects in NSW (OEH)	
Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW (OEH).	
NSW Heritage Manual (OEH)	
Land	
Primefact 1063: Infrastructure proposals on rural land (DoI – L&W)	Land use, Section 7.4.
Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA)	Consultation, Section 6.3.
Local Land Services Act 2013	Biodiversity assessment, Section 7.1 and Appendix F.
Australian Soil and Land Survey Handbook (CSIRO)	Land and soil assessment Section 7.3 Land use, Section 7.3.
Guidelines for Surveying Soil and Land Resources (CSIRO)	
The land and soil capability assessment scheme: second approximation (OEH)	
Land Use Conflict Risk Assessment Guide (DoI – L&W)	Land use, Section 7.4.
Noise	
NSW Noise Policy for Industry (EPA)	

Guideline	How the guideline has been addressed?
Interim Construction Noise Guideline (EPA)	Noise assessment, Section 8.3 and Appendix I.
NSW Road Noise Policy (EPA)	
Transport	
Guide to Traffic Generating Developments (RTA)	Proposal description, Section 4. Traffic assessment, Section 8.6 and Appendix J.
Austroads Guide to Road Design & relevant Australian Standards	
Austroads Guide to Traffic Management	
Water	
Managing Urban Stormwater: Soils & Construction (Landcom)	Land and soil assessment, Section 7.3. Water assessment, Section 8.1.
Floodplain Development Manual (OEH)	Proposal description, Section 4. Water assessment, Section 8.1. Flooding assessment, Section 7.5.
Guidelines for Controlled Activities on Waterfront Land (DoI – L&W)	
Water Sharing Plans (DoI – L&W)	
Floodplain Management Plan (DoI – L&W)	
Guidelines for Watercourse Crossings on Waterfront Land (DoI – L&W)	
Hazards and Risks	
Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DPE)	Hazard assessment, Section 8.11.
Multi-Level Risk Assessment (DPE)	
Waste	
Waste Classification Guidelines (EPA)	Resource use and waste generation, Section 8.10.
Electric and Magnetic Interference	
ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields	Electric and magnetic fields, Section 8.8.

6.1.4 Agencies' additional comments and consultation

As part of preparing the EIS for the development application, the SEAR's require that the relevant State or Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders be consulted.

The issues raised through consultation with these entities are provided below.

Table 6-4 Additional Agency comments and section they are addressed in the EIS and consultation

Issue raised	How issue has been addressed
Mid-Western Regional Council	
Matters raised in Department's addendum to the SEARs included impacts on transport, noise and visual amenity, construction impacts and community consultation. • **Transport**: o Council requests that a full traffic study be undertaken as part of the EIS which details traffic volumes, vehicle sizes/loads and timing of deliveries during both construction and operational phases of the proposed project. Council also requests information on any proposed road upgrades that the proponent intends on undertaking. This includes intersection treatments, railway crossings, lane widths and surfacing details in accordance with the relevant AustRoads Guidelines. o The proponent is requested to address the impact on local roads during the construction and operational phases and include a Road Dilapidation Report and a complete audit of the road formation and/or pavement condition on existing roads. Roads that are anticipated to be affected by the proposal are Maree Road, Barigan Road, Wollar Road and the Castlereagh Highway. Dust and noise impacts on sensitive receptors along haulage routes should also be considered.	The traffic assessment is included in Section 8.6. A Road Dilapidation Report would be prepared prior to construction.
• **Noise and visual amenity**: o Council requests that specific details are provided to adequately assess any noise and visual amenity impacts that may be experienced by residents within local proximity of the project. As the project is of a very large scale, it is anticipated that noise and visual amenity will be key areas of concern for adjoining neighbours and local residents. Where impacts are expected, it is requested that the proponent provide a thorough analysis of these impacts and details on the proposed mitigation measures and management practices that will be implemented.	The visual assessment is included in Section 8.2. The noise assessment is included in Section 8.3. No concerns have been raised to date by the community regarding noise or visual amenity.
• **Construction impacts**: o There is limited information available on the size of the construction workforce and timing for construction. Council requests that the proponent provide sufficient details regarding the construction phase of the project to be able to adequately assess any social impacts. This	The construction phase of the project is described in detail in Section 4. Cumulative impacts associated with mining developments have been addressed in Section 8.12.

Issue raised	How issue has been addressed
includes details of the average and peak construction workforce, the total construction period, accommodation requirements, travel arrangements to/from site, vehicle movements, hours of construction etc. o It is also requested that the proponent consider the status and timing of any mining development projects or activities within the local area (e.g. by Ulan, Wilpinjong, Moolarben) to minimise any adverse cumulative impacts.	
• **Community consultation**: o Council requests that the proponent conducts extensive consultation with any impacted neighbours, local businesses and the broader community throughout the construction and operation period. This will ensure the community has current and accurate information to provide relevant feedback on the project including visual, noise, traffic or social impacts. o Council also requests that the proponent provide details on its proposed communications plan and identifies mechanisms by which the community can provide feedback during construction and operations. This should also include the proponents approach to dealing with complaints or compliance issues.	Details of community consultation and feedback mechanisms are included in Section 6.3. The Community Consultation Plan is included in Appendix C.
Office of Environment and Heritage (OEH)	
Matters raised in Department's addendum to the SEARs included impacts on biodiversity and offsetting, Aboriginal cultural heritage, historic heritage, water and soils and flooding. **Biodiversity**: • Biodiversity impacts to be assessed according to the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR)	The BDAR is summarised in Section 7.1 and provided in full in Appendix F. Additional consultation was undertaken with OEH including: • On 13 August 2018 regarding mapped important habitat for the Regent Honeyeater and the Swift Parrot. • On 29 August clarifying the proposal site is not mapped as important habitat, but is mapped as Regent Honeyeater important habitat.
Aboriginal cultural heritage: • Identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR).	The ACHAR is summarised in Section 7.2 and provided in full in Appendix G.

Issue raised	How issue has been addressed
• 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 ACHAR. • Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. • Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.	Details of Aboriginal consultation undertaken are included in Section 6.2.
Historic Heritage: • A heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall: o 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) o 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) o include a statement of heritage impact for all heritage items (including significance assessment) o 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 o 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.	The desktop Heritage assessment was informed by a site inspection and is provided in Section 8.4.
Water and Soils: • The EIS must map the following features relevant to water and soils including: o Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map). o Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).	The soil and water assessments were desktop and informed by site inspection. Land and soil assessment is provided in Section 7.3.

Issue raised	How issue has been addressed
o Wetlands as described in s4.2 of the Biodiversity Assessment Method. o Groundwater. o Groundwater dependent ecosystems. o Proposed intake and discharge locations. • The EIS must describe background conditions for any water resource likely to be affected by the Wollar Solar Project, including: o Existing surface and groundwater. o Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations. o Water Quality Objectives (as endorsed by the NSW Government o http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters. o 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. o Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions http://www.environment.nsw.gov.au/research-and- o publications/publications-search/risk-based-framework-for-considering-waterway-health-outcomes-in-strategic-land-use-planning • The EIS must assess the impacts of the Wollar Solar Project on water quality, including: o The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the Wollar Solar Project 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. o Identification of proposed monitoring of water quality. o Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan) • The EIS must assess the impact of the Wollar Solar Project on hydrology, including: o Water balance including quantity, quality and source. o Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas. o Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems. o Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect	Water use and water quality assessment is provided in Section 8.1.

Issue raised	How issue has been addressed
river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches). o Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water. o 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. o Identification of proposed monitoring of hydrological attributes.	
Flooding and Coastal Hazards • The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: o Flood prone land. o Flood planning area, the area below the flood planning level. o Hydraulic categorisation (floodways and flood storage areas). o Flood hazard • The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1%AEP, flood levels and the probable maximum flood, or an equivalent extreme event. • The EIS must model the effect of the proposed Wollar Solar Project (including fill) on the flood behaviour under the following scenarios: o Current flood behaviour for a range of design events as identified in 14 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change. • Modelling in the EIS must consider and document: ▪ Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies. ▪ The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme 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, hazard categories and hydraulic categories. ▪ Relevant provisions of the NSW Floodplain Development Manual 2005. • The EIS must assess the impacts on the proposed Wollar Solar Project on flood behaviour, including:	A flooding assessment was undertaken by a specialist and included a desktop assessment informed by a site visit. Flooding risks are assessed in Section 7.5 and Appendix H.

<table>
<tr><th>Issue raised</th><th>How issue has been addressed</th></tr>
<tr><td>

Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
Consistency with Council floodplain risk management plans.
Consistency with any Rural Floodplain 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.
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 NSW SES and Council.
Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW 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 NSW SES.
Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

</td><td></td></tr>
<tr><td colspan="2">Division of Resources and Geoscience</td></tr>
<tr><td colspan="2">Matters raised in Department’s addendum to the SEARs included impacts on mineral titles.</td></tr>
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The EIS must include a mineral, coal and petroleum titles search through the Division’s MinView application, with the results shown on a map(s).
Consult with the holders of Exploration Licence 6676 and Petroleum Exploration Licence 456 and provide evidence of these consultations.
check for new mineral and energy titles that may be granted in the vicinity of the subject site during all decision-making stages of the project to ensure that other stakeholders (such as title holders) with interest in the area are aware of the solar farm project.
Consult with GSNSW in relation to the proposed location of any biodiversity offset areas (both on and off site) or any supplementary biodiversity measures to ensure there is no consequent reduction in access to prospective land for

</td><td>Details of consultation undertaken is outlined in Section 6.4 and 6.5 and provided in Appendix D

Potential impact on mineral and energy titles are addressed in Section 7.4 and Appendix E.</td></tr>
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<tr><th>Issue raised</th><th>How issue has been addressed</th></tr>
<tr><td>mineral exploration, or potential for sterilisation of mineral or extractive resources.</td><td></td></tr>
<tr><td colspan="2">Roads and Maritime Services (RMS)</td></tr>
<tr><td colspan="2">Matters raised in RMS’s addendum to the SEARs included the requirement for:</td></tr>
<tr><td>
A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA’s Guide to Traffic Generating Developments 2002 and including:
Hours and days of construction.
Schedule for phasing/staging of the project.
Traffic volumes:
Existing background traffic.
Project-related for each stage of the project including construction, operation and decommissioning.
Projected cumulative traffic volumes.
Traffic volumes are to also include a description of:
Ratio of light vehicles to heavy vehicles.
Peak times for existing traffic.
Peak times for project-related traffic.
Transportation hours.
Project related traffic interaction with existing and projected background traffic.
The origin, destination and routes for:
Employee and contractor light traffic.
Heavy traffic.
Over size and over mass traffic.
A description of all oversize and over mass vehicles and the materials to be transported.
The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.
The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.
Local climate conditions that may affect road safety for vehicles used during construction, operation and decommissioning of the project (e.g. fog, wet and dry weather).
Proposed road facilities, access and intersection treatments are to be identified and be in accordance with Austroads Guide to Road Design including Safe Intersection Sight Distance (SISD).
The layout of the internal road network, parking facilities and infrastructure within the project boundary.
</td><td>The traffic assessment is included in Section 8.6.

The appointed construction contractor would prepare a Traffic Management Plan (TMP), including this information, in consultation with the RMS and Mid-Western Regional Council.</td></tr>
</table>

Issue raised	How issue has been addressed
• A Traffic Management Plan (TMP) developed in consultation with Mid-Western Regional Council and Roads and Maritime. The TMP is to identify and provide management strategies to manage the impacts of projected related traffic including: o Haulage of materials to site. o The management and coordination of construction and staff vehicle movements to and from the site and measures to be employed to limit disruption to other motorists. The management of construction staff access to the works site is to include strategies and measures employed to manage the risks of driver fatigue, road hazards and driver behaviour.	
Department of Industry (DoI)	
Matters raised in Department's addendum to the SEARs included impacts on Crown Land, water and agriculture.	
Water • The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased. • A detailed and consolidated site water balance. • Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts. • Proposed surface and groundwater monitoring activities and methodologies. • Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy, the DPI Water Guidelines for Controlled Activities on Waterfront Land and the Water Sharing Plans for the Greater Metropolitan Region Groundwater Sources and Unregulated River Water Sources	Water use and quality is addressed in Section 8.1.
Crown Lands • Consent from the Minister for Lands and Water must be obtained prior to the construction of any infrastructure proposed to be located on any Crown roads. • It is noted that the Crown roads may provide legal but not practical access to freehold properties. As such, the proponent should not rely on these roads for practical access to the site.	Potential impacts on Crown Lands are addressed in Section 7.4. Additional consultation was undertaken: • On 4 July 2018 regarding crown roads within the site. Recommendation was given to apply for a license while

Issue raised	How issue has been addressed
	concurrently applying to purchase these Crown roads. • On 4 December 2018, further advice from DPI – Crown Lands and Water was provided relating to a request for priority determination of road closure and purchase. • On 25 January 2019, DPI – Crown Land and Water confirmed receipt of the landowners consent application.
Agriculture • The EIS is required to address or provide the following: o Assessment of impacts to surrounding agricultural land uses and industries, including impacts resulting in a temporary or a permanent loss to land capability or agricultural productivity. This would include demonstration that all significant impacts on current and potential agricultural developments and resources can be reasonably avoided or adequately mitigated. o Complete a Land Use Conflict Risk Assessment (see link below), including: ▪ Identification of potential land use conflict, in particular relating to separation distances and management practices to minimise dust, noise and visual impacts from sensitive receptors. For example, this may include outlining strategies to avoid land use conflict around agricultural aerial spraying and fertilising in the area. ▪ Consultation and negotiation with owners/managers of affected adjoining agricultural operations. Include a biosecurity (pests, weeds and livestock disease) risk assessment outlining the likely plant, animal and community risks (as per the Infrastructure Proposal guideline below) including monitoring and mitigation measures.	Assessment of potential agricultural impacts and a Land Use Conflict Risk Assessment is included in Section 7.4. Impacts on biosecurity risk are addressed in Section 7.4. Additional consultation was undertaken with DPI: • On 17 September regarding request for early review draft EIS sections (7.3 and 7.4) for feedback. • 26 October 2018 regarding provision of feedback on Section 7.3 and 7.4.
Environmental Protection Authority (EPA)	
Matters raised in EPA's addendum to the SEARs included impacts on waste management, dust, water management and storage of chemicals and fuels.	
Waste Management • incorporate options and strategies for waste minimisation, reuse and recycling. Waste management should be a high	Waste management is addressed in Section 8.10.

Issue raised	How issue has been addressed
priority given the issues that other similar developments in the region have experienced in managing the large volume of waste that is generated during construction. Examples of problematic wastes include large quantities of packing materials such as wooden pallets, metals and plastics. **Dust** • Impacts from dust generated during the construction phase must be identified and appropriate mitigation measures be defined and implemented. **Water Management** • Describe measures to protect surface waters during construction such as installation and management of appropriate sediment and erosion controls in accordance with the EPA endorsed publication "Managing Urban Stormwater - Soils and Construction" Landcom 4th Edition March 2004. **Storage of chemicals and fuels** • Describe the control measures that are to be implemented to ensure the risk of spills to the environment are minimised, such as appropriate storage (bunding) of chemicals and fuels.	Dust management is addressed in Section 7.1 and 7.3. Sediment and erosion control is addressed in Section 7.3.
NSW Rural Fire Service (RFS)	
• The EIS should include a Bush Fire Management Plan (BFMP) will be prepared in consultation with the NSW RFS District Fire Control Centre. The BFMP shall include: o 24/7 contact details including alternative telephone contact; o Site infrastructure plan; o Site access and internal road plan; o Construction of asset protection zones and their continued maintenance; o Location of hazards (Physical, Chemical and Electrical) that will impact on fire fighting operations and procedures to manage identified hazards during fire fighting operations; o Such additional matters as required by the NSW RFS District office (Plan review and update). • The entire solar array development site to be managed as an Asset Protection Zone as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. • To allow for emergency service personnel to undertake property protection activities, a 10 m defendable space that permits unobstructed vehicle access is to be provided around the perimeter of the solar array development site. • 4A minimum 20,000 litre dedicated water supply shall be located adjacent to the main internal road. The water supply	Bushfire risks are addressed in Section 8.7.

Issue raised	How issue has been addressed
shall have a hard stand surface within 4 metres of the supply. • If the water supply is to be within a storage tank, the tank(s) shall be: o Constructed of steel or concrete materials; o Fitted with a 65 mm Storz fitting or similar (as agreed by the District Fire Control Centre; o All external fittings shall be made of metal.	

6.2 ABORIGINAL COMMUNITY CONSULTATION

The 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 *Aboriginal cultural heritage consultation requirements for proponents 2018* (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 of the ACHA provided in Appendix G. A summary of actions carried out 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 Mudgee LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspaper, the Mudgee Guardian on the 1 May 2018 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, ten groups and an individual contacted the consultant to register their interest in the proposal.

The groups who registered interest were:

- North West Wiradjuri Company LTD;
- Murong Gialinga Aboriginal & Torres Strait Islander;
- Buudang;
- Wellington Valley Wiradjuri Aboriginal Corporation;
- Gallaggabang Aboriginal Corporation;
- Mudgee LALC;
- Binjang Wellington Wiradjuri heritage Survey;
- Barraby Cultural Services;
- Yulay Cultural Services; and
- Yurrandaali Cultural Services.

The individual who registered was:

- Paul Brydon (Midnight)

No other party registered their interest, including the other entities and individuals recommended by OEH.

Stage 2. On the 7 June 2018, an Assessment Methodology document for the Wollar Solar Farm was sent to all registered parties. 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.

Bradley Bliss responded for the Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) and the Gallangabang Aboriginal Corporation (GAC). While it was noted that they agreed in principal to the methodology they would like spacing to be no greater than 30 m between survey participants with 20m spacing being optimal. These comments were addressed by NGH in a reply letter sent to the WVWAC on the 6 July 2018 that propose a compromise of 20 m to 25 m spacing. Bradley Bliss responded to this on the 6 July 2018 noting that WVWAC and GAC were happy with the reply.

Murong Gialinga Aboriginal & Torres Strait Islander and Buudang responded that while they agreed in principal to the methodology they would prefer that the spacing of the survey transects be reduced to 10 m to 15 m between survey participants. These comments were addressed by NGH in a reply letter sent on the 6 July 2018 that proposed a compromise of 20 m to 25 m spacing. No further correspondence was received regarding the letter from NGH Environmental that addressed the spacing comments on the methodology.

Mr Paul Brydon responded that he was happy with the methodology and would not be available to participate in any fieldwork due to other commitments.

The Mudgee LALC, Barraby Cultural Services and Yurrandaali Cultural Services did not raise any issues with the methodology and noted that they would like to participate in the field survey.

No other comments were provided from other registered parties.

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 prior to fieldwork.

The fieldwork was organised and four of the registered parties were asked to participate in fieldwork. A single representative from each of the four RAPs selected participated in the fieldwork. The fieldwork was carried out over six days in late July 2018.

The Aboriginal community representatives who participated in the field survey were:

- Larry Foley- Buudang
- Steven Flick - Murong Gialinga Aboriginal & Torres Strait Islander
- Bradley Bliss - Wellington Valley Wiradjuri Aboriginal Corporation; and
- James Williams - Mudgee LALC

Stage 4. In October 2018 a draft version of this _Aboriginal Cultural Heritage Assessment Report_ for the proposal (this document) was forwarded to each registered Aboriginal party inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document.

6.2.1 Aboriginal Community Feedback

Community consultation occurred throughout the project. The draft report was provided to each of the Registered Aboriginal Parties (RAPs) and feedback was sought on the recommendations, the assessment and any other issues that may have been important.

Report feedback was provided in writing via email by Bradley Bliss for the Wellington Valley Wiradjuri Aboriginal Corporation and the Gallangabang Aboriginal Corporation on the 5th of November 2018. A copy of the written response is provided in Appendix A. Bradley Bliss noted that the report had be discussed with the community and that the Wellington Valley Wiradjuri Aboriginal Corporation and the Gallangabang Aboriginal Corporation were in agreeance with the findings and recommendations in the report. It was also stated that the Elders requested that the cultural site be submitted to AHIMS and the site card information be restricted. Copy of all the AHIMS site cards submitted for the project, including the site card for the cultural site were also requested. NGH has consequently submitted a site card to AHIMS for the cultural site. A copy of all the site cards has been provided to Bradley Bliss as requested.

The individual, Mr Paul Brydon (Midnight), responded via email on the 14th of November 2018. A copy of the written response is provided in Appendix A. Mr Brydon noted that he was happy with the report and no further comments were provided.

Report feedback was provided via a phone call from Debbie Foley to the NGH archaeologist Kirsten Bradley for the Murong Gialinga Aboriginal & Torres Strait Islander and Buudang registered groups on the 15th of November 2018. Debbie Foley noted that both groups were happy with the report, recommendations and updated reduction to the development footprint. No further comments were provided.

No comments were received from the Mudgee LALC, North West Wiradjuri Company LTD, Binjang Wellington Wiradjuri Heritage Survey, Barraby Cultural Services, Yulay Cultural Services and Yurrandaali Cultural Services.

6.3 COMMUNITY CONSULTATION

WSD has undertaken consultation with the local community in developing the proposal in line with the Australian Energy Agency's (ARENA's) *Establishing the social license to operate large scale solar facilities in Australia: insights from social research for industry* (ARENA, n.d.). Consultation activities were informed by *Beyond Public Meetings: Connecting community engagement with decision making* (Twyford Consulting, 2007), *Draft Large Scale Solar Energy Guideline for State Significant Development* (NSW Government, 2017) and *Large-scale solar energy guideline for state significant development December 2018* (NSW Government, 2018).

6.3.1 Community Consultation Plan

Effective engagement requires an understanding of community stakeholders and prioritisation of potential impacts. In order to contribute effectively, the community needs to understand the proposal and specific areas of interest to them. The aim of the consultation process for Wollar Solar Farm has been to provide the community with the required information to engage effectively.

A Community Consultation Plan (CCP), provided in Appendix C, was developed for the proposal. The CCP identifies ways to inform the community about Wollar Solar Farm and facilitate engagement within the community.

The CCP identifies:

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

Stakeholders were identified as those potentially being impacted by the solar farm proposal or having an interest in the proposal. The CCP sets out consultation requirements with interested parties including adjacent neighbours, near neighbours, local businesses, special interest groups and representative bodies. The plan also includes strategies for consultation with the local community and the broader community within the region.

The proposal has been developed iteratively in response to agency and community input. Measures to reduce adverse impacts and promote positive impacts have been incorporated in the EIS. The CCP further aims to ensure that there is ongoing effective liaison with the community.

6.3.2 Community and stakeholder consultation activities to date

In accordance with the CCP, a range of community engagement tools have been used with regard to the proposal. These are summarised in Table 6-5.

Table 6-5 Community and stakeholder consultation activities to date

Date of activity	Description of activity
January 2018 – ongoing	WSD met with TransGrid on multiple occasions mostly relating to the electrical connection application for connection to the grid. At meetings with TransGrid, general proposal updates were provided and feedback was sought.
11 January 2018	WSD met with NSW Department of Planning and Environment staff to provide project briefing and to seek feedback.
1 February 2018 19 February 2018	Wilpinjong mine site representative contacted and informed of the proposal. Adjoining properties are all owned by the mine and sub leased to a Pastoral Management Company. Mine advised they will brief this company.
1 February 2018	WSD provided a preliminary proposal briefing discussions with Wilpinjong mine staff at Wollar.
2 February 2018	WSD undertook preliminary proposal briefing discussions with Mid-Western Regional Council (met with General Manager and Director Development)
20 February 2018	Direct engagement with the Presidents of both the Mudgee District Environmental Group and the Wollar Progress Association.
16 March 2018	WSD discussion with staff at offices of Geological Survey of NSW to discuss general geological, exploration and mining issues associated with the site.
25 March 2018	Development of website to provide project information, updates and contact details https://www.wollarsolarfarm.com.au/ Establishment of a dedicated email address for feedback info@wollarsolarfarm.com.au
1 May 2018	Establishment of a dedicated “1300” phone number for enquiries.

Date of activity	Description of activity
8 May 2018	Project information Newsletter 1 created and posted at Wollar General Store.
8 May 2018	Direct engagement by WSD with general store owners/workers including distribution of Newsletter 1 and contact details.
8 May 2018	Meeting with Wilpinjong mine representative to provide details of the proposal.
12 July 2018	Letter box drop of project information Newsletter 2 and feedback form to all Wollar and Tichular households.
10 August 2018	Advertisement in the Mudgee Guardian to inform community of upcoming open house community information session in Mudgee.
13 August 2018	Project media release sent to local TV, radio and print media detailing the project status and the upcoming open house event on 16 August in Mudgee. Interview with local radio station ABC / Central West.
14 August 2018	Advertisement in the Mudgee Guardian to inform community of upcoming open house community information session in Mudgee.
14 August 2018	Interview with local radio station 2MG.
16 August 2018	Open house community information session at the CWA hall in Mudgee. Event held by WSD and NGH to provide further information and an opportunity for community members to provide feedback. Consultation with representative from Bylong Coal Project, Mudgee Hospital Redevelopment, Community members and environmental groups.
17 August 2018	WSD meeting with Mid-Western Regional Council to provide status report on progress of project and to seek feedback (met with Mayor, General Manager and Director Development).
14 November 2018	Advised Petroleum Exploration Licence Holder (PEL456 – Hunter Gas Pty Ltd) by of development by letter and sought feedback. Advised Exploration Licence Holder (EL6676 – Dept. Planning & Environment) of development by letter and sought feedback.
26 November 2018	Discussion with Peabody Australia Pty Ltd representative relating to key construction activities associated with the Wilpinjong Extension Project and anticipated construction timing.
6 December 2018	Consultation with TransGrid requesting landowner consent to lodge the Development Application.
6 December 2018	Consultation with Peabody Australia Pty Ltd requesting landowner consent to lodge the Development Application.
24 January 2019	Received TransGrid landowner consent from The Treasury on behalf of the Electricity Transmission Ministerial Holding Corporation to lodge the DA.

Date of activity	Description of activity
25 January 2019	Received DPI – Crown Lands and Water acknowledgement of receipt of landowner consent application.
31 January 2019	Received Peabody Australia Pty Ltd acknowledgment of previous consultation regarding intent to lodge a DA.
14 March 2019	Consultation with Mid-Western Regional Council regarding accommodation strategy. Council provided public examples of other large infrastructure projects that have considered accommodation impacts.

6.3.3 Results of community consultation

All residents with the potential to be impacted were supportive of the proposal, with no significant objections or concerns. Generally, questions and issues raised by the community centred around the following:

- Potential for construction of the new Mudgee Hospital and Bylong Coal Project to occur at the same proposed for the Wollar Solar Farm (Q3/Q4 2019).
- Concern raised by Mudgee Regional Tourism over temporary workforces overwhelming accommodation in Mudgee that should be servicing the tourism industry.
- Implementation of purpose built work camps may lead to adverse impacts for local landowners.

Feedback forms were distributed at the open house community information session in Mudgee of which 14 were completed. Comments were generally positive and included:

- The proposal would introduce a new industry to the Wollar area attracting more people and encourage young people to stay in the area.
- Support for sustainable power, reducing carbon emissions and investing in the future
- Belief that the proposal would help local businesses and introduce new employment opportunities.
- Strong support from the Mudgee District Environmental Group for renewable energy.
- The proposal demonstrates land use that is compatible with rural land use.
- Support for the construction of a second access site as this has the potential to increase access for emergency vehicles given the bushfire prone nature of the area.

Of the 14 respondents:

- All respondents were supportive of renewable energy generation.
- 11 respondents supported diversification of land use and income streams.
- 10 respondents supported the local economic opportunities provided by solar farms.
- 1 respondent raised concerns about traffic with relation to Barigan Road.
- No respondents raised any concerns with relation to visual or noise impacts, effects on natural areas, effects on land use or land values, effects on recreational opportunities.

6.3.4 Continued engagement

Engagement activities in the CCP extend throughout the determination period, and emphasis would be placed on submissions received during the EIS exhibition period.

The CCP would be reviewed regularly, as well as at key transition phases of the proposal development (e.g. prior to construction or operation). The Plan would continue to guide engagement activities at all phases of the proposal, ensuring that engagement is appropriate and in line with good practice and proactive in maximizing the benefits of the proposal to the local community.

6.4 COAL EXPLORATION LICENSE CONSULTATION

Table 6-6 Consultation to date regarding EL 6676.

Date of activity	Description of activity
1 February 2018 19 February 2018	Wilpinjong mine site representative contacted and informed of the proposal. Adjoining properties are all owned by the mine and sub leased to a Pastoral Management Company. Mine advised they will brief this company.
16 March 2018	WSD discussion with staff at offices of Geological Survey of NSW to discuss general geological, exploration and mining issues associated with the site.
8 May 2018	Meeting with Wilpinjong mine representative to provide details of the proposal.
14 November 2018	Letter sent to The Secretary (DPE) providing proposal information (Appendix E).
29 November 2018	A response was received from Geological Survey of NSW stating they had no concerns at this stage with the proposal (Appendix E). They however state they may provide comments during the public exhibition of the EIS.

6.5 PETROLEUM EXPLORATION LICENSE CONSULTATION

Table 6-7 Consultation to date regarding PEL456.

Date of activity	Description of activity
14 November 2018	Letter sent to Hunter Gas Pty Ltd. providing proposal information (Appendix E). To date no response has been received.

7 ASSESSMENT OF KEY ISSUES

7.1 BIODIVERSITY (FLORA AND FAUNA)

7.1.1 Approach (NSW)

A specialist Biodiversity Development Assessment Report (BDAR) was prepared by NGH Environmental to investigate and assess the potential impacts of the proposal on biodiversity. The aim of the BDAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the *Biodiversity Conservation Act 2016.*

The Biodiversity Assessment Methodology (BAM) is the current assessment methodology for SSD under the NSW Biodiversity Offsets Scheme prescribed by the NSW *Biodiversity Conservation Act 2016.* The BAM is established for accessing certain impacts on threatened species and threatened ecological communities and their habits. This report follows the BDAR format required by the BAM.

The following terms are used in this chapter, as required for a BDAR:

- **Development footprint** – The area of land that is directly impacted on by the proposal. Including, solar array design, perimeter fence, access roads, transmission line footprint and temporary areas used to store construction materials etc. This is mapped on Figure 7-1 .
- **Development site** – The broader area of land that may be affected by the proposal and to which the BAM is applied. For the purposes of conducting this BDAR, the development site extends 200m out from the development footprint. This is mapped on Figure 2-1.
- **Study area** – The broader area of land surveyed as part of the assessment. In this case, all land within the affected lot boundaries. This is mapped on Figure and referred to in the Environmental Impact Statement as the 'proposal site'.
- **Buffer area** – Land extending 1500m out from the development site used to assess native vegetation extent and other landscape features.

The full report is included in Appendix F 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 aims of the site surveys were as follows:

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

A BAM Calculator Assessment was completed using the online OEH tool by an accredited BAM assessor.

The following methods were adopted during the surveys:

- Broad vegetation mapping to establish zones for survey and preliminary constraints for development was undertaken in February 2018.
- Three targeted survey programs targeting candidate species and collection of BAM plot data:
    - o 22nd-24th May 2018
    - o 27th-29th August 2018
    - o 22nd-26th October 2018

Methods and survey effort specific to the candidates are set out below and mapped on Figure 7-1.

Diurnal Woodland Birds (Regent Honeyeater, Swift Parrot, Gang-gang Cockatoo, White-bellied Sea Eagle, Little Eagle, Square-tailed Kite)

May 2018: A woodland bird census consisting of a five (5) transect and five (5) 20 minute point opportunistic surveys were completed on the mornings and evenings of the 22-24 May for a total of seven (7) hours. Remnant trees were surveyed for evidence of stick nests used by raptors.

August 2018: Three (3) 20 minute two (2) ha diurnal bird surveys over a total one hour survey time. Targeted hollow-bearing tree surveys as well as surveys for large stick nests were carried out for evidence of suitable breeding habitat. All paddock trees within the development footprint were surveyed for the presence of hollows.

October 2018:

Six (6) 20 minute two (2) ha diurnal bird surveys as well as area searches and call playback were completed within mapped regent honeyeater habitat. Suitable Eucalypt species in flower within the development site were also observed for a period for 20 mins to monitor avifauna activity. Targeted hollow-bearing tree surveys and opportunistic surveys were also undertaken for evidence Gang-gang cockatoo within the development site.

Nocturnal Birds (Barking Owl, Masked Owl and Powerful Owl)

May 2018: Three (3) separate targeted species surveys for a total of 4 hours. Call playback with a megaphone was used from the vehicle along remnant vegetation, followed by a period of listening for responses and spotlighting.

August 2018: Four separate sites were surveyed for a total of three (3) hours. Spotlighting in addition to call playback with a megaphone and Bluetooth speakers were used from the vehicle and whilst walking through patches of remnant vegetation and isolated paddock trees, followed by a period of listening for responses in accordance with OEH threatened species guidelines.

Microbats (Eastern Cave Bat, Eastern Bent-wing Bat, Large-eared Pied Bat)

October 2018: A targeted Anabat survey was completed for four nights. Recordings produced were filtered and analysed by NGH Environmental ecologists.

Nocturnal Mammals (Squirrel Glider, Brush-tailed Phascogale, Koala)

May 2018:

Targeted spotlighting surveys were undertaken on three nights over four (4) separate areas for approximately one hour each night (30 mins per area). A 100-watt spotlight was used in both vehicle-based and foot surveys within remnant woodland patches and isolated paddock trees prior to nocturnal owl call playback surveys. Seven separate scat surveys were completed for Koalas on over two days, with mature feed trees searched for signs of Koalas for approximately 8 person hours.

August 2018: Four surveys were undertaken via spotlighting from a vehicle and on foot on two nights for approximately two hours each night. A 100-watt spotlight was used in both vehicle-based and foot surveys within remnant woodland patches and isolated paddock trees prior to nocturnal owl call playback surveys.

Reptiles (Pink-tailed Legless Lizard)

October 2018: Areas of rocky outcrop were assessed and surveyed by two ecologists over two days for approximately 30 minutes at each site within and surrounding the development site. This included traversing the rocky outcrop area and randomly turning and inspecting loose rocks and partially embedded rock that occurred before being placed back into their original position. Where practicable, between 100-150 rock were turned and inspected at each surveyed area.

Threatened flora (*Acacia ausfeldii, Monotaxis macrophylla, Commersonia procumbens, Prostanthera cryptandroides)*

August 2018: Suitable habitat for these species occurs in the small remnant patches of moderate to good condition vegetation associated with PCT 1303, PCT 281 and PCT 1610 (vegetation zones 1, 2, 5 and 8). Areas of vegetation within the development site that had been recently burnt and recovering following the 2017 bushfire were also surveyed. Areas of suitable habitat within the development site were surveyed using the parallel field traverse survey technique were practicable in conjunction with random meander where vegetation became more degraded and less optimal during suitable survey periods in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016).

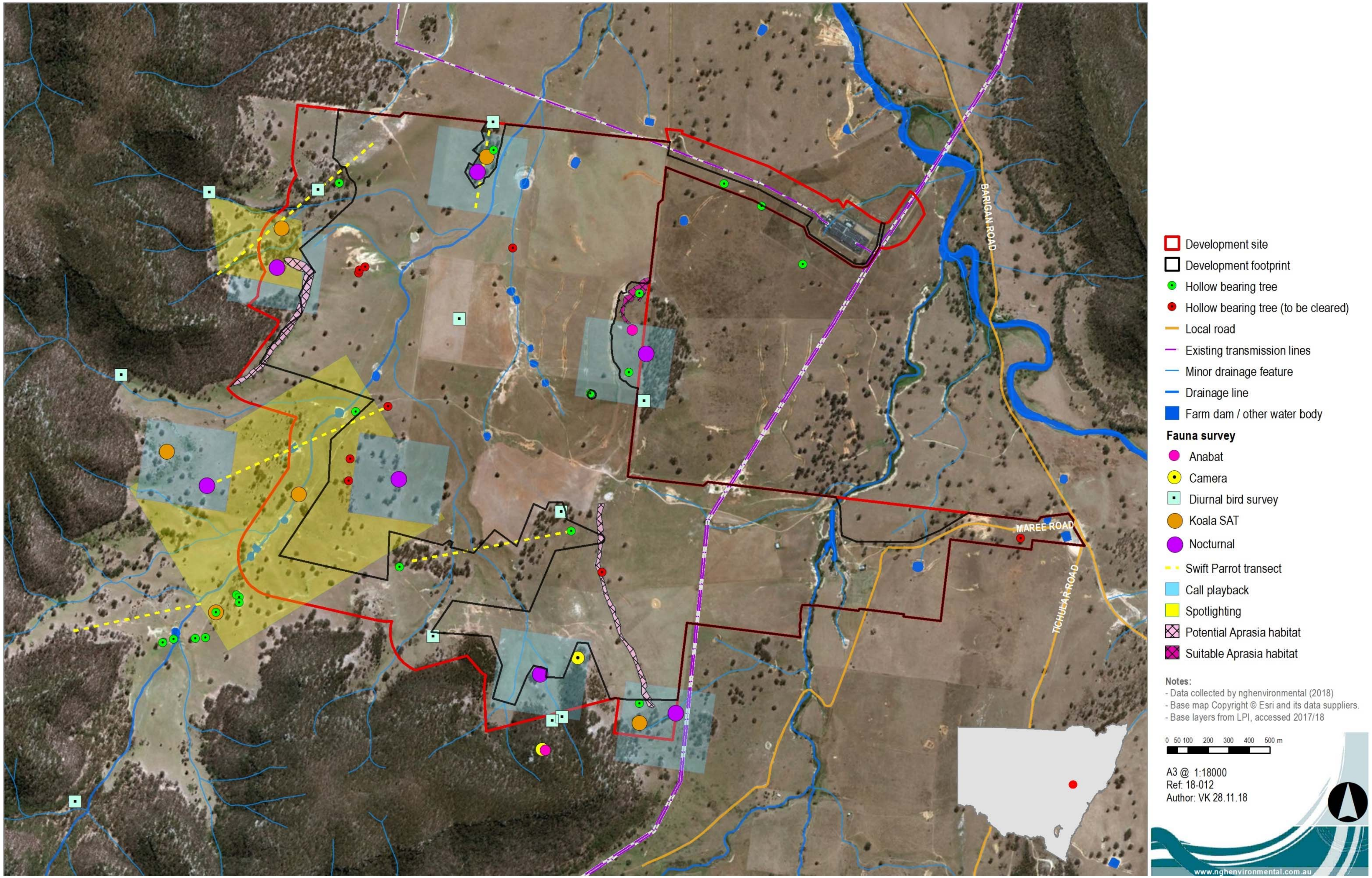

Figure 7-1 Threatened fauna targeted survey locations

BAM plot data

BAM plot data to support assignment of Plant Community Types (PCTs) and undertake the BAM assessment were conducted in May 2018 by two ecologists accredited under the BAM and one graduate ecologist. The methodology conducted was consistent with the methodology presented in the BAM 2017 by persons trained in the BAM.

Further surveys were conducted onsite in October 2018 to complete the density of plot surveys required for each validated vegetation zone inside the development footprint. A total of thirty-two plots were collected to adequately survey for all eight validated vegetation zones onsite (refer Figure 7-2 below for location of zones and BAM Vegetation Integrity Plots.

7.1.2 Approach (Commonwealth)

Following data collected during initial site surveys in May 2018, a referral to the Commonwealth Department of Environment and Energy commenced in July 2018. On 3 October 2018, the proposed Wollar Solar Farm was determined to be a controlled action for impacts on MNES protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Supplementary SEARs were issued for the project.

The assessment of MNES is contained within this BDAR (Appendix F), as follows:

- Data base searches and supplementary SEARs set out relevant matters to be considered under the Act.
- MNES impacts are assessed in detail, with reference to the additional surveys undertaken in October 2018 to address additional MNES requirements of the Supplementary SEARs and EPBC Habitat Assessment Evaluations. The evaluations considers all entities returned in the MNES search and included in the Supplementary SEARs. In consideration of entity habitat requirements, the surveys undertaken onsite, the habitat that is available onsite and the likelihood of occurrence, the potential for impact is determined in this table.
- Where entities are deemed to have less than a low risk of impact, an EPBC Assessment of Significant Impact is undertaken. The assessments also assist to target mitigation strategies as required.
- Only for those entities where significant impact is evaluated likely to occur, are Commonwealth offsets required. Quantification of offsets for relevant entities is undertaken using the Commonwealth offset tool.
- An offset strategy for relevant entities, as determined above, has been included.

7.1.3 Existing environment

Site description

The bioregion is characterised by warm summers and no dry season. The geology is characteristic of the Sydney-Bowen Basin, comprised of Carboniferous and Triassic marine volcanic sediments, creating a landscape of elevated plateaued sandstone for the most part of the basin, and sandstone and conglomerate cliff lines of Permian sediments to the south and west. The dominant IBRA subregion impacted by the proposal is the Kerrabee subregion. This was entered into the BAM Calculator for the proposal.

The development site is in the Upper Goulburn Valleys and Escarpment Landscape. This landscape as described by Mitchell, 2002 is distinguished by steep hills and escarpments with rock outcrops on a mix of quartz sandstone, lithic sandstone and conglomerate and shale, making up harsh texture-contrast soils.

Woodland in this area generally consists of grey box (*Eucalyptus moluccana*), forest red gum (*Eucalyptus tereticornis*), white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*).

Spring Flat Creek traverses the middle of the development site in a south-west to north-east direction and discharges into Wollar Creek approximately 2.5km north of the development site. This creek is also a fourth order stream under the Strahler stream classification system (Strahler, 1952). There are eight unnamed tributaries of Spring Flat Creek which traverse throughout the development site. The development site also contains fifteen farm dams; four to the south west, nine to the centre and two to the south east. Wollar Creek (Figure 2-4) dissects the western portion of the development site. This creek is a fourth order stream under the Strahler stream classification system (Strahler, 1952).

The development site is agricultural land comprising:

- **Cleared areas:** primarily cultivated land where there is evidence of past ploughing/cultivation and where infrastructure is located (i.e. the substation and farm buildings). These areas provide limited foraging habitat for native species. Grass and weed seeds would provide some food for parrots and rodents which in turn would provide foraging habitat for raptors. Introduced species such as foxes and rabbits also occur. Around 204 ha (33%) of cleared areas exists within the development site. Cleared areas also include farm houses, sheds and the substation.
- **Native vegetation:** As determined by GIS mapping from aerial imagery, approximately 3408 ha of native vegetation occurs in the 1500m buffer area. The native vegetation in the landscape surrounding the development is considered to be predominantly grassy woodland on the Wollar Valley flats comprising White Box (*Eucalyptus albens*), Blakely's Red gum (*Eucalyptus blakelyi*), Rough-barked Apple (*Angophora floribunda*), Grey Box (*Eucalyptus moluccana*) and Yellow Box (*Eucalyptus melliodora*). Black Cyprus (*Callitris endlicheri*) as well as White Box (*Eucalyptus albens*) dominate the foot slopes and steeper hilly terrain.

Figure 7-2 Example of cleared areas within the development site.

Figure 7-3 Example of native vegetation found within the Development Site.

Figure 7-4 Spring Flat Creek south west of the development site leading into a dam.

Figure 7-5 Wollar Creek directly south of property access track creek crossing.

Plant Community Types (PCTs) and zones

Three PCTs were identified within the development site:

- White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion (PCT 1303);
- Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (PCT 281); and
- White Box - Black Cypress Pine shrubby woodland of the Western Slopes (PCT 1610).

Eight zones were identified within the study site, as per below Table 7-1 below.

Five paddock trees occur inside the development site within 'Exotic groundcover' within Zone 4 and 7.

Table 7-1 Vegetation zones within the development footprint (impact area).

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)
1	1303 - White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion.	Box Gum Woodland	16.19	3 plots required (4 plots collected on site includes W1, W6, W7, W8)
2	1303 - White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion.	Derived Native Grassland	102.3	6 plots required (6 collected including W4, W9, W10, W11, W12, W29)
3	1303 - White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion.	Cultivated Low Condition	110.8	6 Plots required (6 collected including plots W3, W13, W14, W15, W16, W17).
4	1303 - White Box – Grey Gum – Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion.	Exotic Ground Cover – 1 Paddock tree	12.83	One Plot (W18) carried out to confirm groundcover species composition dominated by exotics (>80%) and lack of native groundcover.
5	281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Box Gum Woodland	12.61	3 Plots required. (3 collected including W2, W19 and W20)
6	281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Derived Native Grassland	101.5	6 Plots required. (6 collected including W5, W21, W22, W23, W28 and W30)
7	281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the	Exotic Groundcover – 4 paddock trees	34.64	One Plot (W24) carried out to confirm groundcover species composition dominated by

Zone ID	PCT ID	Condition	Zone area (ha)	Survey effort (Number of plots)
	northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion			exotics (>80%) and lack of native groundcover.
8	1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Good	0	NA
9	1610 - White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Degraded	26.86	4 collected including W25, W27, W31 and W32.

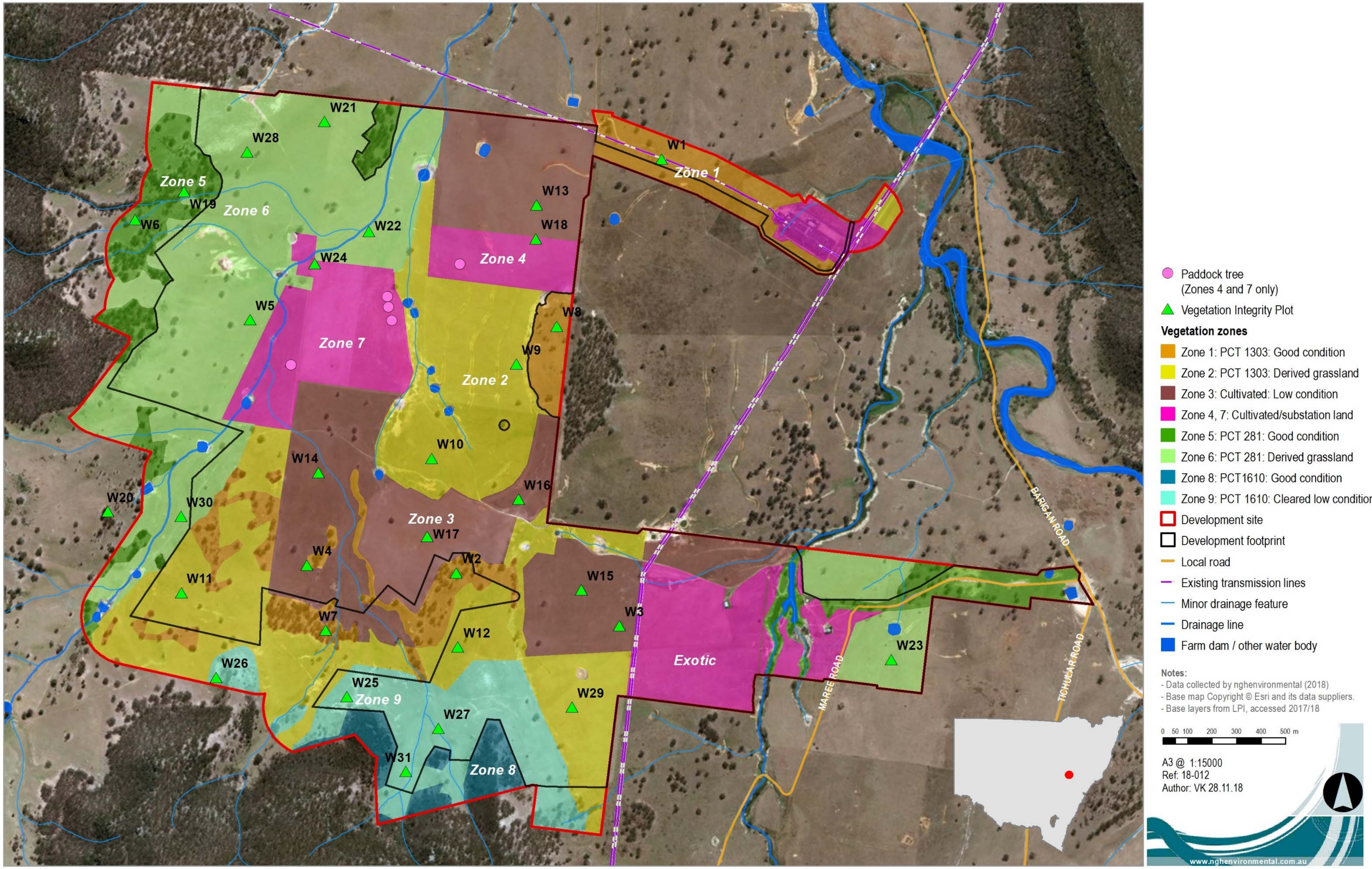

Figure 7-6 Vegetation zones, PCTs and representative Vegetation Integrity plots for development site.

ngh environmental

Threatened Ecological Communities (TECs)

While in varying condition can be classified as NSW listed EEC and or Commonwealth listed CEEC.

NSW

One threatened ecological community will be impacted on by the proposal that is listed as a potential SAII entity. This is the White Box-Yellow Box- Blakely's Red Gum Woodland (Box-gum Woodland).

343 ha of this EEC (Zones 1, 2, 5 and 6) would be impacted by the development. 29 ha of this is structural woodland and is of sufficient quality to generate offsets. The remainder (92%) is cultivated and derived grasslands in largely degraded condition.

Commonwealth

One EPBC listed community – 'White Box -Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grassland' (PCT 281 and 1303) would be impacted (Zones 1, 2, 3, 5 and 6).

540 ha of Box Gum Woodland (BGW) and Derived Native Grasslands (DNG) occurs within the development site of which 231 ha will be directly impacted. 29 ha of this is considered high diversity and the residual areas (88%) are relatively degraded. Development footprint revisions were undertaken to exclude as much of the high diversity CEEC as possible.

Threatened species

The BAM Calculator predicted the following species credit species to occur at the development site. The survey timing, presence onsite and assumed impacts on each species are summarised in Table 7-2.

Table 7-2 Summary of species credit species surveyed at the development site.

Species Credit Species	Biodiversity risk weighting	Survey Period[1]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone)
FLORA					
Acacia ausfeldii **Ausfeld's Wattle**	2	Aug - Oct	Surveyed August 2018	No	0 ha Not recorded during survey
Commersonia procumbens	2	Jan – May Aug to Dec	Surveyed August 2018	No	0 ha Not recorded during survey
Monotaxis macrophylla **Large-leafed Monotaxis**	2	Aug only	Surveyed August 2018	No	0 ha Not recorded during survey
Prostanthera cyrptandriodes subsp. cryptandroides **Wollemi Mint-bush**	2	Anytime	Surveyed August 2018	No	0 ha Not recorded during survey
FAUNA					

[1] As prescribed in the BAM calculator.

Species Credit Species	Biodiversity risk weighting	Survey Period[1]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone)
Anthochaera phrygia **Regent Honeyeater**	3	Sept-Dec	Important mapped habitat areas surveyed May, August and October 2018	Not recorded during survey. Mapped important habitat occurs survey indicated non-optimal habitat	0 ha Not recorded during survey
Aprasia parapulchella **Pink-tailed Legless Lizard**	2	Sept-Nov	Surveyed October 2018	Not recorded during survey. Suitable habitat has been avoided.	0 ha Not recorded during survey
Callocephalon fimbriatum **Gang-gang Cockatoo (breeding)**	2	Oct-Jan	Surveyed October 2018	No	0 ha Not recorded during survey
Chalinolobus dwyeri **Large-eared Pied Bat**	3	Sept-Mar	Surveyed October 2018	Yes	0 ha Recorded during survey however no impacts to optimal breeding and or foraging habitat)
Haliaeetus leucogaster **White-bellied Sea-Eagle**	2	July-Dec	Surveyed August and October 2018	No	0 ha Not recorded during survey
Hieraaetus morphnoides **Little Eagle**	1.5	Aug-Oct	Surveyed August and October 2018	No	0 ha Not recorded during survey
Lophoictinia isura **Square-tailed Kite (Breeding)**	1.5	Sept-Jan	Surveyed October 2018	No	0 ha Not recorded during survey
Miniopterus schreibersii oceanensis **Eastern Bent-wing Bat (Breeding)**	3	Nov-Feb	Surveyed October 2018	Probable, therefore assumed present. (Anabat recording)	0 ha Recorded during survey however no impacts to optimal breeding and or foraging habitat
Ninox connivens **Barking Owl (Breeding)**	2	May-Dec	Surveyed May and August and October 2018	No	0 ha Not recorded during survey
Ninox strenua **Powerful Owl (Breeding)**	2	May-Aug	Surveyed May and Aug 2018	No	0 ha Not recorded during survey

Species Credit Species	Biodiversity risk weighting	Survey Period[1]	Assumed to occur/survey/ expert report	Present on site?	Species polygon/ area (ha) assumed habitat (Veg Zone)
Petaurus norfolcensis **Squirrel Glider**	2	Anytime	Surveyed August and October	No	0 ha Not found during survey
Phascogale tapoatafa **Brush-tailed Phascogale**	2	Anytime	Surveyed August and October 2018	No	0 ha Not recorded during survey
Phascolarctos cinereus **Koala (Breeding)**	2	Anytime	Surveyed May	No	0 ha Not recorded during survey
Tyto novaehollandiae **Masked Owl (Breeding)**	2	May-Aug	Surveyed May and Aug 2018	No	0 ha Not recorded during survey
Vespadelus troughtoni **Eastern Cave Bat**	3	Nov-Jan	Surveyed October 2018	Possible, therefore assumed present. (Anabat recording)	0 ha Recorded during survey however no impacts to optimal breeding and or foraging habitat

7.1.4 Potential impacts

Qualification of impacts

Direct and indirect impact types

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided. This would occur through direct impacts such as habitat clearance and installation and existence of infrastructure. Table 7-3 and Table 7-4 set out the direct and indirect impact types.

Table 7-3 Potential direct impacts to biodiversity during the construction and operational phases

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	461 ha (assuming total impact over developm ent footprint)	Regular	Construction	• Direct loss of native flora and fauna habitat • Potential impacts of additional clearing outside the proposed development footprint • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock

Nature of impact	Extent	Frequency	Duration and timing	Consequence
Displacement of resident fauna	Unknown	Regular	Construction, operation	• Direct loss of native fauna • Decline in local fauna populations
Injury or death of fauna	Unknown	Regular	Construction	• Direct loss of native fauna • Decline in local fauna populations
Removal of habitat features e.g. HBTs	9 HBTs 0.56 ha waterbodies	Regular	Construction	• Direct loss of native fauna habitat • Injury and mortality of fauna during clearing of habitat features
Shading by solar infrastructure	250.5 ha	Regular	Operational Phase: Long-term	• Indirect impacts of altered light (i.e. shading) on derived native grasslands of TECs which could lead to altered species composition and cover abundance. • Modification of native fauna habitat. • Potential loss of ground cover resulting in unstable ground surfaces and sedimentation of adjacent waterways.
Existence of permanent infrastructure (Fencing)	Approximately 15.6km	Regular	Operational Phase: long-term	• Reduced fauna movements across landscape due to fencing • Collision risks to birds and microbats due to fencing.

Table 7-5 Potential indirect impacts to biodiversity during the construction and operational phases.

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Inadvertent impacts on adjacent habitat or vegetation	Unknown	Rare	Construction Phase: Short-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Direct loss of native flora and fauna habitat • Injury and mortality of fauna during clearing of fauna habitat and habitat trees • Disturbance to stags, fallen timber, and bush rock • Increased edge effects
Reduced viability of adjacent habitat due to edge effects	Unknown	Constant	Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Further degradation of TECs. • Loss of native flora and fauna habitat
Reduced viability of adjacent habitat due to noise, dust or light spill	Unknown	Rare	Operational Phase: Short-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• May alter fauna activities and/or movements • Loss of foraging or breeding habitat • Inhibit the function of plant species, soils and dams
Transport of weeds and pathogens from the site to adjacent vegetation	Unknown	Irregular	Construction and Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Degradation of TEC onsite through future weed invasion
Increased risk of starvation, exposure and loss of shade or shelter	Unknown	Rare	Construction and Operational Phase: Long-term	• White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of foraging habitat

Nature of impact	Extent	Frequency	Duration and timing	TEC, threatened species and habitats likely to be affected	Consequence for bioregional persistence
Loss of breeding habitats	12 HBTS adjacent to impact areas	Constant	Construction Phase: Long-term	White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of potential breeding habitat
Increase in pest animal populations	Developm ent footprint	Regular	Long term	White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Solar arrays may provide potential habitat for pest species like rabbits and foxes to take refuge under panels.
Bush rock removal and disturbance	TBA	One off	Long term	White Box – Yellow Box – Blakely's Red Gum Woodland EEC (NSW) White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland (EPBC)	• Loss of potential breeding habitat

Prescribed impacts

The following prescribed impacts are relevant to the proposal:

- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of these species across their range
- Impacts of development on movement of threatened species that maintains their life cycle
- Impacts of development on the habitat of threatened species or ecological communities associated with human made structures or non-native vegetation
- Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities
- Impacts of vehicle strikes on threatened species or on animals that are part of a TEC

These are addressed in detail in Appendix F.

Impacts to biodiversity values that are uncertain

The majority of the development footprint (55%) will consist of solar panels. The impacts of shading and diversion of rainfall runoff from the panels themselves is largely unknown. For the purpose of this BDAR report, the entire development footprint is assumed to be removed however, as the indicative layout shows, substantial peripheral areas are likely to be unimpacted and it is likely that a number of perennial native species will persist underneath the solar arrays. Certainly, only a minor proportion of the seed bank will be impacted, given the limited excavation proposed.

In this assessment, an assumption has been made that all vegetation within the development footprint would be removed. This is a 'worst case' and highly conservative approach. There is currently limited ability to vary this assumption without specific scientific data to justify a lesser impact; such as the results of ground cover monitoring beneath the solar array. Therefore the costs associated with purchasing and retiring ecosystem and species credits or the need for offset areas is currently an 'over estimated result' of the impacts of this solar farm undertaken to address current uncertainty.

Quantification of impacts

For biodiversity impacts that are unavoidable, native vegetation impacts comprise:

- 370 ha out of the 461 ha development footprint.

This is comprised of:

- 29 ha of structural woodland, the remainder being derived grasslands and cultivated low condition area.
- 343 ha of vegetation that meets the NSW criteria for Endangered Ecological Communities, most (92%) in degraded condition that does not generate offsets.
- 232 ha of vegetation that meets the Commonwealth criteria for Critically Endangered Ecological Communities, most (88%) in degraded condition.

The NSW credit requirement has been defined as:

- 826 ecosystem credits, generated by Zone 1 and 5 as well as paddock trees in Zones 4 and 7.
- 0 species credits

Table 7-4 Zones that require offsets.

Zone ID	PCT ID	PCT name	Zone area (ha)	Vegetation Integrity Score	Vegetation integrity loss	Ecosystem credits required
1_BoxGumWL	1303	White Box - Grey Gum - Kurrajong grassy woodland on slopes of the northern Capertee Valley, Sydney Basin Bioregion	16.15	47.2	47.2	388
5_BoxGumWL	281	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	12.6	68.7	68.7	433

Table 7-5 Paddock trees that require offsets.

Class of Paddock Tree being cleared	Hollows Present	Number of Paddock Trees to be cleared	Number of Credits Required	Ecosystem credits required
Class 3 **>50cm DBH**	**No**	5	5	5

The credit report is provided in full in Appendix F. The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Policy Scheme under the BC Act.

Commonwealth assessment

CURRENT LEGISLATIVE CONTEXT

Prior to the introduction of the NSW *Biodiversity Conservation Act 2016*, the NSW Framework for Biodiversity Assessment was the Commonwealth endorsed NSW offset scheme for Major Projects such as the Wollar Solar Farm proposal. Assessment and offset requirements were able to be determined through the NSW scheme, with final approval then provided by the Commonwealth Department of Environment (DoE).

The updated NSW BOS is currently seeking the same endorsement. As it is not yet endorsed by the Commonwealth, offset quantification and options are considered using Commonwealth tools below.

QUANTIFICATION OF THE OFFSET REQUIREMENT

For MNES, offsets are required only where significant impacts may result. For this project, that is limited to White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland – Critically Endangered Ecological Community.

Appendix F sets out the offset requirement using the EPBC offset tool. The minimum direct offset requirement (90% direct offset required for Commonwealth physical offsets) equates to 233 ha in total comprised of:

- 29 ha for treed BGW.
- 204 ha for BGW grassland.

OFFSET OPTIONS UNDER CONSIDERATION

Within the development site, in areas that would not be impacted by the development, 217 ha of CEEC is available for protection under an offset agreement. Based on available mapping, though not subject to detailed survey, it is estimated that an additional 258 ha remains within study area, that would not be impacted by the development and may provide suitable direct offsets. If suitable, this exceeds the required amount by 62 ha.

It is noted that an estimated 5,497ha of similar vegetation occurs in the local area and outside the project area. This figure has been assumed from aerial photography, knowledge of the landscape, and observation of vegetation within the landscape during field surveys.

In advance of the NSW BOS being endorsed by the Commonwealth (as of 15 February 2019 it is on public exhibition), the Wollar Solar Farm offset strategy retains flexibility. This strategy demonstrates that:

- Securing in perpetuity physical offsets within the study area are likely to be feasible.
- Similar vegetation occurs in the locality and could also be considered, if required, for physical offsets.

Payment options may also be considered, such as making payments into the NSW Biodiversity Conservation Fund using the offset payments calculator, or funding a biodiversity action.

Pending project approval, consultation would be undertaken with NSW OEH and Commonwealth DoE to provide a detailed offset strategy that meets legislative requirements that are currently in flux.

Note on overestimation of impacts:

> *It is noted that the largest impact expected from this solar farm is the impact of solar panels and shading on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived native grassland onsite. The assumption that solar panel arrays will result in 100% impact on groundcover is used because there is a lack of scientific data proving otherwise. It is recommended that monitoring of groundcover under the solar panels is undertaken:*
>
> 1. *Primarily to ensure that ground cover is retained to resist erosion and potential weed ingress managed,*
> 2. *But also to provide information to the scientific community regarding the impact of shading on native grasslands in this location.*
>
> *It may be that the conservative assumptions of this assessment (regarding 100% impact on vegetation) are an unnecessarily high impost on projects that assist the transition to reduced greenhouse gas emissions and that thereby have many broader environmental benefits.*

7.1.5 Safeguards and mitigation measures

Iterative constraints mapping has been undertaken to refine the site layout to avoid where possible and minimise impacts on biodiversity values. The proposal has not been able to completely avoid all areas of native vegetation because of the distribution of resources over the development site. Specifically it is noted that:

- Development areas maximise the use of cultivated and non-native vegetation.
- Most hollow bearing trees are avoided.
- All mapped Regent Honeyeater habitat has been able to be avoided.
- Most high diversity CEEC has been avoided.
- Waterway and riparian areas are buffered and water crossings limited to the essential site

A range of mitigation measures would be implemented to ensure that impacts on biodiversity during the construction and operational 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 7.1.5. 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.

Table 7-6 Safeguards and mitigation measures for biodiversity impacts

C: Construction; O: Operation; D: Decommissioning

No.	Safeguards and mitigation measures	C	O	D
1	• Hollow-bearing trees would not be removed during breeding season (spring to summer) for threatened hollow dependant fauna. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur	C		
2	• A tree clearing procedure would be implemented to minimise harm to resident fauna.	C		
3	• Procedure for relocation of habitat features to adjacent area for habitat enhancement would be implemented.	C		
4	• Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. • Access and laydown in areas of Box-Gum Woodland TEC will be minimised to reduce impacts. • Exclusion fencing and signage or similar would be installed around habitat to be retained.	C		
5	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		
6	• Avoid Night Works where possible • Direct lights away from vegetation	C	O	
7	• Daily monitoring of dust generated by construction activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	C		

8	• A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include:
	  • Management protocol for declared priority weeds under the Biosecurity Act 2015 during and after construction
	  • Weed hygiene protocol in relation to plant, machinery, and fill
		C	O	

No.	Safeguards and mitigation measures	C	O	D
	• Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported.			
9	• Site induction and toolbox talks for ecologically sensitive areas would be undertaken.	C		
10	• Preparation of a Biodiversity management plan that would include protocols for: ◦ Protection of native vegetation to be retained ◦ Best practice removal and disposal of vegetation ◦ Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist ◦ Weed management ◦ Unexpected threatened species finds ◦ Exclusion of vehicles through sensitive areas. • Rehabilitation of disturbed areas	C		
11	• Landscape plantings will be comprised of local indigenous species.		O	
12	• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	C	O	
13	• Offsets requirements set out in this assessment would be retired, in consultation with OEH and DoE.	C	O	

7.2 ABORIGINAL HERITAGE

7.2.1 *Approach*

A specialist Aboriginal Cultural Heritage Assessment (ACHA) was undertaken to provide an assessment of the Aboriginal cultural values associated with the Proposal site and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded.

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

This ACHA Report 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).
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (OEH, 2010b)

The consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the NPW Amendment Regulation following the consultation steps outlined in the (ACHCRP) guide provided by the OEH. The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix G. As a result of this process, ten groups and an individual contacted the consultant to register their interest in the Proposal. The groups who registered interest were:

- North West Wiradjuri Company LTD;
- Murong Gialinga Aboriginal & Torres Strait Islander;

- Buudang;
- Wellington Valley Wiradjuri Aboriginal Corporation;
- Gallaggabang Aboriginal Corporation;
- Mudgee LALC;
- Binjang Wellington Wiradjuri heritage Survey;
- Barraby Cultural Services;
- Yulay Cultural Services; and
- Yurrandaali Cultural Services.

One individual also registered in addition.

No other party registered their interest, including the entities and individuals recommended by the OEH. The fieldwork was organised and four of the registered parties were asked to participate in the fieldwork. The fieldwork was carried out in July 2018. A copy of the draft report was provided to all the registered parties for comment.

7.2.2 Archaeological context

The assessment included a review of relevant information relating to the existing landscape of the Proposal site. Included in this was a search of the OEH AHIMS database Two previously recorded Aboriginal sites with artefacts (Wollar Creek 1/AHIMS #36-3-0335 and Wollar Creek 2/AHIMS #36-3-0336) are located within the proposal site along the proposed access track near the substation. The impact is likely to be most extensive where earthworks occur such as the installation of cabling and the transmission line poles, which may involve the removal, breakage or displacement of artefacts and cultural material. This is considered a direct impact on the sites and the Aboriginal objects by the development in its present form.

Assessment of Aboriginal site models for the region suggests that there appears to be a pattern of site location that relates to the presence of potential resources for Aboriginal use. The most archaeologically sensitive areas are noted to occur within close proximity of water. Nonetheless, given that Aboriginal people have lived in the region for tens of thousands of years, there is some potential for archaeological evidence to occur across the proposal site. This would most likely be in the form of stone artefacts and scarred trees.

7.2.3 Survey results

The assessment area is comprised of the proposed solar farm development area and its associated access options that are located on Lots 22-25, 27, 30, 45,46, 49-51, 60-63, 69-80, 84, 91, 96, 105-107, 119 and 152-154 of DP 755430 and Lot 1 of DP 650653, Lot 7303 DP1139558 and Lots 1, 2, 4, 6, 8, 10, 11 of DP1090027 in the Mid-Western Regional Local Government Area.

Following the completion of the field survey the proposed development footprint has had some minor adjustments, specifically the inclusion of the whole of Lot 24 DP 755430 and an additional portion of Lot 91 DP 755430 within the proposed development footprint. This additional 19 ha proposed for development was not assessed during the field survey and is therefore not assessed in this report. Further archaeological assessment would be required if the proposal activity extends beyond the Heritage study area as detailed in this report into the whole of Lot 24 DP 755430 and an additional portion of Lot 91 DP 755430 as shown in Figure 7-7.

The survey strategy was to cover as much of the ground surface as possible within the proposal site. Although the actual ground impact from the construction method for the proposed solar farm was likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites. Survey transects were undertaken on foot across the proposal site to achieve maximum coverage. All mature native trees and sandstone outcrops within the proposal site were also inspected for evidence of Aboriginal use.

Visibility within the proposal site was variable however as a whole the proposal site generally had good visibility averaging 20% overall. The effective visibility in the proposal site ranged from 96% in exposures and recently ploughed fields to less than 5% in areas with a dense low grass cover. Between the survey participants, over the course of the field survey, approximately 400 km of transects were walked across the proposal site. Allowing for an effective view width of 5 m for each person and given the variability in the ground visibility across the proposal site, overall the survey effectively examined 12.5% of the proposal site. It is considered that the survey of Wollar Solar Farm proposal site had sufficient and effective survey coverage.

Despite the variable visibility encountered during the survey there were a number of stone artefacts found across the proposal site that were recorded as 37 site occurrences. These archaeological features have been recorded as 12 artefact scatters and 25 isolated finds. One grinding groove, one scarred tree, one possible scarred tree and a culturally significant site were also recorded. Of the two previously recorded Aboriginal sites within the proposal site, only artefacts from Wollar Creek 2/ AHIMS #36-3-0336 was able to be relocated. Despite intensive survey around the coordinate location for Wollar Creek 1/AHIMS #36-3-0335 no objects could be relocated.

Based on the land use history, an appraisal of the landscape, soil, level of disturbance and the results from the field survey, it was concluded that there was negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the proposal site with the exception of the site Wollar SF AFT 11.

The results of previous archaeological surveys in the Wollar region show that there are sites and artefacts present across the landscape. The predictions based on the modelling for the proposal site were that stone artefacts and scarred trees were the most likely manifestation of Aboriginal occupation of the area. It was noted that while Aboriginal sites may be expected throughout all landscapes the most archaeologically sensitive areas occur in proximity to water. The survey results have confirmed this prediction with stone artefacts recorded as isolated finds and artefact scatters across the proposal site, even in areas highly disturbed by farming activities. The sites were identified across a range of landforms including slopes, flats, spurs, hill crests and along creeks/drainage lines. It should also be noted that the results of this investigation have increased the number of sites recorded in the local area significantly. The dominance of artefacts as a common site type within the area is further supported by the results of this survey.

The cultural significance of the sites recorded during this assessment is only determined by the local Aboriginal community.

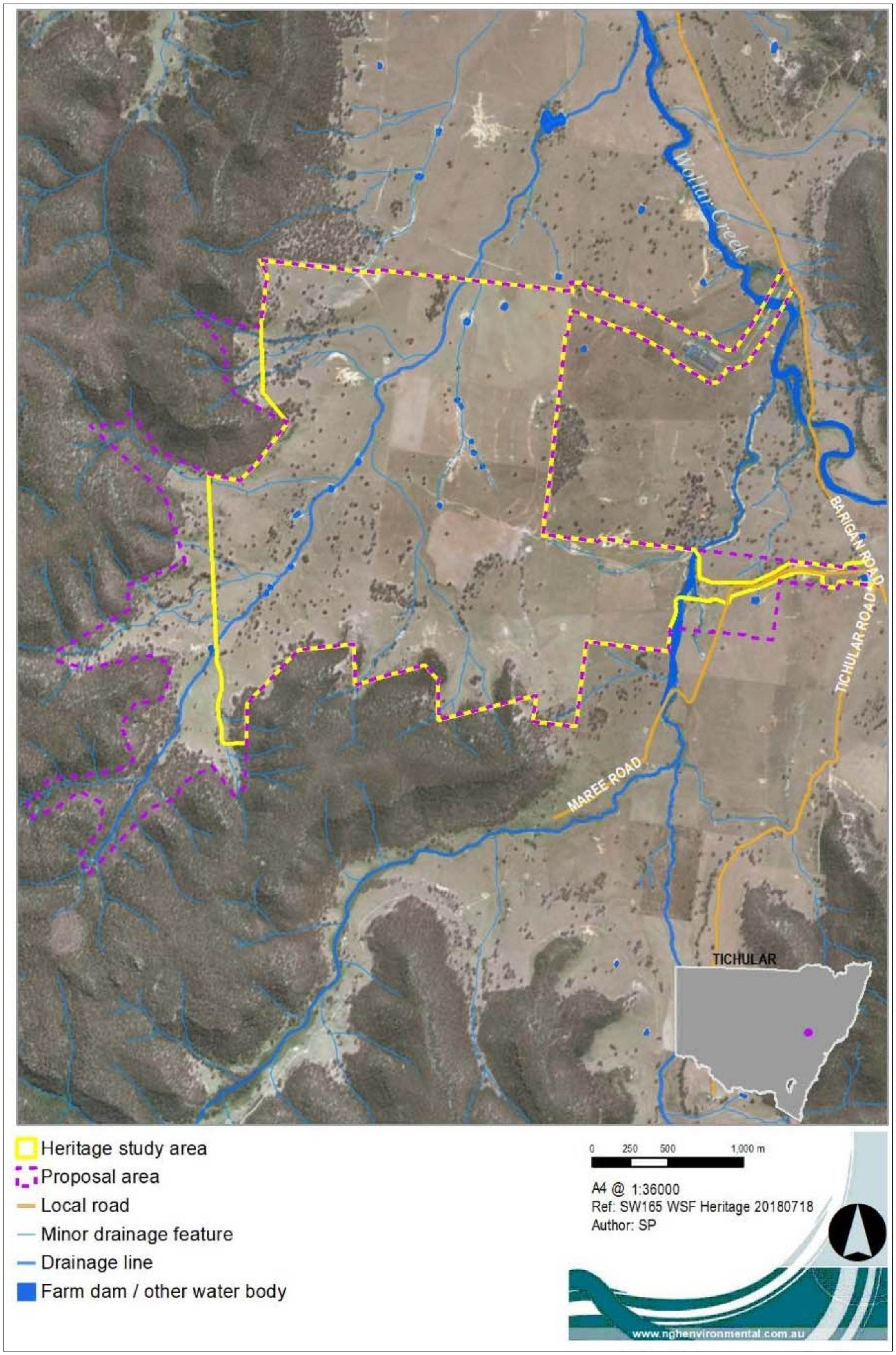

Figure 7-7 Heritage study area in relation to the proposal site.

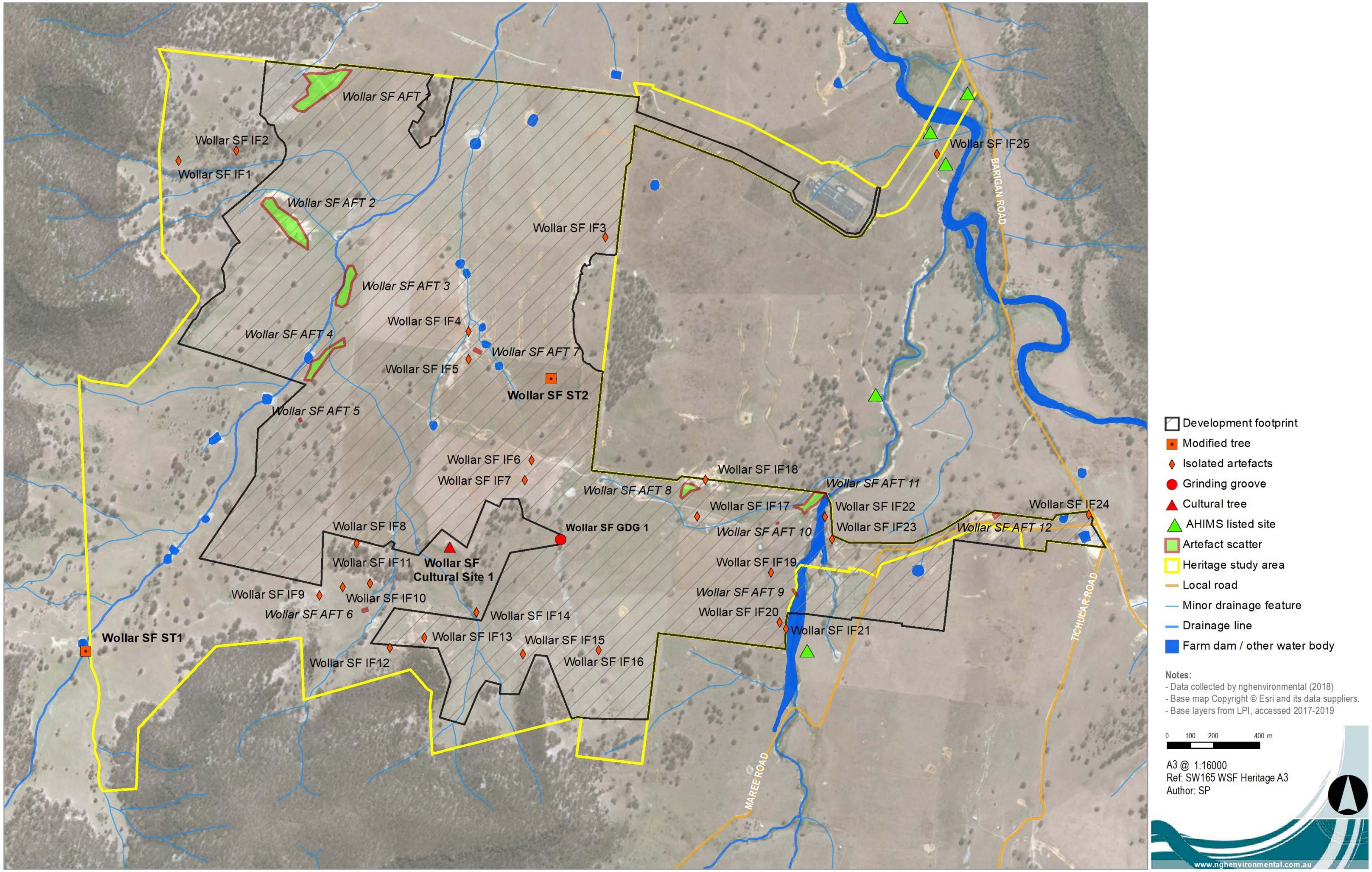

Figure 7-8 Overview of recorded sites in relation to the development footprint.

7.2.4 Potential impacts

The proposal involves the construction of a solar farm and includes connection to the nearby substation. The development would result in disturbance of approximately 461ha.

A total of 26 sites with stone artefacts (Wollar SF AFT 1 to Wollar SF AFT 5, Wollar SF AFT 7 to Wollar SF AFT 12, Wollar SF IF 3 to Wollar SF IF 7, Wollar SF IF 13, Wollar SF IF 15 to Wollar SF IF20 and Wollar SF IF 22 to Wollar SF IF 24) are situated within the area of the proposed solar arrays, tracks, trenches and fencing that would be impacted by the proposed development. The impact is likely to be most extensive where earthworks occur and would involve the removal, breakage or displacement of artefacts. This is considered a direct impact on the Aboriginal objects by the development in its present form. The assessment of harm overall for the project is therefore assessed as moderate.

The cultural site (Wollar SF Cultural Site 1), grinding groove (Wollar SF GDG 1), modified tree (Wollar SF ST1) and possible modified tree (Wollar SF ST2) will not be impacted by the proposal as per the proposed design in this report and as agreed by Wollar Development.

While the majority of the stone artefact sites are rated as having total loss of scientific value it is argued that there are likely to be a number of similar sites in the local area and therefore the impact to the overall local archaeological record is considered to be low. The stone artefacts have little research value apart from what has already been gained from the information obtained during the present assessment. This information relates more to the presence of the artefacts and in the development of Aboriginal site modelling, which has largely now been realised by the recording. The impact to the axe blank artefact at Wollar SF AFT 4 is considered to have low to moderate loss of scientific value and the impact to the site Wollar SF AFT 11 is considered to have moderate loss of scientific value given the density of artefacts and the possibility for subsurface deposits.

No other values have been identified that would be affected by the development proposal.

The Wollar Solar Farm proposal is classified as State Significant Development under the EP&A Act which have a different assessment regime. As part of this process, Section 90 harm provisions under the NPW Act are not required, that is, an AHIP is not required to impact Aboriginal objects as the Department of Planning and Environment provides development approval.

Table 7-7 details the impacts to the 12 artefact scatters, 25 isolated finds, possible scarred tree, modified tree, grinding groove, cultural site and two previously recorded AHIMS sites that were located within the proposal site. It should be noted that design changes to the original layout have been made have avoided the modified/cultural trees and the grinding groove sites. The development footprint has also been further reduced to ensure the protection of the cultural site which was confirmed during the ACHA draft process to be a cultural site important to members of the Aboriginal community.

There is Aboriginal archaeological material present within the solar farm and the assessment is that there are likely to be other artefacts and cultural material present as well, although in similar low densities. The proposed level of disturbance for the construction of the solar farm could impact the stone artefacts recorded during the field survey and others that may be present within other areas of the development site.

The impact is likely to be most extensive where earthworks occur such as the installation of cabling and the transmission line poles, which may involve the removal, breakage or displacement of artefacts and cultural material. This is considered a direct impact on the sites and the Aboriginal objects by the development in its present form.

The proposed construction methodology for the project will however result in only small areas of disturbance. The construction of access and maintenance tracks may involve some grading but given the nature of the majority of the terrain, this is likely to be minimal. The installation of the solar arrays involves drilling or screwing the piles into the ground and no widespread ground disturbance work such as grading required to accomplish this. The major ground disturbance will be the trenching for cables and vehicle movement during construction.

Additionally, the possible cultural site (Wollar SF Cultural Site 1), grinding groove (Wollar SF GDG 1), modified tree (Wollar SF ST1) and possible modified tree (Wollar SF ST2) would not be impacted by the proposal.

The assessment of harm overall for the project is therefore assessed as moderate.

Table 7-7 Identified risks to known sites.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wollar SF ATF 1	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 2	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 3	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 4	Low to Moderate	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 5	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 6	Low	Direct	Total	Total loss of value	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF ATF 7	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 8	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 9	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF ATF 10	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wollar SF ATF 11	Moderate	Direct	Total	Total loss of value	Salvage surface objects and undertake a limited program of subsurface testing/excavation in sandy deposit within site prior to development of proposal site.
Wollar SF ATF 12	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF1	Low	Will not be harmed – outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF2	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF3	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF4	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF5	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF6	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF7	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF8	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF9	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF10	Low	Will not be harmed–	None – outside	No loss of value–	Outside of development footprint. Ensure

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
		outside development footprint	development footprint	outside development footprint	avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF11	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF12	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF13	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF14	Low	Will not be harmed – outside development footprint	None- outside development footprint	No loss of value- outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF15	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF16	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF17	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF18	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF19	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF20	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF21	Low	Will not be harmed– outside development footprint	None – outside development footprint	No loss of value– outside development footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF IF22	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.

Site name	Scientific significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wollar SF IF23	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF24	Low	Direct	Total	Total loss of value	Salvage object prior to development of proposal site.
Wollar SF IF25	Low	Will not be harmed– outside developmen t footprint	None – outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar SF GDG 1	Moderate	Will not be harmed– outside developmen t footprint	None- outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 15 m a buffer placed around site.
Wollar SF ST 1	Moderate	Will not be harmed– outside developmen t footprint	None – outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 15 m buffer placed around site.
Wollar SF ST 2	Moderate	Will not be harmed– outside developmen t footprint	None – outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 15 m a buffer placed around site.
Wollar SF Cultural Site 1	N/A	Will not be harmed– outside developmen t footprint	None – outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 20 m a buffer placed around site.
Wollar Creek 1	Low	Will not be harmed– outside developmen t footprint	None– outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.
Wollar Creek 2	Low	Will not be harmed– outside developmen t footprint	None– outside developme nt footprint	No loss of value– outside developmen t footprint	Outside of development footprint. Ensure avoided with a minimum 5 m a buffer placed around site.

7.2.5 Safeguards and mitigation measures

The report identifies a number of safeguards, these are identified below.

Table 7-8 Safeguards and mitigation measures for Aboriginal heritage

C: Construction; O: Operation; D: Decommissioning

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures</th><th>C</th><th>O</th><th>D</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">The development must avoid the possible cultural site (Wollar SF Cultural Site 1). A minimum 20m buffer should be in place around this tree to prevent any inadvertent impacts to the tree canopy and root system.</td><td colspan="3">Design</td></tr>
<tr><td>C</td><td>O</td><td>D</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">The development must avoid the grinding groove (Wollar SF GDG 1). A minimum 15m buffer should be placed around this site to prevent any inadvertent impacts.</td><td colspan="3">Design</td></tr>
<tr><td>C</td><td>O</td><td>D</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">The development would avoid the modified tree (Wollar SF ST 1) and possible modified tree (Wollar SF ST 2). A minimum 15m buffer should be in place around these trees to prevent any inadvertent impacts to the trees canopy and root systems.</td><td colspan="3">Design</td></tr>
<tr><td>C</td><td>O</td><td>D</td></tr>
<tr><td>4</td><td>If complete avoidance of the 12 artefacts scatters, 25 isolated finds and the two previously identified AHIMS sites (#36-3-0335 and #36-3-0336) recorded within the proposal site is not possible, the artefacts within the development footprint must be salvaged prior to the proposed work commencing and moved to a safe area within the property that will not be subject to any ground disturbance.</td><td>C</td><td></td><td></td></tr>
<tr><td>5</td><td>The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the Code of practice for Archaeological Investigation of Aboriginal Objects in New South Wales. A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database.</td><td>C</td><td></td><td></td></tr>
<tr><td>6</td><td>The Aboriginal community requests that a Cultural Smoking Ceremony take place to cleanse any artefacts salvaged and the reburial location.</td><td>C</td><td></td><td></td></tr>
<tr><td>7</td><td>If the raised sandy deposits of Wollar SF AFT 11 are to be impacted a subsurface salvage testing/excavation program must be conducted. Excavated material may need to be analysed off site and this is most likely to be undertaken in NGH offices, where the material will be analysed and then subsequently returned to site for reburial.</td><td>C</td><td></td><td></td></tr>
<tr><td>8</td><td>A minimum 5m buffer should be observed around all artefact scatters and isolated find sites that can be avoided, including those outside the development footprint.</td><td>C</td><td>O</td><td>D</td></tr>
<tr><td>9</td><td>WSD should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.</td><td>C</td><td></td><td></td></tr>
<tr><td>10</td><td>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.</td><td>C</td><td></td><td></td></tr>
</table>

ID	Safeguards and Mitigation Measures	C	O	D
11	Further archaeological assessment would be required if the proposal activity extends beyond the Heritage study area as detailed in this report, including the whole of Lot 24 DP 755430 and an additional portion of Lot 91 DP 755430. This would include consultation with the registered Aboriginal parties and may include further field survey.	C	O	D

7.3 LAND AND SOIL ASSESSMENT

7.3.1 Approach and methods

Impact on land capability and resource values of the proposal site and locality have been assessed with reference to the following:

- NSW Land and Soil Capability Assessment Scheme.
- NSW eSPADE information database.
- Primefact 1063 Infrastructure proposals on rural land.
- Biophysical Strategic Agricultural Land and Important Agricultural Land identification processes.
- Landholder, ABS and ABARES agricultural production.

7.3.2 Existing environment

Topography

The topography of the proposal site is generally undulating with forested hills boarding the site. The elevation is 400 – 540m Australian Height Datum (AHD). The proposal site is bound by steep terrain to the east and west with a 30% gradient and ridgeline elevations of approximately 600 – 700m AHD. Native vegetation has been removed from much of the area, particularly within the broad open valleys which tend to be dominated by grasses and used for pastoral purposes. The proposal site includes the following topographical features:

- Steep hills and sandstone escarpments with cliffs, rock outcrop and long debris slopes.
- Broad open floodplain valleys.
- Ephemeral waterways including Spring Flat Creek and Wollar Creek with several other unnamed tributaries and drainage lines.

Figure 7-9 Rocky outcrop within south eastern portion of the proposal site (left) and open floodplain valley and steep hills within proposal site (right).

Geology

The Gulgong 1:100,000 geological map (MinView, 2018) indicates that the geology underlying the proposal site consists of the Permian and Quaternary geological sequences with Triassic geological sequences adjacent to the proposal site. The majority of the proposal site is within the Sydney Basin group with the eastern portion of the proposal site within the Cainozoic unit, and is comprised of Permian sedimentary and volcanic rocks. More specifically, the proposal site belongs to the following:

- Illawarra Coal Measures at the south western portion of the site, which is:
  - Quartz-lithic sandstone, mudstone (sporadically carbonaceous), claystone, coal, torbonite, rhyolitic tuff, some lenses of polymictic conglomerate.
- Shoalhaven Group at the central and north eastern areas of the proposal site, which is:
  - Polymictic conglomerate, lithic sandstone, shale, siltstone, claystone, minor carbonate and evaporite.

The proposal site is encompassed by a single Mitchell Landscape, the Upper Goulburn Valleys and Escarpment, which is surrounded by the Wollemi Ranges landscape. The Mitchell Landscape descriptions are provided in Table 7-9 below.

Table 7-9 Description of the Mitchell Landscape relevant to the proposal.

Mitchell Landscape
Upper Goulburn Valleys and Escarpment
Steep hills and sandstone escarpments with cliffs, rock outcrop and long debris slopes on Permian and Triassic quartz sandstone, lithic sandstone, conglomerate and shale, general elevation 250 to 700m, local relief to 250m. Stony coarse textured rubbly earths and harsh texture-contrast soils. Woodland of; grey box (*Eucalyptus moluccana*), forest red gum (*Eucalyptus tereticornis*), white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and grasses. Rainforest elements in protected sites.
Wollemi Ranges
Strongly undulating ranges and dissected plateau on horizontal Triassic quartz and lithic sandstones, conglomerate and some shale, general elevation 300 to 800m, local relief 200m. Extensive rock outcrop with

Mitchell Landscape
thin sandy soils in joint crevices and on benches. Steeper slopes below plateau remnants with iron cemented gravels, gradational yellow earth and yellow texture-contrast profiles. Woodland and heaths on the plateau with red bloodwood (_Corymbia gummifera_), smooth-barked apple _(Angophora costata_), blue-leaved stringybark (_Eucalyptus agglomerata_), silvertop ash (_Eucalyptus sieberi_) and snow gum (_Eucalyptus pauciflora_). Marginal slopes with scribbly gum (_Eucalyptus_ sclerophylla), red bloodwood, grey ironbark (_Eucalyptus paniculata_), patches of mountain mallee (_Eucalyptus stricta_) and diverse shrubs. Deep valleys with rainforest elements and rare species.

Soil Landscapes

Soil landscape and land resource mapping provide a more detailed assessment of the landscapes and potential physical constraints of the proposal site based on information at a scale of 1:250,000. Five soil landscapes are described that occur within the proposal site and are described in Figure 7-10 and Table 7-10.

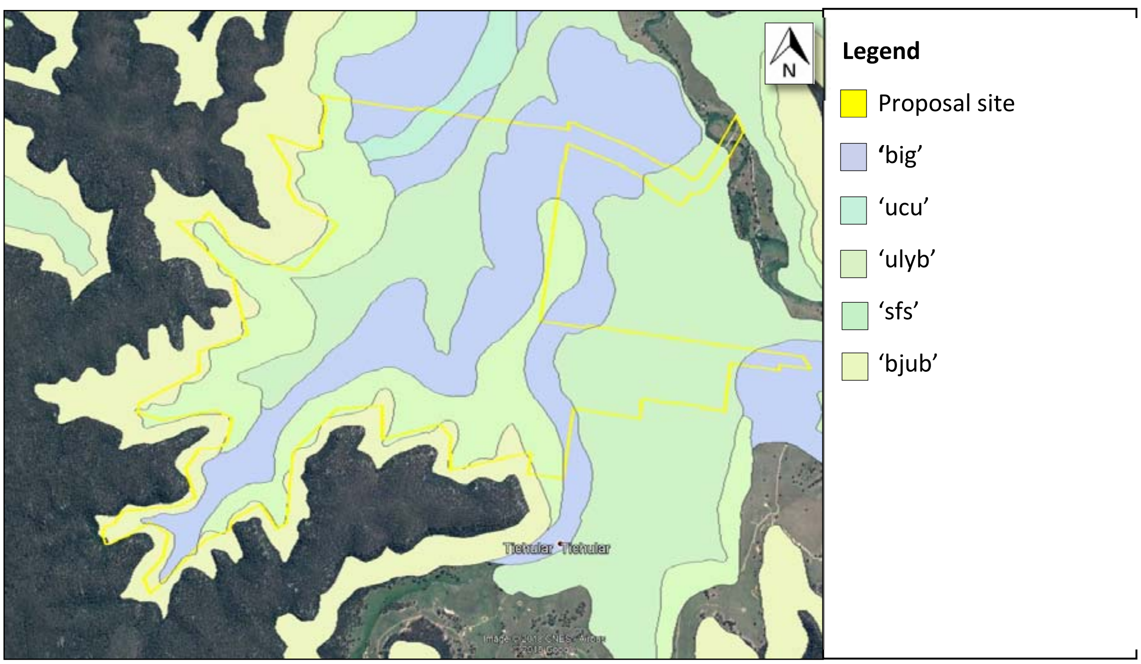

Figure 7-10 Soil and land resource landscape occurrence of proposal site (modified from OEH, 2018).

Table 7-10 Published soil and land resource landscapes and associated limitations relevant to the proposal site.

Soil Landscape	Soil type	Limitations
Barigan (big)	Moderately deep, well drained Red Podzolic Soils and Red Brown Earths. Moderately deep, moderately well drained Yellow and Brown Kandosols.	• Predisposed to significant sheet and rill erosion if the protective vegetative layer is removed. • Subsoils are highly erodible and possibly dispersible. • Seasonal localised waterlogging. • Localised salinity hazard. • Moderate to high cultivation limitations.

Soil Landscape	Soil type	Limitations
		• Slight to moderate grazing limitations. • Localised seepage scalds.
Spring Flat (sfs)	Very deep, poorly drained, Brown and Yellow Kurosols and Chromosols (soloths).	• Widespread salinity hazard. • Localised gully erosion hazard. • Widespread sheet erosion hazard. • Widespread seasonal waterlogging. • Moderate to very high cultivation limitations. • Moderate to high grazing limitations. • Localised seepage scalds.
Ulan Variant B (ulyb)	Shallow, well drained Gravelly Leached Tenosols (Lithosols)	• Widespread sheet erosion hazard. • Widespread steep slopes. • Widespread rock outcrop hazard. • Widespread mass movement hazard. • Very high cultivation limitations. • High grazing limitations.
Upper Cumbo (ucu)	Shallow to moderately deep, well drained Red Chromosols (Red Brown Earths).	• Localised mass movement hazard • Localised gully erosion hazard • Widespread sheet erosion hazard • Predisposed to significant sheet and rill erosion • Very high cultivation limitations • Moderate grazing limitations • Localised gully erosion hazard • Widespread sheet erosion hazard
Benjang Variant (bjub)	Shallow to moderately deep , gravelly stony Leptic Tenosols (Lithosols). Shallow to moderately deep Brown and Red Chromosols (Non-calcic brown soils and Red-brown Earth).	• Widespread steep slopes • Widespread mass movement hazard • Widespread rock outcrop hazard • Widespread gully erosion hazard • Widespread sheet erosion hazard • Extreme cultivation limitations • Very high grazing limitations

An inspection of the proposal site on 8 May 2018, found the proposal site is consistent with the soil landscape mapping as outlined in Figure 7-10, in particular:

- Evidence of localised salinity within areas surrounding Wollar Creek and Spring Flat Creek. Gully and sheet erosion (Figure 7-11) consistent with the highly erodible and saline soils typical of the Barigan (big) soil landscape and the Spring Flat (sfs) soil landscape.
- Evidence of surface soil erosion in the form of scalding across the areas of the site mapped as 'sfs' (Figure 7-12). Consistent with the eroded isolated scalds typical of Spring Flat (sfs) soil landscape.
- High erosion hazard in areas of low ground cover (Figure 7-13) consistent with the Barigan (big) soil landscape.

This site inspection was undertaken during drought conditions and groundcover across the proposal site was low. An additional site inspection was carried out on 23 October 2018. Groundcover at the proposal site during this inspection was greater and consequently the prevalence of erosion and scalding was lower (Figure 7-13).

Figure 7-11 Erosion observed in the north-west corner of the proposal site within area mapped as 'big' (left) and Erosion observed in the central east portion of the proposal site within area mapped as 'sfs' at Wollar Creek (right).

Figure 7-12 Scalding observed on proposal site within soil landscape mapped as 'sfs' in central eastern area.

Figure 7-13 Potential erosion hazard observed during May 2018 site visit due to low ground cover within areas mapped as 'big' and 'sfs'.

Potential Contamination

A search of the NSW OEH Contaminated Sites Register (NSW Government 2018b) was undertaken on 25 January 2018 to identify contaminated sites within the Mid-Western LGA. The search identified one site within the Mid-Western Regional LGA, located approximately 38km from the proposal site. The proposal site does not appear on the List of NSW Contaminated Sites notified to the EPA (NSW Government 2018a), as of the 25 January 2018.

It is noted that the site has a history of agricultural land use and as such, agricultural sites may contain buried rubbish including contaminants such as herbicides that may be encountered during excavation. No indications of potential sources of contamination were identified during the site assessment.

Acid Sulfate Soil

The Australian Resource Information System (ASRIS) database (CSIRO, 2018) indicates there is a low to extremely low probability of acid sulfate soils occurring within the proposal site (Figure 7-14).

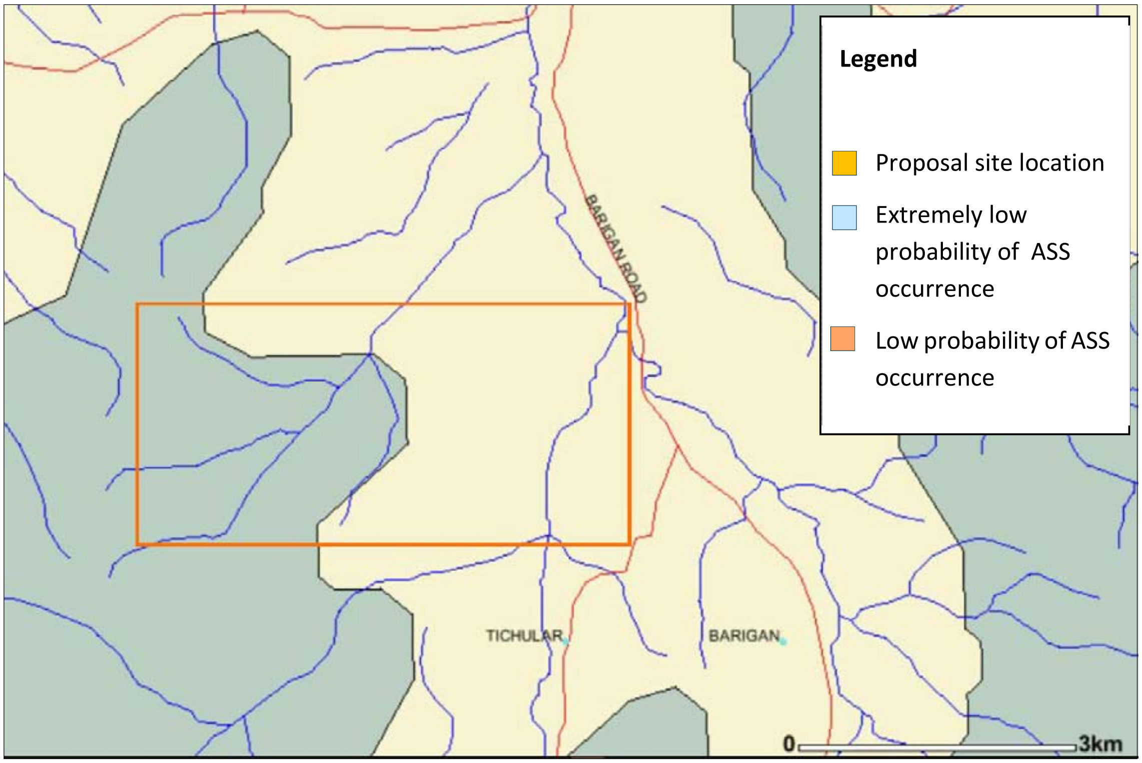

Figure 7-14 Probability of occurrence of acid sulfate soils (CSIRO, 2018)

Land and soil capability

The Land and Soil Capability Assessment Scheme (OEH, 2012) provides land and soil capability (LSC) classes useful for broad-scale assessment of land capability. The eight classes describe land capability ranging from extremely high capability land (class 1) to extremely low capability land (class 8). A pre-determined set of biophysical land and soil features including landform position, slope gradient, drainage, climate, soil type and soil characteristics are used to determine potential land and soil hazards.

The hazard with the most limitations is used to determine the final LSC class (Table 7-11). These classes are used to inform long term land management practices with the aim of ensuring degradation to soil, land, air and water resources does not occur.

The proposal site is predominantly located on land mapped LSC class 5 (moderate-low capability land), with some land along the south and west boundaries mapped as LSC class 7 (very low capability land) as shown in Figure 7-15. An overview of the general description of LSC class 5 and class 7 is provided in Table 7-12.

Table 7-11 Land and soil capability classification.

Hazard Classification	Soil Landscape	
	'big', 'ucu', 'ulyb', 'sfs'	'bjub'
Soil acidification	4	4
Water erosion	5	7
Soil structure decline	3	3

Hazard Classification	Soil Landscape	
	'big', 'ucu', 'ulyb', 'sfs'	'bjub'
Wind erosion	2	3
Shallow soils/Rockiness	3	6
Salinity	4	1
Mass movement	1	7
Water logging	2	1
LSC Class	**5**	**7**
Capability	**Moderate – low**	**Very low**

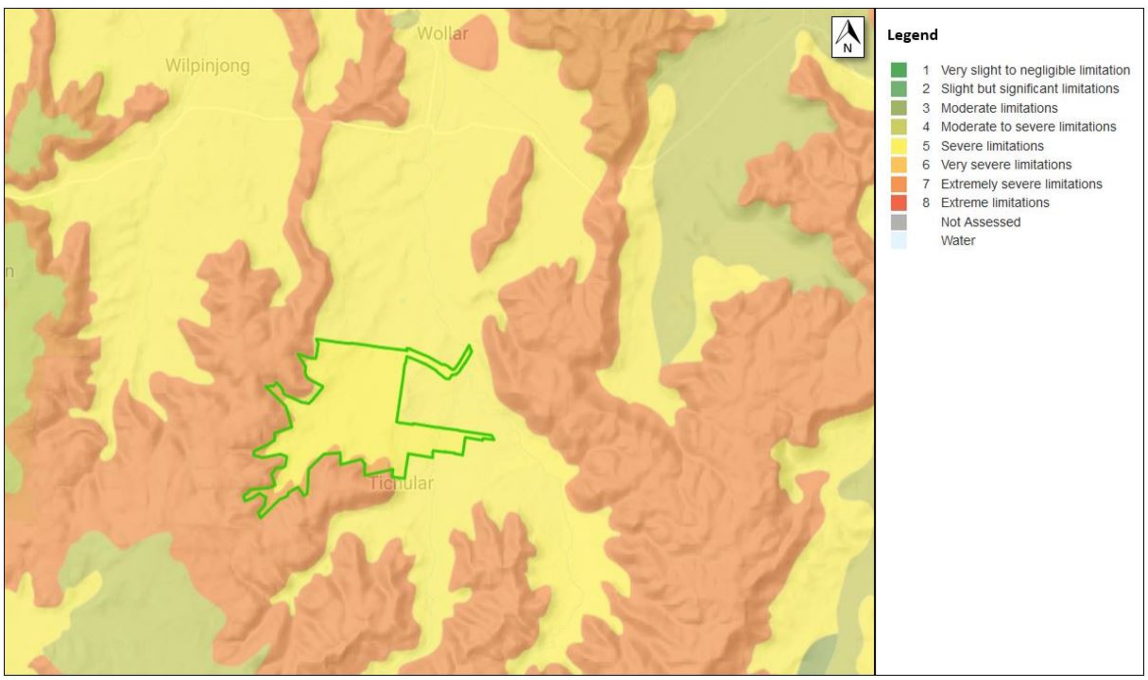

Figure 7-15 Proposal site Land and Soil Capability Classes mapping (modified from OEH, 2018).

Table 7-12 Land and Soil Capability Class definitions (OEH, 2012).

Class	Category	Definition
Class 5	Moderate – Low capability land	Land has high limitations for high-impact land uses. Would largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. Very occasional cultivation for pasture establishment. The limitations need to be carefully managed to prevent long-term degradation.

Class	Category	Definition
Class 7	Very low capability land	Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.

A proposal site inspection carried out on 8 May 2018, revealed characteristics consistent with the Land and Soil Capability classes associated with the site as outlined in Figure 7-15.

Biophysical Strategic Agricultural Land

Biophysical Strategic Agricultural Land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. Across NSW, 2.74 million hectares of land has been mapped as BSAL as a means of sustaining the agriculture industry.

The proposal site is not mapped as BSAL. The closest BSAL is located 13km south east of the proposal site.

7.3.3 Potential impacts

Construction

SOIL DISTURBANCE

The proposed disturbance area for the proposal is approximately 461ha, which includes the infrastructure included in Figure 1-4.

The proposal site has significant risk of sheet, rill and gully erosion and has been previously used for agricultural activities, and as such requires management through the implementation of the mitigation measures presented in this EIS.

The construction of the solar farm would disturb soils through the following activities:

- Establishment of external access road, subject to final detailed design.
- Decommissioning of dams currently on the site, which would involve filling the dams with soil excavated from other parts of the site.
- Removal of existing fences and construction of perimeter security fencing.
- Foundations for the inverter stations, substation and maintenance buildings.
- Establishment of temporary staff amenities and offices for construction.
- Levelling the ground for buildings and structures.
- Localised areas of earth works (cut and fill, grading and compacting) may be required in areas where there is sudden, significant changes in ground slope.
- Construction of internal access roads approximately 6m in width.
- Excavation of cable trenches up to 900mm deep and 500m wide.
- Installation of mounting structures (pile driven or screwed to a depth of 2 - 3m).
- Vegetation clearance.

The soil disturbance has the potential to result in the following impacts:

- Reduce soil stability and increased susceptibility to erosion due to vegetation removal or soil exposure, especially if the subsoil is sodic and dispersive.

- Loss of topsoil and impacts on waterways due to increased erosion and sedimentation hazard.
- Reduced soil permeability and increased run-off as a result of soil compaction for internal access roads and hardstand areas.
- Risk of exposing buried contaminant (pesticides and hydrocarbons).

Limited earthworks are required due to the low relief nature of the land, as such, soil disturbance is anticipated to be minimal. The earthworks and excavations associated with the access tracks, buildings and cabling trenches would require removal of vegetation cover and soil disturbance in some areas. The pile driving or screwing of steel posts associated with the installation of arrays and the installation of security fencing would have a small discrete footprint at the pole location and is unlikely to result in substantial soil disturbance. Ground cover would be maintained where possible during the pre-construction and construction stages of the proposal, and would be rehabilitated upon decommissioning. Sheep grazing would be limited to the area within the development footprint as a maintenance strategy to reduce biomass and assist weed management. This would also provide an opportunity to rest, rehabilitate and improve land that has already been degraded by agricultural practices in the areas of the proposal site that are not within the development footprint.

Erosion and sedimentation impacts that may arise as a result of construction and decommissioning works can be minimised by carrying out the activities in accordance with the 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).

Soil compaction occurring as a result of hardstand and access road construction and vehicle movements would reduce soil permeability; this may increase runoff and the potential for concentrated flows across the proposal site. Groundcover would be maintained beneath solar panels to control concentrated flows after heavy rainfall events.

Prior to commencement of construction, representative soil samples would be gathered as part of a specialist soil survey in order to establish baseline data on the existing agronomic characteristic of the soil. The survey would include sampling for soil texture and structure, nutrients, acidity and organic matter.

Operation

SOIL DISTURBANCE

The land within the proposal site has significant gully and sheet erosion present and poses the primary risk during operation as a result of the following:

- Localised erosion as a result of concentrated runoff from solar panels during significant rain events if ground cover is not maintained underneath the solar arrays. This is particularly relevant to fixed solar array systems.
- Ongoing erosion from disturbed areas associated with unsealed tracks and drainage structures.
- Soil compaction
- Other factors such as dispersive subsoils would be identified as part of the soil survey of the site, and appropriate management actions be identified to deal with this.

Activities associated with the operation stage would be mostly confined to formalised access tracks. Vehicle access between panel arrays where there would not be access tracks would be required occasionally. It is anticipated this would occur infrequently and is unlikely to pose a significant erosion risk.

Soil disturbance would be minimised by rehabilitation measures undertaken during construction and establishment of groundcover following soil disturbance activities. The risk to soil impacts are considered low with the implementation of appropriate mitigation measures.

During operation, the primary land use would transition from agricultural land use to power generation. Grazing would be limited to the area within the development footprint as a maintenance strategy to reduce biomass and assist weed management. This would provide an opportunity to rehabilitate the existing degraded land on the proposal site in areas outside of the development footprint.

Decommissioning

When the solar farm is no longer viable, all above ground infrastructure, with the possible exception of the 330kV substation, would be removed and decommissioning and rehabilitation of the site would commence. The solar arrays would be removed and the steel piles on which they are supported, would be removed. Both the steel piles and the solar panels would be recycled, where possible. All buildings would be removed, including the PCUs together with the associated footings. Cabling would be removed where practical and recycled. Any cabling greater than 500mm below the ground may be left in place since this would not impact on future agricultural activities on the site once the restoration is complete.

Groundcover management during decommissioning would be ensured through the development and implementation of a Ground Cover Management Plan.

REHABILITATION

Following decommissioning, rehabilitation of the site would be undertaken to restore the site to its pre-existing condition.

A Rehabilitation Plan associated with decommissioning activities would be developed and implemented with the objectives of:

- Returning the land to its pre-solar capability and improving the current state of the land.
- Soil resource management.
- Landform and land use areas.
- Development of completion criteria and monitoring reporting.

The plan would be informed by soil information derived from a soil survey using:

Soil information derived from a soil survey using;

- *The Australian Soil and Land Survey Handbook* (CSIRO, 2009).
- *The Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008).
- *The land and soil capability assessment scheme: second approximation* (OEH, 2012).

7.3.4 Safeguards and mitigation measures

Table 7-13 Safeguards and mitigation measures for land

PC: Pre-Construction, C: Construction, O: Operation, D: Decommissioning

ID	Mitigation measures	C	O	D
1	Undertake a soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects.	PC		
2	As part of the CEMP, a Soil and Water Management Plan (SWMP) (with erosion and sediment control plans) would be prepared, implemented and monitored during the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions to: • Install, monitor and maintain erosion controls. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability. • Manage topsoil 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. • Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period had passed. • Areas of soil disturbed by the proposal would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.	C		
3	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial grass cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election.	C	O	D

ID	Mitigation measures	C	O	D
	• Soil preparation. • Establishment techniques. • Maintenance and monitoring requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live grass cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live grass cover falls below 70%. Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. I.e. any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible			
4	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.	Design		
5	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act). • Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment • Induct and train all site staff.	C	O	D

ID	Mitigation measures	C	O	D
6	The transformers will be filled with oil, and waterproof bunds built around them to manage oil spills.	Design		
7	A protocol would be developed in relation to discovering buried contaminants within the proposal site (e.g. pesticide containers). It would include stop work, remediation and disposal requirements.	C	O	D
8	A Rehabilitation Plan would be prepared to ensure the array site is returned to at least or better than pre-solar farm land and soil capability. The plan would be developed with reference to the base line soil testing and with input from an agronomist to ensure the site is left stabilised, under a cover crop or other suitable ground cover. The soil survey would be based on: • *Australian Soil and Land Survey Handbook* (CSIRO, 2009) • *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008) • *The land and soil capability assessment scheme: second approximation* (OEH, 2012)			D
9	A pest and weed management plan would be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Mid-Western Regional Council and NSW DPI requirements.	C	O	
10	Consultation with local community, to minimise impact of the Proposal on adjacent agricultural activities and access.	C	O	D

7.4 COMPATIBILITY WITH EXISTING LAND USES

7.4.1 Approach and methods

Potential for impacts on existing and future land uses at and near to the proposal site have been assessed with reference to:

- Mid-Western LEP land use zones.
- MinView and Common Viewer databases.
- Land Use Conflict Risk Assessment Guide (DPI, 2011).

7.4.2 Existing environment

The proposal site is located on land zoned as RU1 Primary Production under the Mid-Western LEP.

There are three existing land uses currently relevant to the proposal site, including:

- Agricultural grazing and cropping.
- Residential (one dwelling).
- Crown Land and paper roads.

Land use classifications within the region are shown in Figure 7-16 and Table 7-14. Existing land uses adjacent to the proposal site with the potential to be affected by the proposal, or that may be supported by the proposal in the future include:

- Agricultural activities.
- Renewable Energy Projects.
- Industry and commercial use.
- Crown Land and paper roads.
- Aviation.
- Mining and exploration.
- Residential.

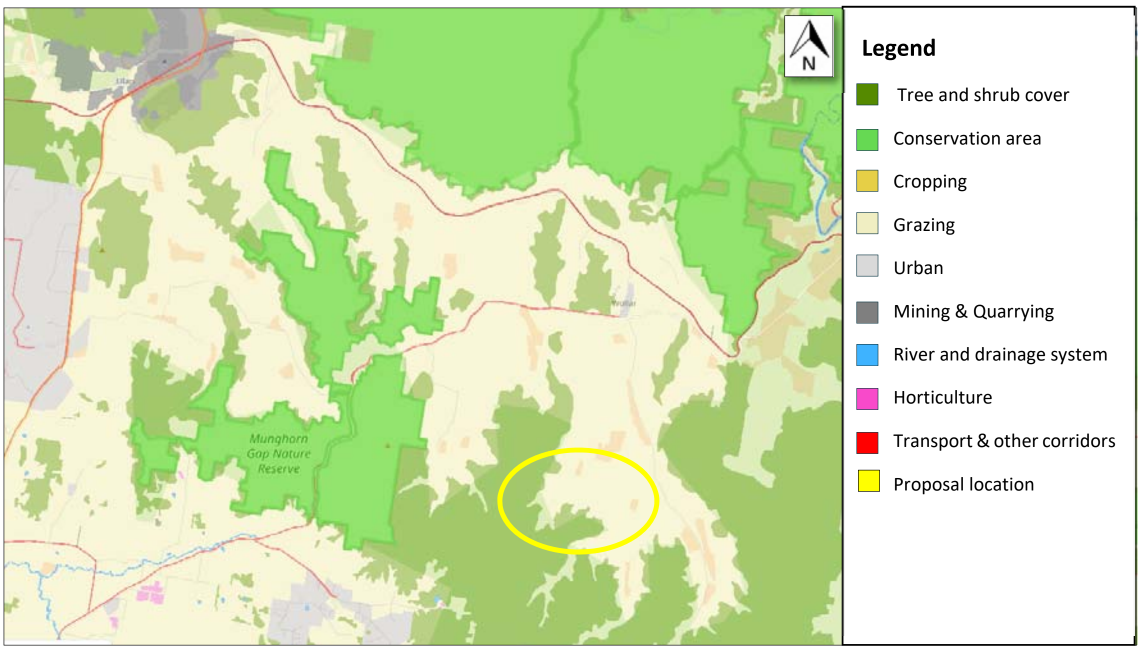

Figure 7-16 Land uses surrounding the proposal location.

Table 7-14 Land use classification within the Mid-Western Regional LGA

Land use classification	Area (ha)	% of Mid-Western Regional LGA
B1 Neighbourhood Centres	0.7	0.00008
B2 Local Centres	11.4	0.001
B3 Commercial Core	32.9	0.004
B4 Mixed Use	17.1	0.002
B5 Business Development	41.9	0.005
E1 National Parks and Nature Reserves	96085.2	10.97
E3 Environmental Management	85050.8	9.71

Land use classification	Area (ha)	% of Mid-Western Regional LGA
IN1 General Industrial	253.1	0.03
IN2 Light Industrial	11.6	0.001
IN3 Heavy Industrial	22.5	0.003
R1 General Residential	1008.0	0.12
R2 Low Density Residential	1061.1	0.12
R3 Medium Density Residential	162.1	0.02
R5 Large Lot Residential	27760.0	3.17
RE1 Public Recreation	473.3	0.05
RE2 Private Recreation	77.2	0.01
RU1 Primary Production	623292.1	71.2
RU3 Forestry	4620.8	0.53
RU4 Primary Production Small Lots	15335.3	1.75
RU5 Villages	915.9	0.10
SP2 Infrastructure	19468.8	2.22
SP3 Tourist	12.1	0.001

Agricultural production

The proposal site is located within the Central West NSW region which occupies 70,298km^2 (8.78%) of NSW; 57,244km^2 (81%) of which is agricultural land (ABS, 2017). The most common land use within the region is grazing modified pastures, which occurs on 38,075km^2 (54%) of the Central West region. The total RU1 Primary Production holding in Mid-Western Regional LGA was 6232km^2 in 2015, occupying 71% of the LGA.

The proposal site is approximately 878ha and is comprised mostly of derived native grasslands, some of which as high diversity in the groundcover. The land on which the development footprint is located is predominantly grazed with a small area of cropped paddock including:

- Grazing of around 200 cattle and 18 sheep over the entire property.
- A small area of forage cropping and hay production from lucerne.
- A small area of sown improved pasture comprised of barley grass, rye grass, oats and clovers for cattle feed.

The land immediately surrounding to the site is predominantly Crown Land with lesser areas leased by Minnamurra Pastoral Company. The land leased by Minnamurra Pastoral Company has a ‘no cropping’ caveat attached to the lease. The wider landscape also consists largely of land historically cleared for agriculture, with vegetation cover occurring along Barigan Road. Land use surrounding the site includes:

- North: The land immediately north of the proposal site is leased by Minnamurra Pastoral Company and used for cattle grazing. This land use extends approximately 4km north to Wollar village.
- West: The land immediately east of the proposal site is Crown Land zoned as E3 Environmental Management. This land use extends approximately 4.8km west of the proposal site.
- South: The land immediately south-west of the proposal site is Crown Land zones as E3 Environmental Management extending approximately 2.5km to the south. The land immediately south-east is privately owned and used for cattle grazing. This land use extends for 2.2km.
- East: The land immediately east of the proposal site is leased by Minnamurra Pastoral Company and used for cattle grazing. This land extend approximately 2km to the east.

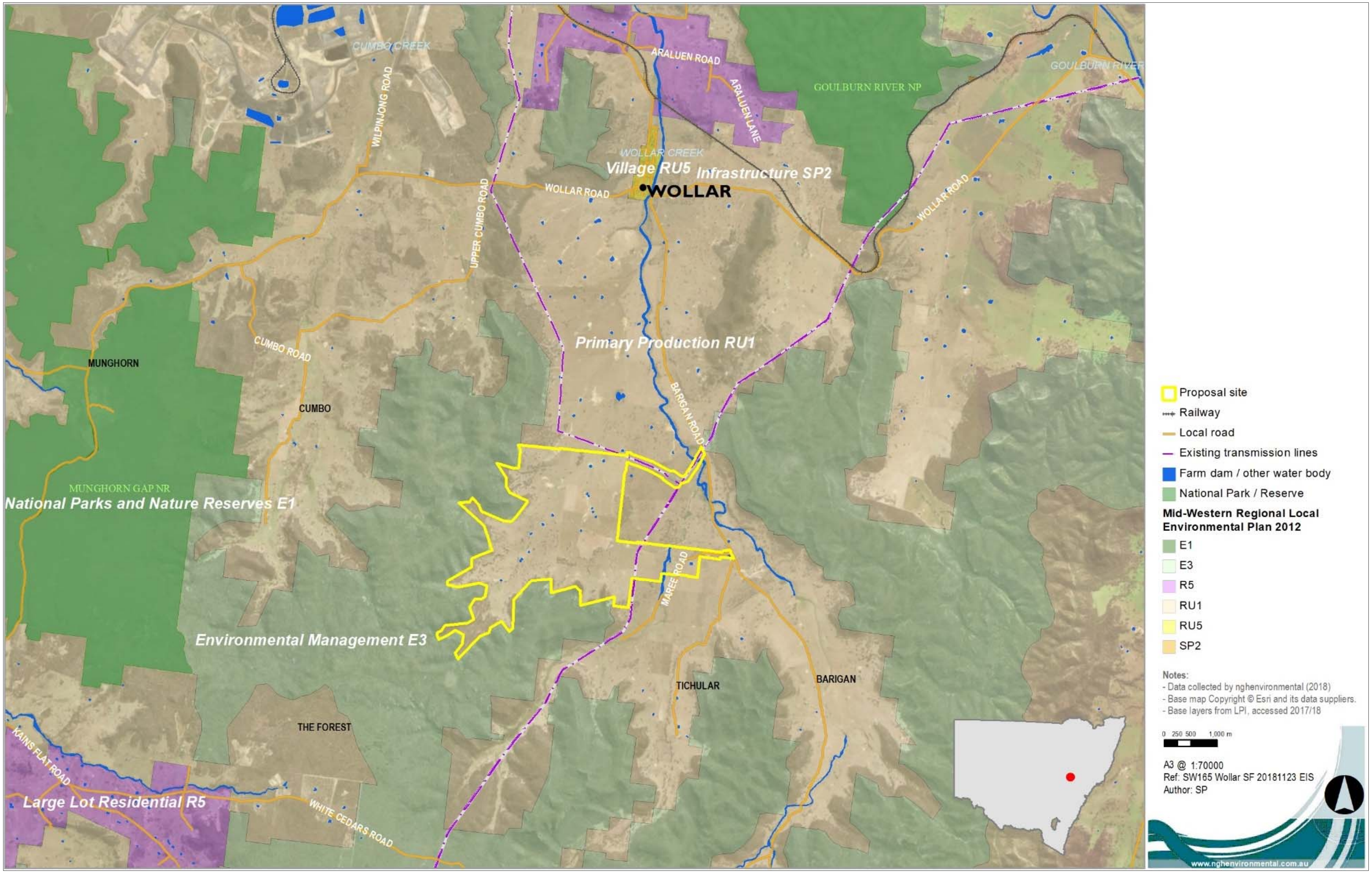

Figure 7-17 Land zoning relevant to the proposal site.

Renewable energy projects

The Beryl Solar Farm, proposed by First Solar, is located 50km north-west of the proposal site and commenced construction in August 2018. Construction is forecasted to be completed by mid-2019. There would be no cumulative construction impacts associated with the Wollar Solar Farm, as the anticipated construction timeframes do not overlap.

There are also two wind farms within the vicinity of the proposal site:

- Crudine Ridge Wind Farm, proposed by CWP Renewables. It has commenced construction and is located about 80km south-west of the proposal site.
- Uungala Wind Farm, proposed by CWP Renewables, would be located approximately 58km west of the proposal site. The EIS and DA are currently being prepared.

Cumulative construction impacts associated with the Wollar Solar Farm are not anticipated as haulage routes are different for each.

Industry and commercial use

An existing TransGrid 330kV transmission line transects the proposal site in the north eastern corner. This transmission line connects to the 330kV Wollar Substation to the east of the proposal site. The proposal would loop into the existing 330kV transmission line to connect to the 330kV Wollar Substation.

Crown land and paper roads

Lot 7303 DP1139558 is mapped as Crown Land and is located within the eastern portion of the proposal site. Development would not occur within this lot.

There are 11 paper roads within the proposal site that have been identified as Crown roads (Figure 7-18). WSD is working with DPI – Lands to gain a licence to occupy and use the Crown roads while concurrently applying to purchase these roads. Consultation with DoI – Lands is summarised in Section 6.

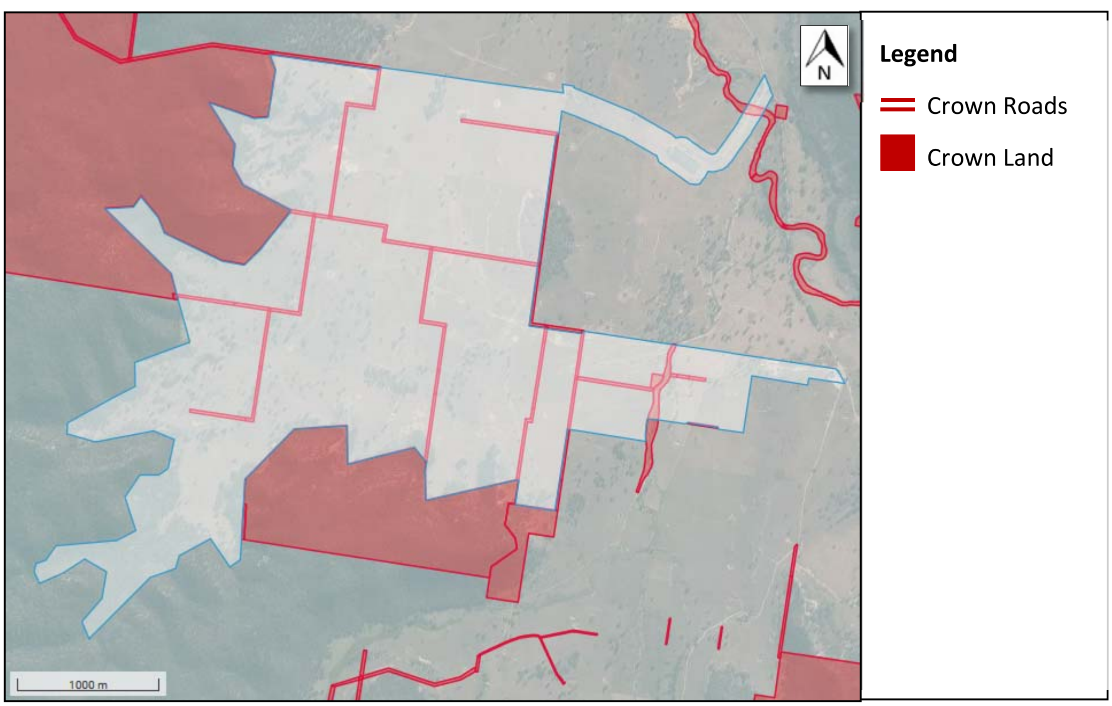

Figure 7-18 Crown land and crown roads associated with the proposal site.

Aviation

A number of airports are located within the vicinity of the proposal site:

- Mudgee airport approximately 35km south west
- Coolah airport approximately 75km north west
- Dubbo City Regional airport approximately 130km north west

Dubbo City Regional Airport is a principle regional airport that provides direct flight services to major Australian airports. The remaining airports are smaller scale and are primarily used by light aircrafts, private charter flights and medical services.

Due to the nature of the mining and agricultural industry in the area, there are potentially other smaller (private) airstrips at the locality used for transport or aerial spraying of crops.

Exploration licences and mining leases

Two expired exploration licence apply to the proposal site (Table 7-15). WSD have consulted with the exploration licence holders, as summarised in Section 6.3.2, 6.4 And 6.5.

Table 7-15 Exploration licences associated with the site.

Exploration Licence number	Owner	Grant date	Expiry date	Resource type
EL 6676	Secretary of DP&E	21.11.2006	20.11.2016	Coal
PEL 456	Hunter Gas Pty Ltd	05.03.2008	05.03.2018	Petroleum

There are three operational coal mines within the vicinity of the proposal site:

- Wilpinjong Coal mine approximately 11km north west off Ulan-Wollar Road, Wilpinjong (Figure 7-20 Mining Lease number ML1573).
- Moolarben Coal mine approximately 21km north west off Ulan Road, Ulan (Figure 7-20 Mining Lease numbers ML1605, ML1606 and ML1715).
- Ulan Coal mine approximately 23km north west off Ulan Road, Ulan (Figure 7-20 Mining Lease numbers ML1468, ML1341 and CCL741).

There is one proposed coal mine within the vicinity of the proposal site:

- Bylong Coal Project, proposed by KEPCO Bylong Australia, is approximately 20km east of the proposal site and is still in the approvals phase. Commencement of constructed is proposed for 2019.

The Wilpinjong Extension Project proposed by Peabody Australia Pty Ltd was Approved in April 2018. The extension includes development of a new open cut pit approximately 2.2km from Wollar village and approximately 5km from the proposal site.

Residential

The proposal site is located approximately 7km south of Wollar village. One residence is located within the proposal site, this is owned by the current landowner. No other residences are within 2km of the proposal site. The closest receiver is 2.8km from the site and is not involved with the project.

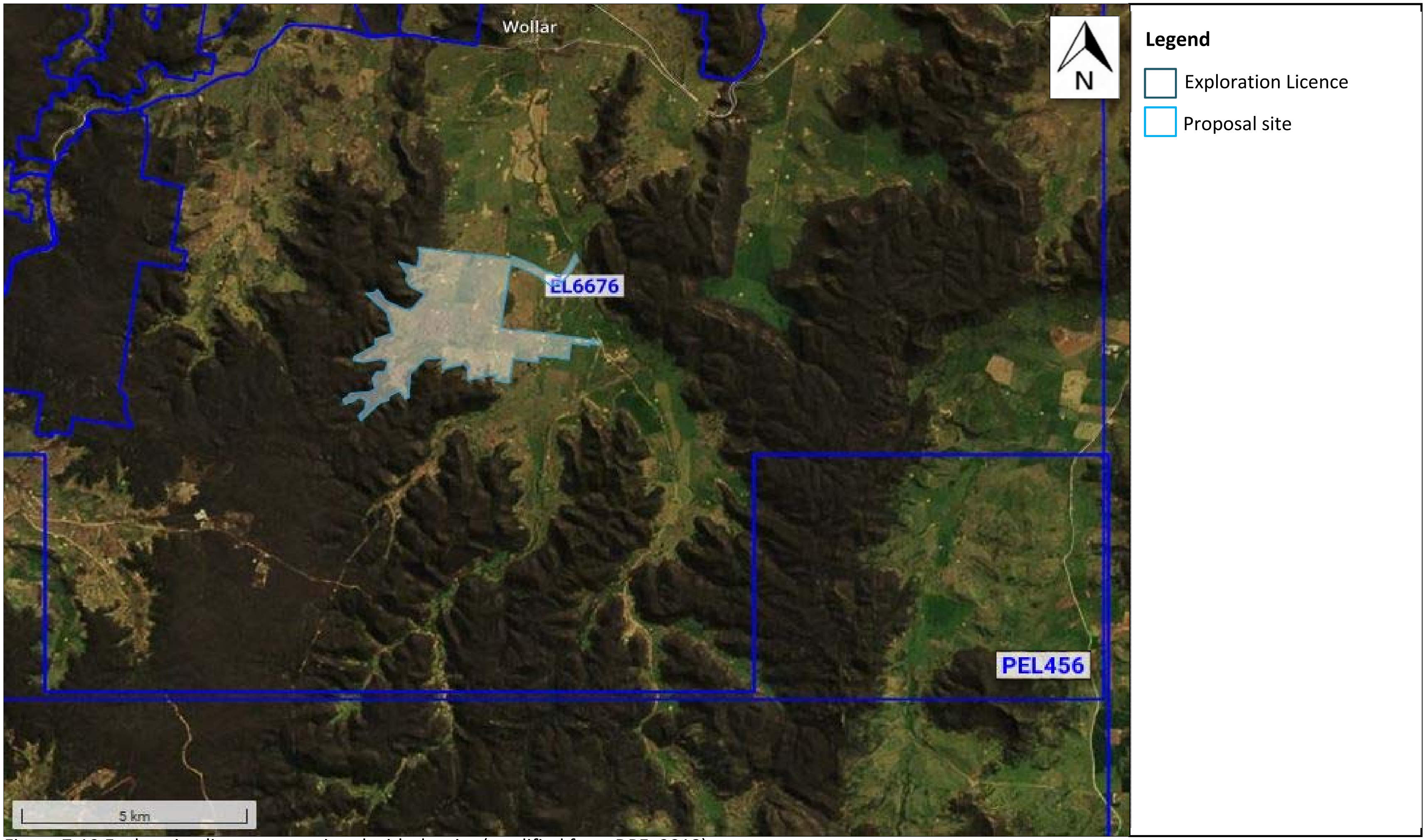

Figure 7-19 Exploration licences associated with the site (modified from DPE, 2018).

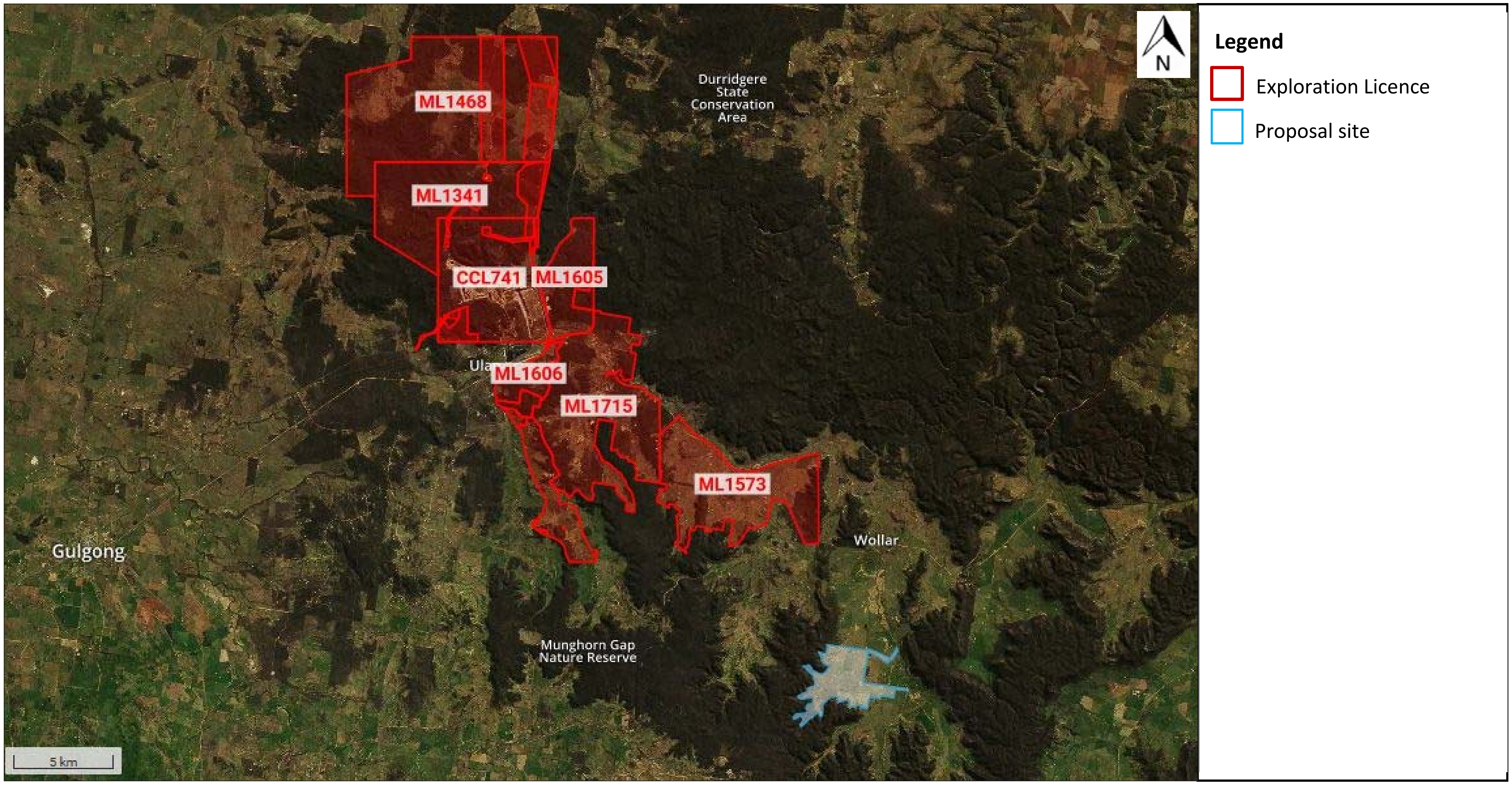

Figure 7-20 Exploration licenses relevant to the proposal site (modified from DPE, 2018).

7.4.3 Potential impacts

Construction

The potential impacts of the proposal during construction on surrounding land uses is considered to be minimal given the temporary nature of the construction stage and the high confidence in the ability to mitigate impacts. Potential impacts to surrounding land uses include the following:

AGRICULTURE

The potential impacts of the Proposal on agriculture are detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

<u>Resource loss and fragmentation</u>

- Agricultural activities would temporarily cease upon commencement of construction in areas within the proposal site and areas involved with primary access to the site.

<u>Biosecurity risks – pests diseases and weeds</u>

- The increased movement of vehicles, machinery and people to within the proposal site, particularly during construction and decommissioning poses the largest risk to biosecurity. Weed seeds can be transported via the tyres and undercarriages of vehicles and clothing of staff resulting in a risk of spreading weeds to the proposal site. Confining vehicles and machinery movements to formed access tracks during all phases, and implementing a wash down procedure for vehicle entering the proposal site would mitigate potential risk of seed dispersal.
- Preparation of a Weed Management Plan for the construction and decommissioning phases based on Mid-Western Regional Council and NSW DPI requirements would assist in the management of weeds.
- A temporary construction site compound would be established with the aim of reducing pest animals at the proposal site.

INDUSTRY AND COMMERCIAL USE

Minimal impact is anticipated during construction on the existing 330kV transmission line and 330kV Wollar Substation. This would be ensured through consultation with TransGrid to ensure access to the proposal site via the Northern Access does not disrupt operation and maintenance of the TransGrid substation.

CROWN LAND AND PAPER ROADS

The identified paper roads are confirmed to be Crown Land by Dubbo Land Office. A license and/or purchase would be required prior to constructing the proposal. A summary of consultation with DPI-Land is provided in Section 6.1.4.

AVIATION

There is unlikely to be any construction impacts on aviation or aerial spraying during construction of the Proposal. The proposed infrastructure is low-lying with the transmission line poles being the tallest infrastructure. The installation of this infrastructure would not impact on any flight paths or present a hazard to aircraft.

MINING AND EXPLORATION

Exploration licenses

During construction, extraction of any resources within the proposal site would not be possible, potentially affecting exploration licence holders. Given the highly reversible nature of the proposal, resource extraction would not be sterilised in the long term and could resume post decommissioning. The relevant exploration licence holders have been notified of these restrictions. It is understood that vegetation offset areas, established in perpetuity, may form an additional long term restriction to exploration. It is noted that permission to impact offset areas can be sought under the Biodiversity Offset Scheme, albeit with a surcharge applied to account for impacts on offset areas and subject to the *Biodiversity Conservation Act 2016*.

Mining leases

Both the proposed Bylong Coal Project and approved Wilpinjong Extension Project will result in an influx of vehicles and workers to the region. The Wilpinjong mine is unlikely to use Wollar Road or Barigan Road for Haulage due to their location and proximity to railway lines. Traffic associated with this mines is likely to be on Ulan-Wollar Road which has the capacity for the heavy vehicles utilised.

Construction vehicles associated with the proposed Bylong Coal Project would use Wollar Road. Traffic Assessments undertaken for both the proposed Wollar Solar Farm and Bylong Coal Project indicated that the road capacity is sufficient to accommodate construction vehicles for both projects should construction be concurrent. Consultation with representatives from KEPCO Bylong Australia and Peabody Australia Pty Ltd would be ongoing to ensure this influx is managed appropriately so as to not place stress on stakeholders including road users and business owners in Mudgee.

RESIDENTIAL

Residences located near the site or along the access route may experience temporary noise, dust and traffic during construction. The receivers are very few (Figure 8-10) and these impacts are considered manageable and are addressed in Sections 8.3, 8.6 and 8.9. No impacts on the use of recreational areas would occur.

Operation

The potential impacts of the proposal during operation on surrounding land uses is considered to be manageable with implementation of mitigation measures. Potential impacts to surrounding land uses include the following:

AGRICULTURAL ACTIVITIES

During operation, the proposal site would change from agricultural land use to power generation. The potential impacts of the Proposal on agricultural resources is detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

Resource loss and fragmentation

- The proposal would result in the loss of 878ha of agricultural land for the life of the solar farm (approximately 30 years). This represents 0.002% of the agricultural holdings within the Mid-Western Regional LGA and does not significantly reduce the availability of land for primary production in the region.
- The proposal site is bound by Crown Land along the western and southern boundaries. This minimises resource fragmentation of the surrounding land zoned as RU1 Primary Production.

- Connection to the national grid does not require additional power lines as the Proposal would connect via an existing 330kV transmission line that traverses the north-east corner of the site. This reduces the potential for limiting ground clearance and impacting on safe movement of agricultural machinery. Furthermore, access to the site is anticipated to be via existing road reserves and tracks.

Impacts on farming operations and livestock

- Some sheep grazing may continue to be undertaken at the proposal site to control grass and weed growth around the solar arrays. Grass fuel levels within the site would be managed to minimise bushfire risks (refer to Section 8.7). Adequate groundcover would be maintained to protect soil and water values (refer Section 7.3 and 8.1).
- The proposal would not affect access or agricultural land uses on surrounding properties during the operation phase. The existing surrounding land uses are known and the solar farm is not considered to be an incompatible land use with a potential to create land use conflicts. Local pastoral companies have the potential to benefit from future grazing arrangement within the proposal site.
- Best practice waste and wastewater management, fuel storage and re-fuelling and chemical handling would be stringently applied to prevent soil and water pollution (refer Section 8.10 and 8.1).
- Impacts on soils and erosion risk are assessed in Section 7.3, impacts on downstream water quality are assessed in Section 8.1 and impacts on local air quality are assessed in Section 8.9. These assessments conclude that the Proposal would not be likely to adversely affect land uses or activities on neighbouring properties or elsewhere in the locality, subject to identified mitigation measures.

Biosecurity risks – pests, diseases and weeds

- Biosecurity risks associated with construction and decommissioning are also relevant during the operational phase, to a lesser degree. An operational weed management plan would be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the proposal site and the importation and dispersal of weeds due to vehicle movements and dispersal by humans and animals. Additionally, weed control techniques including herbicide and grazing pressure would be a focus of the plan.
- Risk of increasing pest animals (cats and foxes) at the proposal site during operation would be managed by ensuring waste from rubbish bins containing food are covered and regularly removed. Targeted pest management during the operational phase of the proposal would control rabbit and fox numbers. Resources and cover for pest species would be reduced grazing pressure and reduced plant matter.

INDUSTRY AND COMMERCIAL USE

The Wollar 500/330 kV substation is identified as a Connection Opportunity by TransGrid. As such, potential impact during the operation phase is considered unlikely.

AVIATION

There is a perceived issue of glint or glare associated with PV solar panels. Glint is a quick reflection that occurs when the sun is reflected on a smooth surface. Glare is a longer reflection. Onsite infrastructure that may cause glint or glare depending on the sun angle, include:

- Solar panels.
- Steel array mounting – array mounting would be steel or aluminium.
- PCUs.
- Transmission line poles, if steel is used.
- On-site substation.
- Temporary construction site buildings.

Recent studies have suggested that potential for glare from PV solar panels is relatively limited (Spaven Consulting, 2011). PV solar panels are designed to reflect as little sunlight as possible as the PV panels are designed to absorb solar energy in order to generate the maximum amount of electricity. It is documented that PV panels may reflect as little as 2% of the light they receive (FAA, 2010).

The panels would not generally create noticeable glare compared with an existing roof or building surfaces. Figure 7-21 compares the reflectivity of various common surfaces. Seen from above (such as from aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar PV plants have been installed on a number of airports around the world and in Australia including Karratha in WA and Darwin in NT.

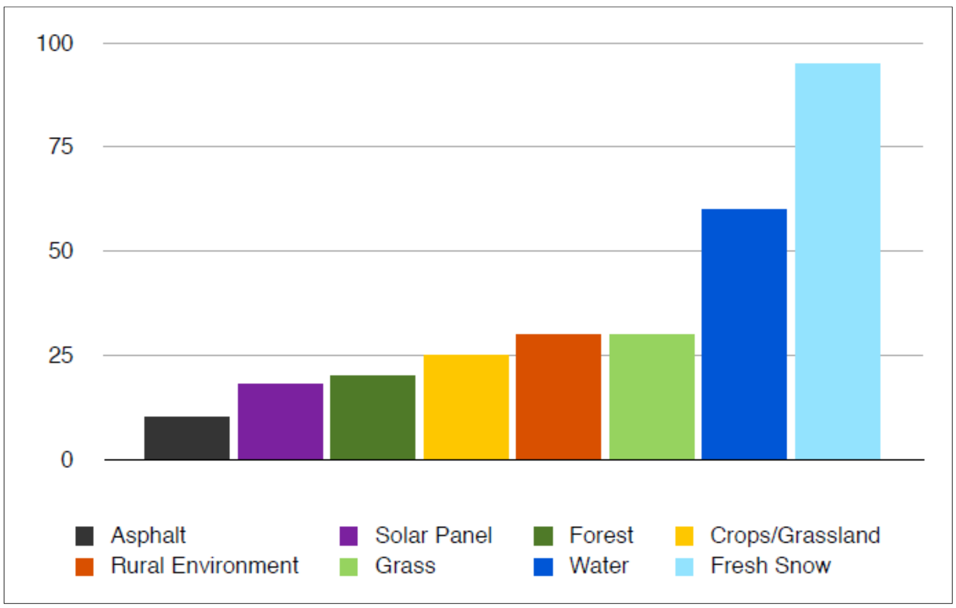

Figure 7-21 Comparative reflection analysis (Spaven Consulting, 2011).

MINING AND EXPLORATION

The Proposal would be likely to preclude the extraction of mineral resources from the site for the life of the solar farm. The Proposal would not prevent future resource exploitation following decommissioning of the solar farm.

Decommissioning

The potential impacts of the proposal during decommissioning on surrounding land uses is considered to be manageable with the implementation of the mitigation measures presented in this EIS. Potential impacts to surrounding land uses include:

AGRICULTURAL ACTIVITIES

Existing agricultural land uses or future agricultural land uses on the proposal site or adjacent land are not anticipated to be impacted due to the highly reversible nature of the proposal.

The potential impacts of the Proposal on agricultural activities is detailed below with respect to *Primefact 1063: Infrastructure proposals on rural land* (DPI, 2013).

<u>Site rehabilitation</u>

A Rehabilitation Plan associated with decommissioning activities would be developed and implemented with the objectives of:

- Returning the land to its pre-solar capability, and improving the current state of the land.
- Soil resource management.
- Landform and land use areas.
- Development of completion criteria and monitoring reporting.

The plan would be informed by soil information derived from a soil survey using:

- *The Australian Soil and Land Survey Handbook* (CSIRO, 2009).
- *The Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008).
- *The land and soil capability assessment scheme: second approximation* (OEH, 2012).

AVIATION

There is unlikely to be any impacts on aviation or aerial spraying during decommissioning of the Proposal. The proposed infrastructure is low-lying with the substation being the tallest infrastructure. The removal of infrastructure would not impact on any flight paths or present a hazard to aircraft.

INDUSTRY AND COMMERCIAL USE

Minimal impact during decommissioning on the existing 330kV transmission line and 330kV Wollar Substation would be ensured through consultation with TransGrid.

RESIDENTIAL

Residences located near the site may experience temporary noise, dust and traffic during decommissioning. These impacts are considered manageable and are addressed in Sections 8.3, 8.6 and 8.9. No impacts on the use of recreational areas would occur.

The proposal is considered highly reversible given the relatively low impact on the soil surface. Following decommissioning, rehabilitation of the site would be undertaken to restore the site to its pre-existing condition. All above ground infrastructure would be removed upon decommissioning and alternate land uses including agriculture and mining could resume.

Land use risk assessment

A Land Use Conflict Risk Assessment (LUCRA) has been carried out in accordance with the DPI *Land Use Conflict Risk Assessment Guide* (DPI, 2011). Given the surrounding land uses are different the proposed solar farm, specifically agriculture and mining, this assessment aims to identify and rank potential land use conflicts to ensure they are adequately managed.

To undertake the LUCRA, activities are assessed according to the probability and consequence of conflicts that may ensue. Probability is categorised from A to E (refer to column headers of Table 7-40 for further explanation). Consequence is categorised from 1 to 5 (refer to row titles of Table 7-40 for further explanation). Based on the risk and consequence, each activity is given a rank. Generally, an activity that produces a rank of above '10' is considered to generate unacceptable risk and requires further management. These are highlighted in red.

Evaluation criteria		A – Almost certain: Common or repeating occurrence	B – Likely: Known to occur, or 'it has happened'	C – Possible: Could occur, or 'I've heard of it happening'	D – Unlikely: Could occur in some circumstances, but not likely to occur	E – Rare: Practically impossible
1	• Severe and/or permanent damage to the environment • Irreversible • Severe impact on the community • Neighbours are in prolonged dispute and legal action involved	25	24	22	19	15
2	• Serious and/or long-term impact to the environment • Long-term management implications • Serious impact on the community • Neighbours are in serious disputes	23	21	18	14	10
3	• Moderate and/or medium-term impact to the environment and community • Some ongoing management implications • Neighbour disputes occur • Minor and/or short-term impact to the environment and community • Can be effectively managed as part of normal operations • Infrequent disputes between neighbours	20	17	13	9	6
4	• Minor and/or short-term impact to the environment and community • Can be effectively managed as part of normal operations • Infrequent disputes between neighbours • Example/ Implication • Theoretically could affect the environment	16	12	8	5	3

Evaluation criteria		A – Almost certain: Common or repeating occurrence	B – Likely: Known to occur, or 'it has happened'	C – Possible: Could occur, or 'I've heard of it happening'	D – Unlikely: Could occur in some circumstances, but not likely to occur	E – Rare: Practically impossible
5	• Very minor impact to the environment and community • Can be effectively managed as part of normal operations • Neighbour disputes unlikely	11	7	4	2	1

This LUCRA for the Wollar Solar Farm lays out the information gathered about the existing and adjacent land use activities and activities associated with the Proposal. Based on desktop studies and field work, the risk level of each activity is evaluated. Where applicable, management strategies to reduce risk are identified. These factors are reviewed and presented in a risk assessment matrix (refer to Table 7-41). Given the management strategies proposed, no items result in a score greater than '10'.

The table below lists the potential sources of land use conflict from the Proposal, assesses the risk based on the matrix above, and suggests management strategies to reduce possible conflicts. Land use conflicts identified are expected to be manageable.

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
Use of Agricultural Land	<u>Opportunity cost:</u> For the lifetime of the project, the current agricultural practices would be precluded or limited. Limited grazing would be possible.	A5 / 11	A Groundcover Plan would ensure erosion and weeds are addressed during the operation of the solar farm. Information from Soil surveys and land assessments would provide baseline information to guide land and soil constraints during construction, remediation post construction and during decommissioning	D3 / 9	Return site to equal or better agricultural potential following project decommissioning.

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
			for final rehabilitation purposes. A Rehabilitation Plan would be developed to remove all infrastructure following the decommissioning of the solar farm. Following decommissioning of the site, the land can be used for agricultural grazing and cropping for feed. The final land forms and land uses aim to restore land to at least or better land and soil capability, and achieve long term stability, and agricultural production outcomes.		
Resource extraction/exploration	Opportunity cost: Exploration and extraction of natural resources on the site would be precluded for the lifetime of the solar farm.	A3 / 20	The proposal is not expected to modify or depreciate the value of resources on the site. The proposal is to build limited infrastructure in the form of boundary roads and substations while the solar panels would be installed on pile driven posts or on small pad footings. Upon decommissioning of the solar farm, the	D3 / 9	NA

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
			pile driven posts or small pad footings would be removed causing minimal soil and landscape disturbance and the land would be largely as it occurs today. Following the decommissioning of the solar farm it is expected any economic resources would be available for exploitation.		
Construction	Visual amenity: During construction of the solar farm, construction equipment, personnel and facility would be installed. Earthworks would be undertaken.	D5 / 2	The impacts would be temporary and distributed across a large landscape. No specific mitigation is proposed.	D5 / 2	Respond promptly to complaints.
	Noise and vibration: Based on the distance to sensitive receivers, noise is unlikely to exceed noise management levels.	D4 / 5	Implementation of a Noise Management Plan is required to manage this impact.	D4 / 5	Comply with Noise Management Plan.
	Dust: During construction and especially earthworks, dust may be generated.	B4 / 12	Dust generated during the construction and decommissioning phases would be managed by the use of water carts where required. Dust is not expected to generate a land use	C5 / 4	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/m^2 are also specified.

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
			conflict during operation.		
	Traffic: There would be a significant increase in the amount of heavy vehicles along Barigan Road during construction. Up to 92 vehicles may access the site during peak hour on a given day during the peak construction period. Existing traffic volumes have been assessed as relatively low and the roads can accommodate the increase.	B4 / 12	Traffic impacts are most notable during construction and decommissioning phases of the proposal. A Traffic Management Plan would be developed to mitigate traffic impacts. Continued consultation with Bylong Coal Project and Mudgee Hospital to ensure management of peak construction traffic should the developments overlap.	B5 / 7	Comply with traffic management plan.
Operation and maintenance of PV array and associated infrastructure	Visual amenity: The PV array is a significant deviation visually from the current land use.	C4 / 8	There are no dwellings in the immediate vicinity of the proposal site, with the exception of the involved landowner. The infrastructure occupies low relief and should not greatly modify skylines / horizons.	C5 / 4	
	Bushfire ignitions: Depreciated electrical infrastructure is a known source of bushfire ignitions.	D2 / 14	The site would be maintained in accordance with management practices for electrical sites. Biomass on site	E2 / 10	NA

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
			would be managed by grazing (land use management plan) and weeds will be managed in accordance with a weed management plan.		
	Traffic: Proposal is expected to employ 5 (equivalent) employees long term on site and would be unlikely to cause traffic congestion. No long term modification of roads planned.	E5 / 1	None required	E5 / 1	NA
Decommissioning	Visual amenity: During decommissioning of the solar farm, equipment, personnel and facility would be removed.	D5 / 2	The impacts would be temporary and distributed across a large landscape. No specific mitigation is proposed.	D5 / 2	Respond promptly to complaints.
	Noise and vibration: Based on the distance to sensitive receivers, noise is unlikely to exceed noise management levels.	D4 / 5	Implementation of a Noise Management Plan is required to manage this impact.	D4 / 5	Comply with Noise Management Plan.
	Dust: During decommissioning especially removal of infrastructure, dust may be generated.	B4 / 12	Dust generated during the decommissioning phases would be managed by the use of water carts where required. Dust is not expected to generate a land use	C5 / 4	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/m^2 are also specified.

Activity	Identified Potential Conflict	Risk Category and Rank	Management Strategy (Method of Control)	Revised Risk Category and Rank	Performance Target
			conflict during operation.		
	Traffic: There would be a significant increase in the amount of heavy vehicles along Barigan Road during decommissioning. Existing traffic volumes have been assessed as relatively low and the roads can accommodate the increase.	B4 / 12	Traffic impacts are most notable during construction and decommissioning phases of the proposal. A Traffic Management Plan would be developed to mitigate traffic impacts.	B5 / 7	Comply with traffic management plan.
Weed and pest control	Weeds: Transfer of weeds from site to surrounding properties which may affect agricultural or amenity plantings on neighbouring properties.	D4 / 5	Implementation of Weed Management Plan during construction and operation phases.	E4 / 3	Comply with weed management protocols.
Grazing around PV array	Grazing: The site is currently used for grazing, and the surrounding land is also used for grazing. Grazing surrounding the PV array is not expected to cause conflicts.	N/A	N/A	N/A	N/A
Agriculture on land surrounding site	Agriculture: Agriculture on lands surrounding the site is not expected to cause conflicts for the solar array.	N/A	N/A	N/A	Maintain consultation with surrounding land owners and users.

7.4.4 Safeguards and mitigation measures

Table 7-16 Safeguards and mitigation measures for compatibility with existing land uses

PC: Pre-Construction, C: Construction, O: Operation, D: Decommissioning

ID	Mitigation measures	C	O	D
1	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C	O	D
2	Consultation with proposal site exploration licence holders regarding the proposal and potential impacts.	C	O	D
3	Consultation with relevant parties involved in existing or proposed developments associated with the Wilpinjong mine, Ulan mine, Moolarben mine and Bylong mine.	C	O	D
4	Consultation with DPI-Lands would be ongoing and the following would be undertaken: • Prior to construction, a lease will be applied for to allow construction to commence within Crown roads on the proposal site. • Prior to construction, the Proponent will apply to purchase the Crown roads associated with the proposal site.	PC		

7.5 HYDROLOGY AND FLOODING

7.5.1 Approach

A Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd to assess the impact of the proposed permanent infrastructure on flooding. The report has been provided as Appendix H and summarised below.

7.5.2 Existing environment

The Mid-Western Regional Local Emergency Management Plan covers preparation form response to and recovery from emergencies including flooding.

Most of the land in the east and south of the local area is undulating or hilly in nature, creek gradients are relatively steep and flood warning times and duration of inundation are short. In the North – West and North the terrain is flatter; floodplain areas are more extensive and warning times and duration of inundation are longer.

According to the Mid-Western Regional Council Flood Emergency Sub Plan (2013), the area of the LGA to the north, which encompasses the proposal site, is drained by the Goulburn River and tributaries entering it from the north. The primary tributaries are the Munmurra, Krui, Bow and Merriwa Rivers, Worondi Rivulet and Halls Creek, which together drain the Warrumbungle and Liverpool ranges of the Great Dividing Range and flow through wide valleys across the Merriwa Plateau.

The highest floods recorded for the LGA was on the Cudgegong River and occurred in February 1955, March 1956 and November 1969. During these events, the Cudgegong River and Lawson Creek were in flood together. There is no record of serious flooding on the Goulburn River within the Mid-Western LGA.

The Mid-Western Regional Council Flood Emergency Sub Plan (2013) identifies roads that may be affected by local flooding, none of which are relevant to the proposal site.

No existing flood studies are known to exist within proximity of the proposal site.

The proposal site consists of an area of approximately 878ha and is traversed by two named waterways (Wollar Creek and Spring Flat Creek). Wollar Creek traverse the site in the east in a north-south direction and Spring Flat Creek (a tributary of Wollar Creek) flows through the proposal site in a south-west to north-east direction. Eight unnamed tributaries of Spring Flat Creek also traverse the site (Figure 8-2). All watercourses are described as ephemeral and would only contain flowing water during rainfall. Wollar Creek is a tributary of the Goulburn River, which is located approximately 18km north-east of the proposal site.

Elevations over the site range from RL310 m AHD to RL390m AHD as depicted in Figure 7-22.

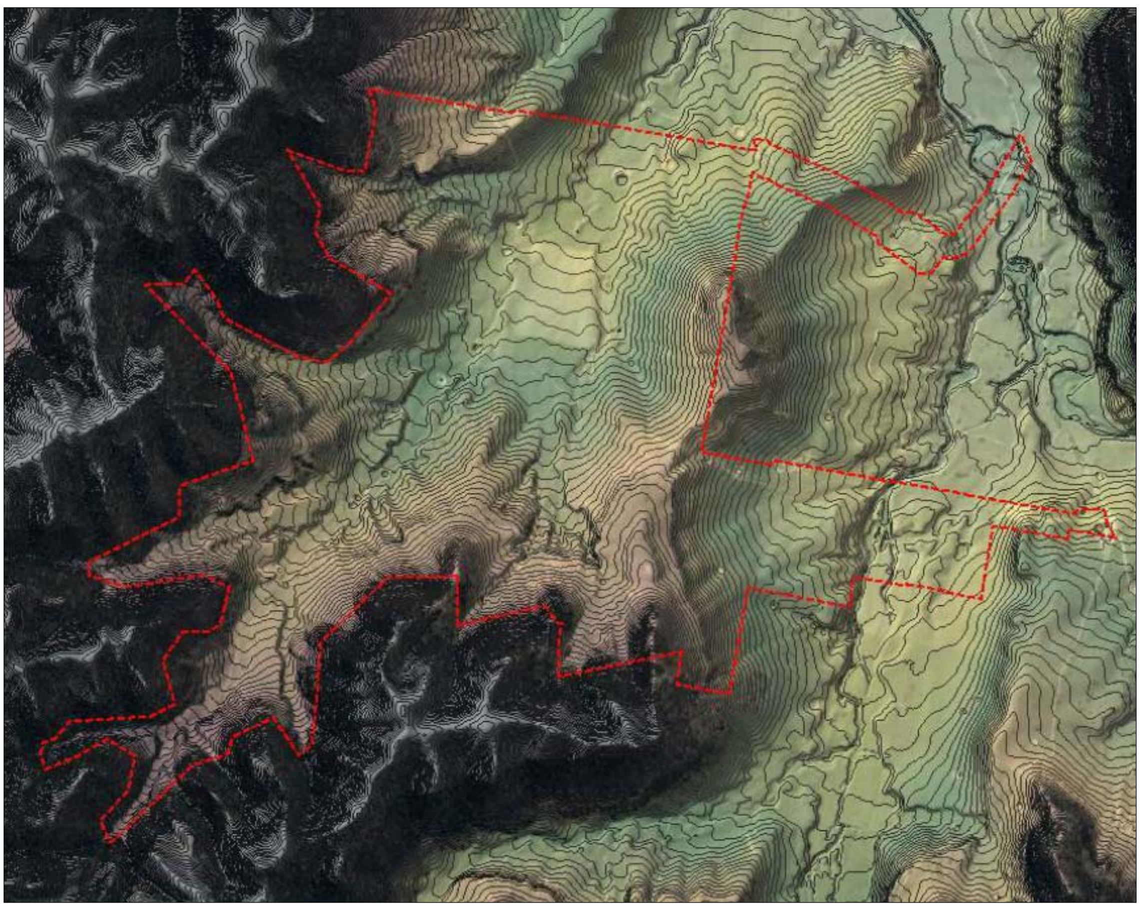

Figure 7-22 Terrain analysis over the proposal site with 2m contour interval (Footprint, 2018).

7.5.3 Hydrological and hydraulic modelling results

The results of the hydrological and hydraulic modelling show that significant flow depth (up to 1.2m outside existing dams) is expected to occur along Spring Flat Creek in the 1% AEP event with velocities approaching

4m/s in places. Within the unnamed tributaries of Spring Flat Creek, flow depths do not typically exceed 0.3m in the 1% AEP event, however velocities remain reasonable high and are typically in the 2 – 3m/s range (Figure 7-23 and Figure 7-24).

Hazard vulnerability

The flood hazard vulnerability mapping over the proposal site shows that flows along Spring Flat Creek and Wollar Creek within the watercourse are typically categorised as H4 and H5 in the 1% AEP event and would therefore be unsuitable for development. This investigation has been used to inform the proposal site layout. Along most other watercourses within the proposal site flows are typically categorised as H4 and H5 in the upper reaches were grades are steep and the channel is confined and reduce to H1-H3 in the lower flatter reaches where flood depths and velocities reduce (Figure 7-25).

The results demonstrate there is not predicted to be a significant impact on flood behaviour within the floodplain as a result of the proposed solar farm, with flood levels, depths, velocities and hazards remaining relatively unchanged. Importantly the modelling demonstrates that changes in peak flood levels are limited to within the proposal site and are therefore not anticipated to adversely affect adjoining properties.

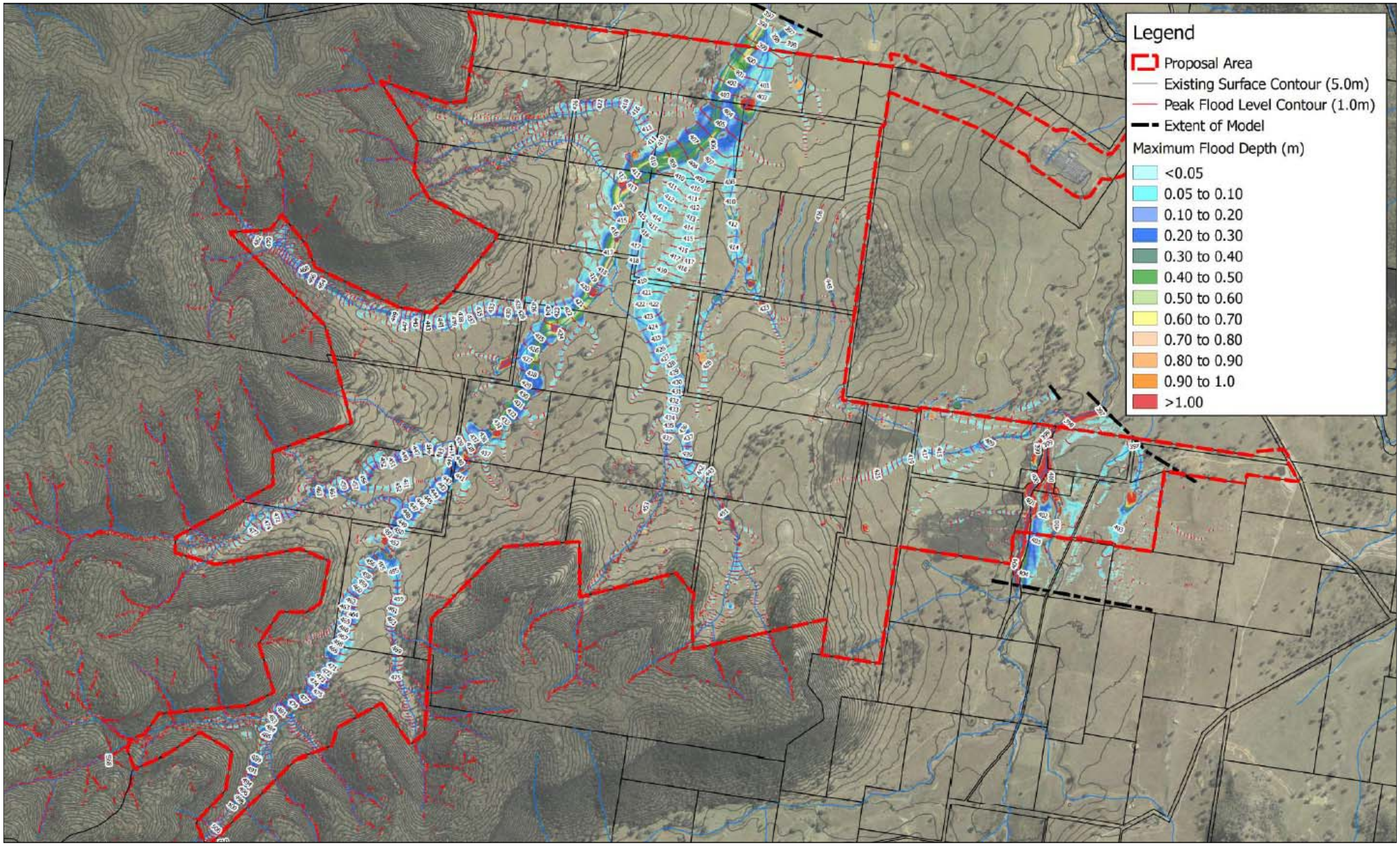

Figure 7-23 Existing 1% AEP Maximum flood levels and depths (Footprint, 2018).

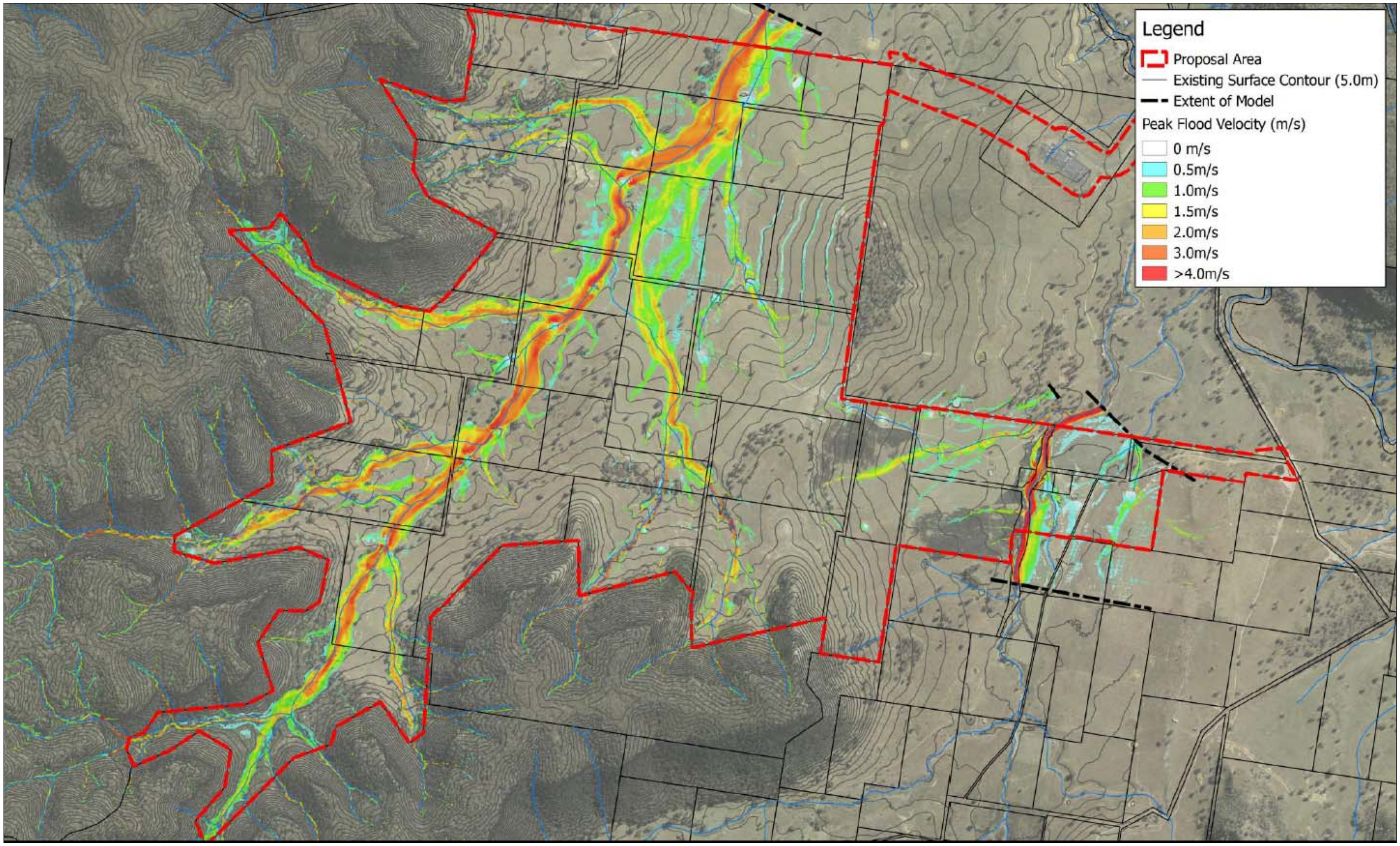

Figure 7-24 Existing 1% AEP Peak flood velocities (Footprint, 2018).

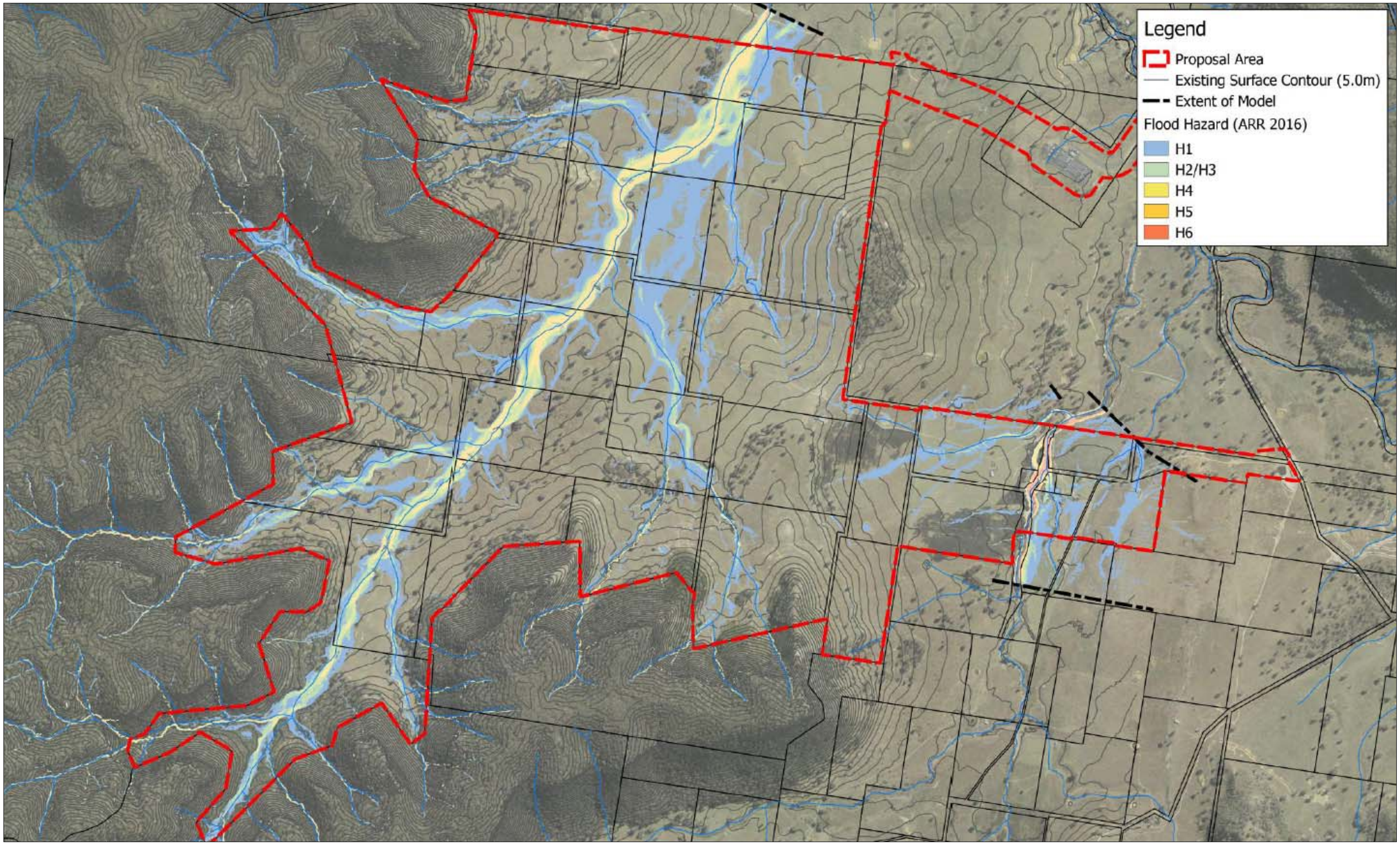

Figure 7-25 Existing 1% AEP Flood hazard (Footprint, 2018).

7.5.4 Potential impacts

Construction and decommissioning

Flood impacts can relate to the potential of a development to increase the risk of flood occurrence or severity, or the potential to create hazards in the event of a flood actually affecting the site.

Parts of the site may be at risk of temporary flooding during high rainfall events and high flows within the vicinity of Spring Flat Creek and Wollar Creek. Temporary localised flooding has the potential to interfere with construction and poses a safety risk for workers onsite. The proposal has potential to create the following hazards in the event of a localised flood:

- Electrical hazards to staff, emergency workers and assets due inundation of infrastructure.
- Pollution risks from leakage of stored pollutants (hydrocarbons, pesticides, solvents).
- Physical damage from the mobilisation of components in flood waters.

Buildings, equipment foundations and footings would be considered during detailed design in relation to the potential for flooding at the site. No components are considered susceptible to becoming mobile and entering waterways during construction. All potential pollutants stored on-site during construction would be stored in accordance with HAZMAT requirements and bunded. A flood response plan would be developed to manage the safety of workers and equipment in the event of extended flooding in the region.

Access to the proposed solar farm via the Northern Access would utilise existing crossings on Wollar Creek. The Northern Access point has an existing concrete causeway and is the access point that would be used by both light and heavy vehicles. No upgrade to this waterway crossing is proposed.

The Southern Access point has an existing culvert and would be limited to use by light vehicles. This crossing is low-level and would become inundated in flood events (up to approximately 2m in the 1% AEP event). With the implementation of the measures in Section 7.5.5, it is not considered necessary to upgrade this crossing.

Maintaining grass cover across the site as far as practicable during construction, particularly within the existing waterways, would help maintain soil stability during floods, and would improve soil permeability over time.

Operation

The addition of the solar arrays and their associated infrastructure would result in a slight increase in surface roughness over the site, from grazed/cropped pasture to a regular grid of steel piers. The Modified Cowan Method for Floodplain Roughness was used to assess the impact of the proposal on floodplain roughness (Table 7-17). Localised increases in flood levels in the vicinity of the solar array would result from the slight increase in surface roughness.

Table 7-17 Modified Cowan method for estimation of floodplain roughness (Footprint, 2018).

Roughness component	Existing (grazed pasture)	Proposed (solar array)
Floodplain material (n_b)	0.020	0.020
Degree of irregularity (n_1)	0.001	0.001

Roughness component	Existing (grazed pasture)	Proposed (solar array)
Variation in floodplain cross section (n_2)	NA	NA
Effect of obstructions (n_3)	0.000	0.003[2]
Amount of vegetation (n_4)	0.004	0.004
Total	**0.025**	**0.028**

The proposed development would include a network of access roads that would be constructed from gravel and within the floodplain itself. The roads would be constructed at the existing surface level so as not to result in adverse impact on flood behaviour. The increase in floodplain roughness as a result of the internal road network is considered marginal and as such was not included in the post development model.

Localised flooding during operation may pose the following risks:

- A safety risk for workers and assets, where electrical infrastructure becomes inundated.
- A pollution risk, where stored pollutants may be leaked to the environment.
- A local flooding risk should any components become mobile in flood waters.

Predicted changes in peak velocity resulting from the proposal are typically expected to be in the range of plus or minus 0.25m/s which would ensure the stability of the bed and banks of existing watercourses and minimise further erosion potential. Localised increases in floodplain velocity in close proximity to piers for the proposed solar array are likely and piers should therefore be located outside areas subject to high velocity flows.

Structural damage to solar array infrastructure could be expected for areas categorised as being within hazard threshold H5 or H6. Development in these areas is avoided (Figure 1-4).

Design of footings for electrical componentry would consider flood risk. All infrastructure would be located above the 1% Annual Exceedance Probability (AEP) flood level plus 500mm freeboard so as not to impact on existing flood behaviour and to prevent infrastructure from being damaged. Infrastructure would be designed to withstand periods of local flooding. No components are considered susceptible to becoming mobile and entering waterways.

Access to the site via the Southern Access would utilise an existing low-level crossing within Wollar Creek that would become inundated in flood events (up to approximately 2.0m in the 1% AEP event). As such, flood warning signs, flood level indicators, a flood refuge building and a Business Floodsafe Plan should be implemented.

[2] Based on an obstruction of 2.5% of the available flow area (i.e. 150mm piers at 5-6m intervals).

7.5.5 Safeguards and mitigation measures

C: Construction; O: Operation; D: Decommissioning

Table 7-18 Safeguards and mitigation measures for hydrology and flooding.

ID	Safeguards and Mitigation Measures	C	O	D
1	The design of buildings, equipment foundations and footings for electrical componentry and panel mounts would be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including: • The solar array mounting piers are designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500mm freeboard, giving regard to the depth and velocity of floodwaters. • The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, would be located above the 1% AEP flood level. • Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water. • The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater. • Security fencing would be designed so as to create two separate fenced compound on either side of Spring Flat Creek. • Flood warning signs and flood level indicators would be installed on each approach to the existing low-level crossing at the Southern Access. • A weatherproof flood refuge building or structure would be constructed within the site on the western side of Wollar Creek.	Design		
2	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal. The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	C	O	D
3	A Business Floodsafe Plan would be prepared prior to construction in general accordance with the NSW SES Business Floodsafe Toolkit and Plan".	C	O	D

8 ASSESSMENT OF ADDITIONAL ISSUES

8.1 WATER USE AND WATER QUALITY

8.1.1 Existing environment

Surface water

The Wollar Solar Farm proposal site is located in the Central Tablelands Local Land Services area within the 22,000km^2 Hunter River Catchment. The dominant surface water feature within the locality is the Goulburn River, located approximately 18km north of the proposal site and feeds the Moolarben Dam storage area. The closest Nationally Important Wetland and Ramsar Wetland to the proposal site is the Macquarie Marshes and Nature Reserve, which is approximately 200-300km upstream.

The existing surface water environment within the proposal site is characterised by 15 dams (four to the south west, nine to the centre and two to the south east), two named watercourses (Wollar Creek and Spring Flat Creek) and approximately 8 unnamed tributaries. The dams are located mostly along the watercourses that traverse the site. All watercourses are described as ephemeral and would only contain flowing water during significant rainfall events. No flowing water or pooling was observed on any of the site visits (Figure 8-1).

Most of the smaller watercourses on the proposal site are tributaries of Spring Flat Creek which discharges into Wollar Creek approximately 2.5km north of the subject site. The two main named tributaries are described in Table 8-1 and shown in Figure 8-2. Wollar Creek (Figure 8-3) traverses the south eastern portion of the site, it contains aquatic habitat and vegetation, and is also mapped as Key Fish Habitat. Spring Flat Creek (Figure 8-4) flows through the proposal site in a south-west to north-east direction, and does not have defined channels.

Total catchment areas (and sub-catchments) contributing to the main watercourse were estimated by Footprint (2018) using Digital Elevation Models (DEM). The Wollar Creek catchment drains to an outlet within the TransGrid access road and covers an area of approximately 75ha. The total catchment area contributing to Spring Flat Creek at the northern boundary of the proposal site was estimated to be approximately 1,390ha (Footprint, 2018)

Water quality onsite for all the waterways would be influenced by the surrounding agriculture activities specifically stock access, informal waterway crossings and runoff of chemicals (e.g. fertilisers and herbicides) and animal waste. Additionally, the dams onsite have been contaminated with ash from a fire in February 2017. The fire occurred within the adjacent Crown Land, during which flows along the tributaries of Spring Flat Creek carried debris from the surrounding valleys onto the proposal site.

Table 8-1 4th order tributaries within the proposal site.

Tributary	Strahler Stream order[3]	Mapped as Key Fish Habitat?	Water present during site inspection?	Aquatic vegetation or habitat present	Water quality?	Description
Named Tributaries						
Wollar Creek	4th	Yes	Yes – pools of water	Yes – aquatic vegetation and habitat	Moderate – aquatic habitat present. However, the waterway is accessed by stock and contains informal vehicle crossings.	Main tributary onsite that flows from the north to the south within the south-eastern portion of the proposal site.
Spring Flat Creek	4th	Yes	No	No	Poor – no water flow, accessed by stock.	Incised drainage line. Potential to flow during rainfall events.

Figure 8-1 Unnamed 1st order tributaries of Spring Flat Creek located along the western boundary of the site.

[3] As determined by Footprint, (Footprint 2018).

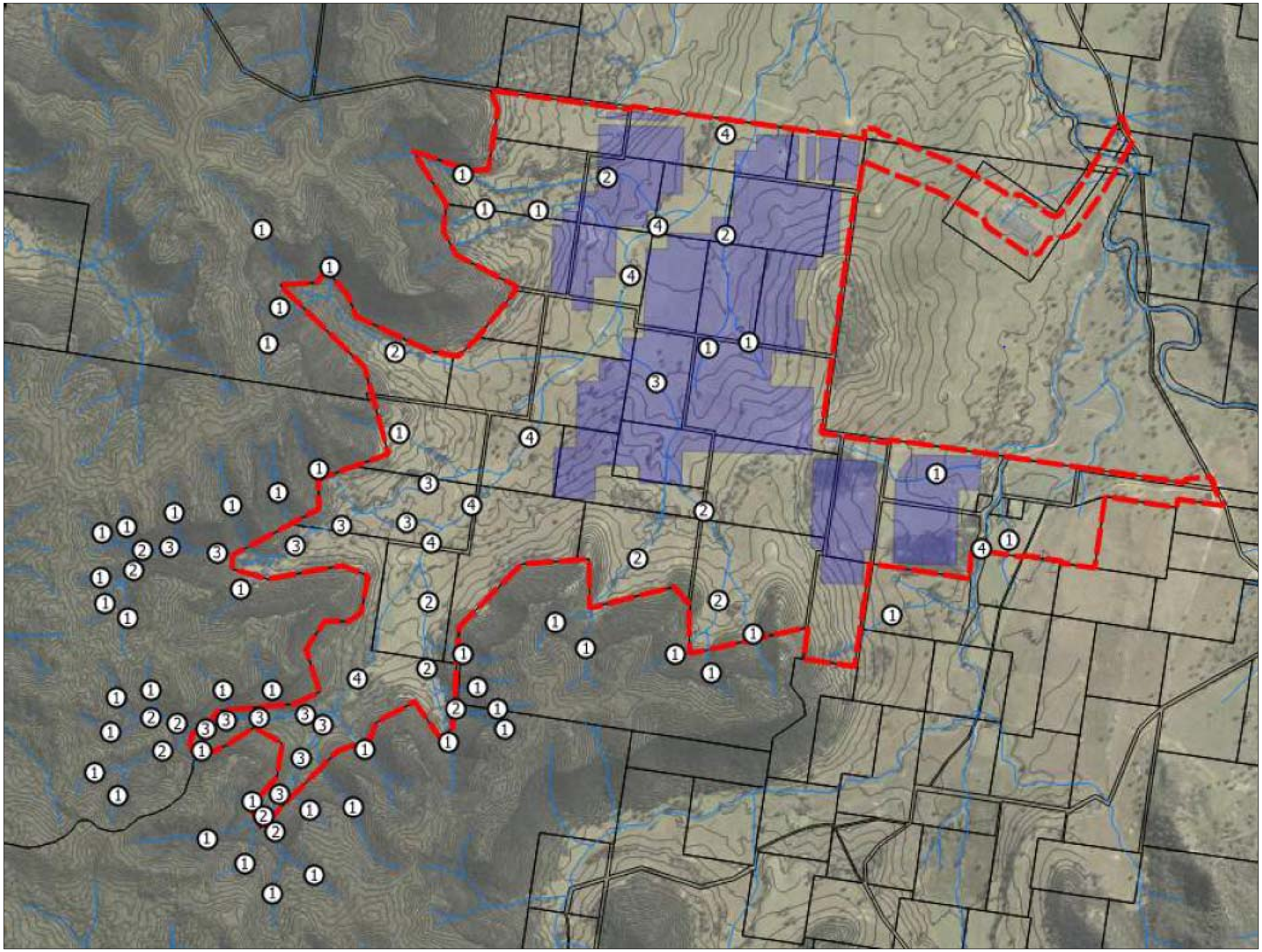

Figure 8-2 Waterways and stream orders within the proposal site (Footprint, 2018).

Figure 8-3 Wollar Creek (left – May 2018; right – August 2018).

Figure 8-4 Spring Flat Creek (left – north portion of proposal site; right – south portion of proposal site).

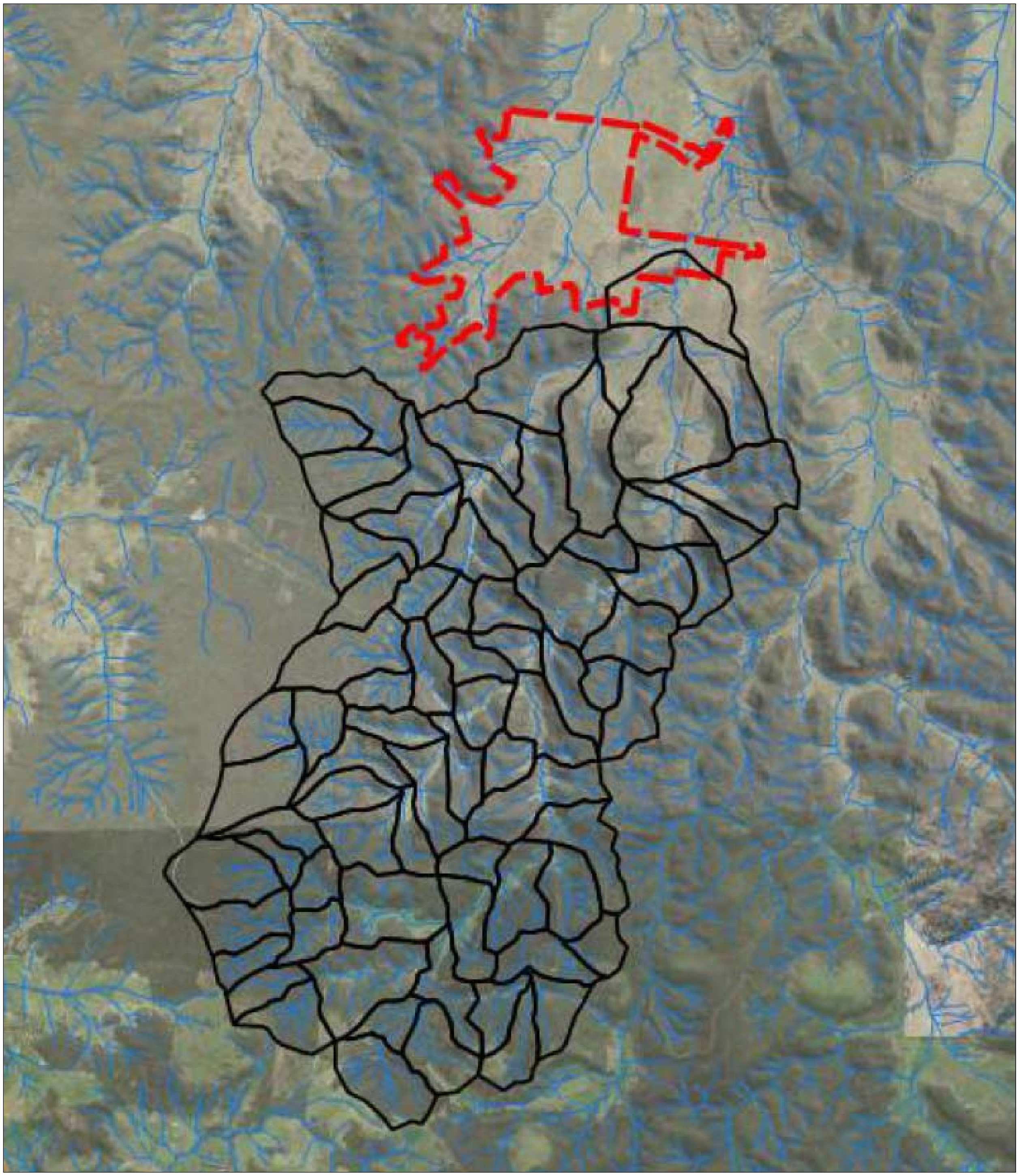

Figure 8-5 Wollar Creek catchment areas (Footprint, 2018).

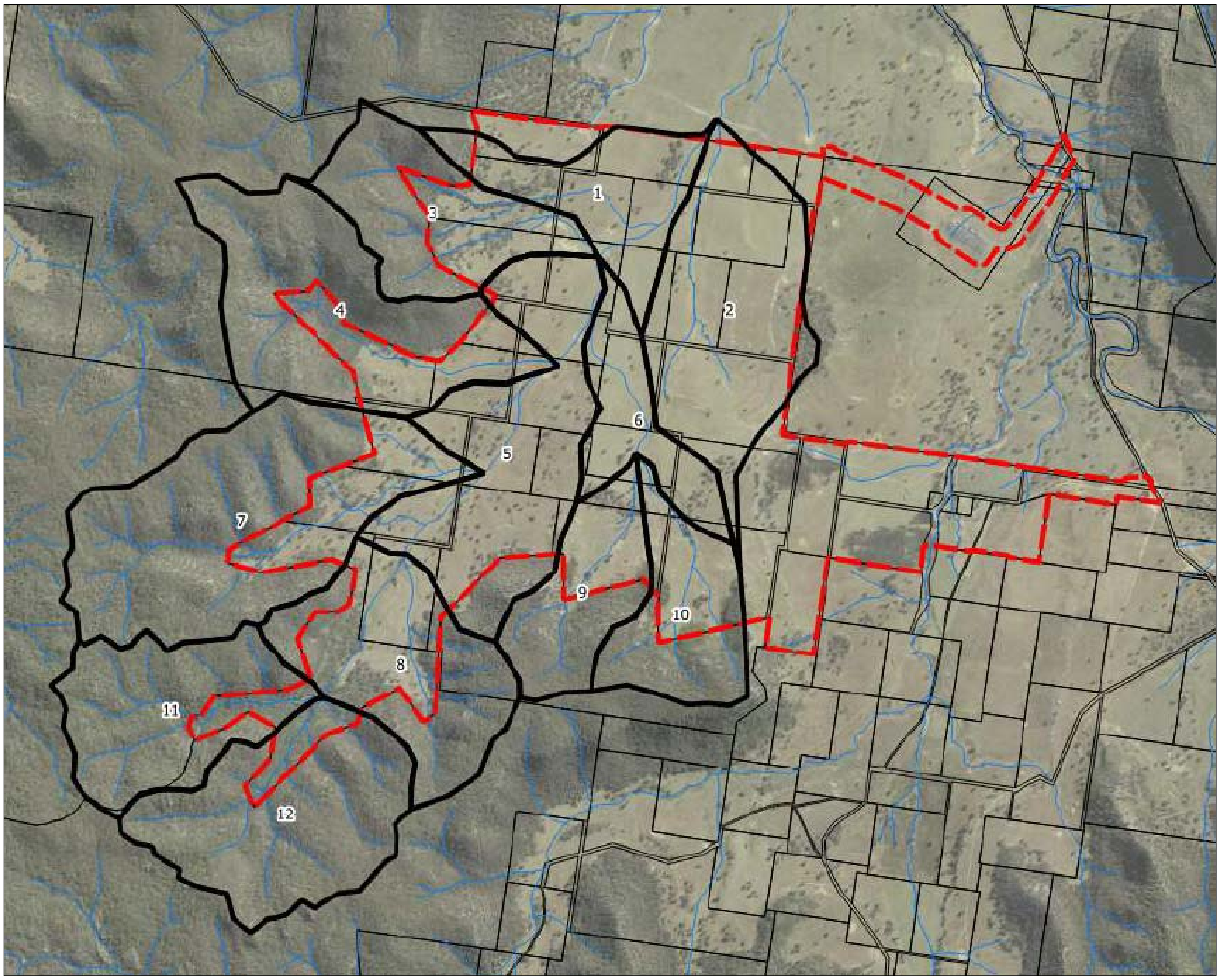

Figure 8-6 Spring Flat Creek sub-catchment plan (Footprint, 2018).

Groundwater and water entitlements

The NSW DPI database of groundwater lists no bores located at the proposal site or within 500m of the proposal site (Figure 8-7).

The proposal site is not located in an area mapped as having groundwater vulnerability under the Mid-Western Regional LEP.

The proposal site is subject to the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources.

Groundwater Dependent Ecosystems (GDEs)

Groundwater Dependent Ecosystems (GDEs) include ecosystems which may rely on the surface expression of groundwater (including surface water ecosystems that may have a groundwater component) and ecosystems which may rely on the subsurface presence of groundwater (including vegetation ecosystems).

The Groundwater Dependent Ecosystems Atlas (BOM, 2018) maps potential GDE's within the vicinity of the proposal site (Figure 8-8 and Figure 8-9). No Groundwater Dependent Ecosystems occur within the proposal site. Low potential terrestrial GDE's occur within and surrounding the proposal site.

Figure 8-7 Groundwater works surrounding the proposal site.

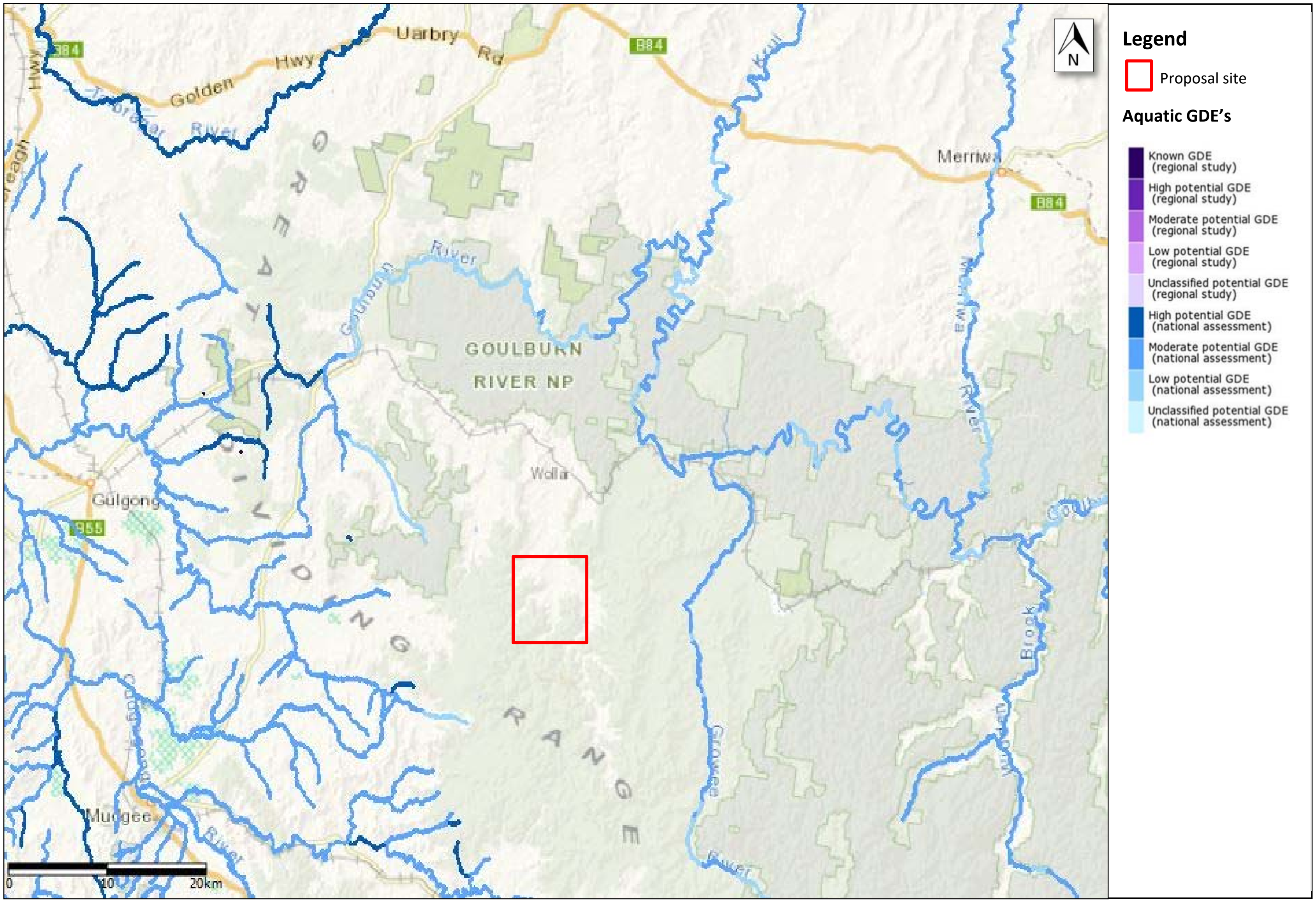

Figure 8-8 Aquatic Groundwater Dependent Ecosystems in proximity to the proposal site (BOM, 2018).

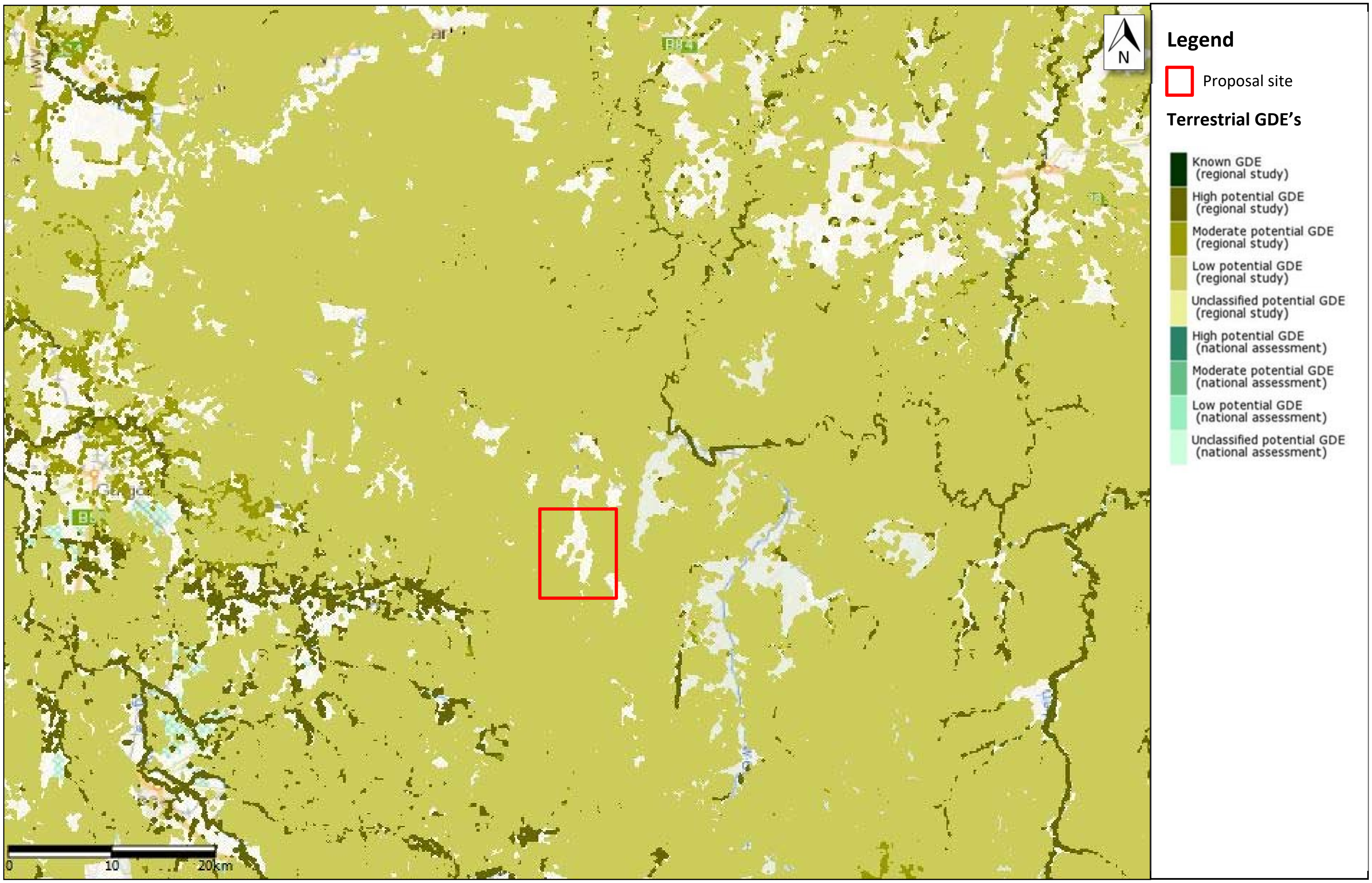

Figure 8-9 Terrestrial Groundwater Dependent Ecosystems in proximity to the proposal site (BOM, 2018).

8.1.2 Potential impacts

Construction and decommissioning

SURFACE WATER

Construction of the solar farm would disturb soils and potentially lead to sediment or other pollutants being present in runoff, mobilising and entering local waterways. Activities that may contribute to this include:

- Excavations for the construction of internal roads and associated drainage, parking areas, footings for onsite substation, inverters and maintenance building and footings for temporary staff amenities and offices during construction.
- Construction of up to two waterway crossings for internal access roads. The crossings would be located at Spring Flat Creek.
- Trenching for underground cable installation.
- Construction of hardstand areas and access tracks would result in soil compaction, consequently reducing soil permeability, increasing surface water runoff and the potential for concentrated flows.

During construction however, as much ground cover as possible would be retained and protected, by rationalising laydown areas and tracks and use steel piles that are driven or screwed into the ground rather than excavated footings.

Construction may slightly alter surface water drainage patterns, this would be managed by ensuring flow is directed to existing locations. Surface water would still drain via the ephemeral drainage lines which flow into Spring Flat Creek and Wollar Creek. The two main tributaries (Wollar Creek and Spring Flat Creek) would not be altered by the proposal with the exception for the construction of crossings for the internal access roads and for the installation of underground cables. The design and construction of the waterway crossings would need to consider the requirements of the following publications:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).
- *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003).
- *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012).
- *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (NSW DPI, 2012).

Given the waterway is categorised as a 4^{th} order stream under the Strahler System, a 40m buffer would apply and crossings would need to be in the form of bridges or culverts.

Solar panels would be installed over some sections of the drainage lines within the north west, north east and south east portion of the site. This is not likely to change the hydrology of the site or present any risk to bank stability. The drainage lines to be constructed over are 4^{th} order streams that are moderately grassed and prone to erosion, flow paths would only be created during substantial rainfall events.

The construction phase would entail the following water pollution risks:

- A hydrocarbon spill risk from use and re-fuelling of construction vehicles and machinery.
- On-site concreting for building and equipment foundations.
- Wash off from curing asphalt pavement and road seal.
- Storage and use of paints, cleaning solvents and other chemicals.
- Pesticide and herbicide storage and use.
- Fertilisers used for revegetation.

- Runoff from waste materials.

Sediment and chemical pollutants which enter the drainage lines present on the site have the potential to flow into Wollar Creek and be further transferred into the Goulburn River.

Activities with the potential for adverse water quality impacts would be managed through the development of site specific sediment control plans and spill control plans, as detailed in Sections 7.3 And 8.11. Additionally, impacts to local water quality can be minimised by ensuring erosion and sediment control plans include measures to ensure *Managing Urban Stormwater: Soils and Construction, Volume 1* (Landcom) criteria are met prior to discharge of water offsite.

GROUNDWATER AND GROUNDWATER DEPENDENT ECOSYSTEMS

No groundwater is anticipated to be intercepted, and no groundwater would be extracted. The maximum depth of infrastructure would be pile driven or screwed mounting structures up to a depth of 2 - 3m. The proposal site is not located in an area mapped as having groundwater vulnerability under the Mid-Western Regional LEP. Impacts to groundwater are considered unlikely to occur.

Groundwater supplies would not be affected, as such, impacts to Terrestrial GDE’s that are known to occur within the proposal site would not occur as a result of impact to groundwater supplies. No groundwater is anticipated to be intercepted and no groundwater would be extracted.

WATER USE

Water use during the construction phase would be minimal and used predominantly for dust suppression on unsealed tracks and for the construction of new roads. The requirement for water is dependent on weather conditions, such as wind and rainfall, and is anticipated to be up to 150 – 180ML in total. About 0.5ML of potable water would be required for employees and contractors (Table 8-2).

Table 8-2 Water requirements for construction of the proposal.

Water quality	Total construction water requirement (ML)	Sources	Availability
Potable (drinking)	0.5ML (for about 12 – 18 months)	Bottled water	Available as required – commercial supply
Non-potable	150 – 180ML (for about 12 – 18 months)	Truck delivery Dams Rainwater tanks	Available as required

Operation

SURFACE WATER

During operation, there is minimal potential for any impacts to surface water quality to occur. Suitable drainage features would be constructed along internal roads to minimise the risk of polluted water leaving the site or entering the waterways. As part of construction, the site would be revegetated with grass cover with the exception of internal roads, parking areas and areas around the substation. As such, water quality impacts during operation would be low and not considered substantially different to the existing potential water quality impacts occurring from onsite activities including cropping, and use of vehicles and machinery. There is potential for water quality onsite to be improved through revegetation of areas that are eroded with low levels of vegetation. Additionally, improvements to water quality may occur due to waterway crossings being constructed in accordance with waterfront land and water crossing guidelines and with the removal of agricultural impacts such as cattle access.

GROUNDWATER AND GROUNDWATER DEPENDENT ECOSYSTEMS

No operational activities would affect groundwater at the proposal site. No groundwater is proposed to be sourced during the operation of the solar farm.

WATER USE

It is estimated that up to 21.7ML would be required per year during operation and if insufficient water is collected on site from rain water tanks and dams, water would be obtained commercially.

Dust generated from the construction and operation of the Wilpinjong Extension Project may travel as far as the proposal site when prevailing winds are travelling from the north. It should be noted that prevailing winds for the Wollar region generally travel from the south and west (BOM, 2018), as such, panel cleaning is only expected to be required during periods of drought. Should panel cleaning be required, it is estimated that up to 700kL of water would be needed per year.

Water would be sourced from farm dams or trucked in if required. A license under the WM Act is not required to draw water from onsite dams, and a water use approval is not required for SSD.

Toilet facilities would be connected to a septic tanks installed in accordance with Mid-Western Regional Council requirements.

8.1.3 Safeguards and mitigation measures

Additional measures that would be implemented to manage water quality and water use impacts are provided below.

Table 8-3 Safeguards and mitigation measures for water quality and water use impacts.

C: Construction; O: Operation; D: Decommissioning

ID	Mitigation measures	C	O	D
1	Design waterway crossings and services crossing in accordance with the publications: • *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). • *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). • *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012). • *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (NSW DPI, 2012).	C	O	D
2	All fuels, chemicals, and liquids would be stored at least 40m from any waterways or drainage lines, not on sloping land and would be stored in an impervious bunded area.	C	O	D
3	The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
4	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D

ID	Mitigation measures	C	O	D
5	Roads and other maintenance access tracks would incorporate appropriate water quality treatment measures such as vegetated swales to minimise the opportunity of dirty water leaving the site or entering the waterways.	C		D

8.2 VISUAL AMENITY AND LANDSCAPE CHARACTER

8.2.1 Approach

This Visual Impact Assessment has been completed in the following stages:

1. Background investigations, including view shed modelling.
2. Field survey including ground truthing and photography of key viewpoints.
3. Community consultation.
4. Impact assessment.
5. Development of a visual impact mitigation strategy.

The assessment has been completed by NGH Environmental and is provided below.

Background information

Background investigations included identifying key landscape features within the locality that may be affected by the visual characteristics of the proposed solar farm. This was done using existing literature and aerial photos.

Mapping and modelling were undertaken to:

- Identify Landscape Character Units (LCUs) within 7km of the proposed solar farm. This was done based on aerial imagery and later validated with field inspection. LCUs are a way to summarise differences in landscape amenity and the visual sensitivity of different areas.
- Define areas in which the infrastructure may be visible, using Zone of Visual Influence (ZVI) modelling. A map identifying the ZVI (or viewshed) of the proposed solar farm was produced. This method models proposed infrastructure heights against topographic information to determine areas in which views of infrastructure may be visible. The infrastructure was modelled as 4m high for arrays and 6m high for ancillary infrastructure (i.e. inverters). Topography was based on a 2m resolution Digital Elevation Model (DEM). Modelling does not take into account screening that may be provided by existing vegetation or structures. The transmission line was not considered in the viewshed due to the height of the infrastructure and it not being a new visual feature in the landscape, transmission lines are a common feature within the study area.
- Identify key viewpoints such as major travel routes, public recreation areas, potential receivers (dwellings and other structures), and built up areas. This excluded areas deemed not to be visible from the ZVI modelling.
- Understand the feasibility of screening to mitigate visual impacts.

The ZVIs for the foreground (2km) and middle ground (7km) are provided in Figure 8-10.

The results were used to focus the field survey in areas where the proposal would be most visible.

Field survey

With reference to the background information above, field surveys were undertaken to:

- Validate and document the existing LCUs in the study area.
- Provide photographs from representative viewpoints within the LCUs, including foreground, middle ground and background viewpoints.
- Understand the likely extent of visibility and sensitivity of the LCUs to views of the proposed solar farm.

Fieldwork consisted of driving along publicly accessible roads, investigating and documenting dominant visual character elements and potential views to the proposed infrastructure. Photographs were taken at representative locations. No residences were specifically targeted however, nearby roadside viewpoints have been tagged 'residential' where they occur near a residence.

Representative view point locations and their associated LCUs are provided in Figure 8-11.

The property involved in the proposal is not represented by a specific viewpoint. Impacts on the involved residence are not considered in this assessment.

Community consultation

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

- Understand how the community values existing visual amenity in the study area.
- Document the perceptions of the community to solar farms in general and the proposed development specifically.

Community consultation was undertaken as part of the environmental impact assessment process, in accordance with a Community Consultation Plan. As part of the plan, respondents were surveyed on their views regarding solar farm development and local visual amenity. The feedback form questions are included in Appendix D. The results are used in the impact assessment and are summarised in Section 6.3.3.

Impact assessment

The impact assessment methodology used in this Visual Impact Assessment 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 proposed solar farm.

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

- Define Landscape Management Zones (LMZs) for the representative viewpoints, based on:
  - The scenic quality of the study area's LCUs.
  - The expected sensitivity at representative viewpoints.
  - The proximity of each representative viewpoint.
- Evaluate the degree of contrast the solar farm would result in at representative viewpoints in consideration of the management objectives of the relevant LMZ.
- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

The criteria for scenic quality, sensitivity, proximity, contrast and visual impact are included in the assessment, below.

Mitigation measures are considered warranted for 'high impact' receivers, for whom unmitigated impacts are considered greater than what is acceptable. For 'medium impact' receivers, the contrast is considered acceptable. For 'low impact' receivers, the contrast is considered low or not perceived.

8.2.2 Results

Existing environment

The proposed solar farm is located approximately 7km south of Wollar. Wollar is the closest village to the proposal site with a population of 69 people in (ABS) 2016. Mudgee is approximately 38km south west from the proposal site and is the closest regional center for residents of Wollar to access services; the population in (ABS) 2016 was 10,923 people.

Interesting regional features include Munghorn Gap Nature Reserve and Goulburn River National Park. The reserve is located approximately 9km to the west and the national park is approximately 13km to the north east of the proposal site. The Munghorn Gap Nature Reserve is the second oldest nature reserve in Australia and covers approximately 5,934ha. The reserve offers recreational uses and holds important Aboriginal heritage values. The Goulburn River National Park stretches along 90km of river that offers walking, camping and swimming opportunities as well as holding significant cultural values including over 300 known Aboriginal heritage sites. The proposal site is not visible from public roads or vantage points within the Munghorn Gap Nature Reserve and Goulburn River National Park, due to distances from the site and topography (refer to Figure 8-10).

Approximately 150km north of the proposed Wollar Solar Farm is the Siding Spring Observatory. The Dark Sky Region in NSW is centred upon the site of this observatory which is considered Australia's most important visible-light observatory. The Dark Sky region consists of land within a 200km radius of the observatory, which therefore includes the solar farm proposal site.

The land immediately surrounding the proposal site includes grazed (cattle) and Crown Land. Coal mining is the main local industry for employment in the Mid-Western Region, followed by beef cattle farming and primary education (ABS, 2016). The nearest mine site (Wilpinjong) is approximately 11km north west of the proposal site.

The proposal site is accessed via Maree Road off Barigan Road. Barigan Road provides access to one other road, Tichular Road. These three roads only lead to properties. The traffic is expected to be light and would be limited to local residences, deliveries and workers. The closest major transport corridor is Wollar Road, 7km north of the proposal site. Wollar Road provides access to Mudgee and Gulgong via Ulan Road that is comprised predominantly of local traffic. Ulan Road provides direct connections to both the Castlereagh Highway, which provides a direct connection to Sydney; Port Botany, and the Golden Highway, which provides direct access to Newcastle and the Port of Newcastle.

One residence is located within the proposal site, this is owned by the current landowner is located on the subject land. No other residences are within 2km of the proposal site. The closest receiver is 2.8km from the site and is not involved with the proposal.

Values of the community

Considering the broader community, a high percentage (77%) of Australian's believe that large scale solar farms could supply a significant source of Australia's energy requirements (ARENA, 2015). The large scale solar energy sector is still at a relatively early stage of development in Australia. While most members of the community are aware of large scale solar energy, many do not know a great deal about their impacts (ARENA, 2015), including visual impacts.

Three approaches to improving community understanding of the visual impacts of large scale installations (sourced from ARENA, 2015) 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.

This VIA endeavours to address these issues.

Considering the local community, all residents with the potential to be impacted were supportive of the proposal, with no significant objections or concerns. No respondents raised any concerns with relation to visual or noise impacts, effects on natural areas, effects on land use or land values, effects on recreational opportunities.

Landscape character units (LCUs)

Four key LCUs were identified within 15km of the proposed proposal site:

1. Agricultural (grazing lands and cropping lands, with low density dwellings and sheds).
2. Village (Wollar village).
3. Industrial / commercial facilities (Wollar Substation and Wilpinjong Mine).
4. Forest (surrounding ranges, including reserves and recreational areas).

The scenic quality was rated in each LCU as follows:

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

These four LCUs are characterised below.

Landscape Character Unit – Agriculture
Visual features The pastures with scattered trees are of low relief to undulating. Pastures are generally native, not irrigated and so are dull green through to beige and brown with the season and weather conditions. Scattered trees are either at low density or isolated remnants of open woodland. The scattered trees are more dominant along watercourses, roads and around dwellings. The pastures are mostly grazed, cropped green paddocks are rare in the landscape. The grazed paddocks and more intensively cleared area have less variety. Rocky outcrops are also dominant on the top of ridges and rises in the landscape. Unsealed roads and bare paddocks are light beige to dark brown. Local roads are curving, reflect the undulating terrain.

Residences within this landscape are sparsely distributed and commonly associated with additional landscape plantings and out buildings (sheds, yards). Low paddock fencing and electricity lines represents a linear pattern of production over the more organic pattern of the terrain.

In the flat areas, views would be expansive across the landscape. While in the undulating areas views can either be restricted or expansive depending on the viewer's location within dips or rises.

Scenic quality

Scenic quality is generally considered moderate. Elements have subtle variety and contrast and feature naturally pleasing element such as the ranges and scattered native vegetation remnants. Built elements are primary production related.

This LCU is common in the study area, but has features and variety. The proposed proposal site is located within this LCU.

Landscape Character Unit – Village

Visual features

Wollar is a small village with a population of 69 people in 2016. Community facilities include a general store (with post office and fuel), Community Hall, Rural Fire Service and a Public Primary School. There are currently only a small number of privately-owned properties in Wollar village, local mining companies have purchased the majority. Wollar is surrounded by grazing, mining and Crown Land. Wollar Creek is east of the village, it has a small riparian corridor and may have some recreational value to the local community.

Wollar village built environment shows historic character including two old churches and historic street signage. Colours vary from sandstone, yellows to grey. The General Store and private dwellings differ in materials and design with dominate colours being white, blue and grey. Other built forms include fences, water tanks and sheds. Vehicles, yards and gardens produce a residential character. There is limited formal front gardens. Views to the surrounding ranges are visible.

A recreational area is located adjacent to the General Store. It features playground equipment, toilets, landscaping and a memorial. Streets are sealed with no formal curbing or footpaths. There are no street plantings. The street layout is generally rectilinear.

Scenic quality

Scenic quality is considered moderate. These areas have variety in colour and form. They contribute to a unique historic character type framed by ranges in the distance. Built elements and the recreational area contribute to the character type. The character is important in defining the history of land use in the local area.

This LCU is not common in the study area.

Landscape Character Unit – Industrial / commercial facilities

Visual features

Wollar Substation is located 900m east of the proposal site and accessed off Barigan Road. It is dominated by Electrical infrastructure including overhead transmission lines, substation, high security fencing and gravel access tracks. The access track crosses Wollar Creek via a large concrete culvert. The creek is disturbed and vegetation within the waterway. There is limited vegetation within the riparian corridor. The substation is visible from Barigan Road but is not visible from Wollar Road due to the topography.

Wilpinjong Mine is an open cut coal mine located approximately 11km north west of the proposal site. A small part of the extraction pit is located within the 7km study area. This landscape is disturbed and dominated by exposed ground and machinery. Along Wollar Road receivers have glimpses of the mine, which is more obvious at night due to lighting. The mine is fully visible along Ulan-Wollar Road, as the road is adjacent to the road with limited screening.

Both commercial facilities are surrounded by the agricultural LCU. Access roads are unsealed.

Scenic quality

Scenic quality is considered low, these being commercially focused and having less variety and visual interest. No attempt to improve the amenity of the areas, such as vegetation plantings has been undertaken.

This LCU is not common in the study area.

(Sourced: Peabody, 2018).

Landscape Character Unit – Forested ranges and waterways

Visual features

The vegetated ranges to the west, south and east of the proposal site provide a dominant visual element to the study area. The colour is from dusky green-blue to grey. This LCU is in contrast to the low open expanses of the agriculture landscape. A recent fire in adjacent to the proposal site within Crown Land is dull grey in colour with patches of green for new growth.

Lookouts and walking tracks are present that allow for views across valleys. Munghorn Gap Nature Reserve is approximately 9km to the west of the proposal site. The reserve includes a picnic area with toilets, picnic tables and barbecue facilities. The main feature of the reserve is the Castle Rocks Walking Track. The walking track has a lookout that shows scenic views of the area and sandstone pagoda features of the reserve. Visitor numbers are not expected to be high due to its location and limited facilities (i.e. no camping). Due to the distance and topography the proposed proposal site is not visible from the reserve or lookout.

Limited public roads traverse these ranges within the study. There is no formal public access to the Crown Land adjacent to the proposal site.

Scenic quality

Scenic quality is generally moderate. Colour variation is low. Forms are generally uniform, lacking variety. Areas that appear untouched by settlement provide a pleasing visual contrast to the agricultural, rural residential and commercial LCUs. Recreational infrastructure provides a scenic recreational space where groups may congregate.

This LCU is common in the study area.

(sourced: NPWS, 2018).

Representative viewpoints

Representative viewpoints in the study area include travel routes such as roads, waterways, residential areas, houses and farmland. Representative viewpoints within each LCU were identified on the ground using ZVI modelling to ensure all viewpoints are located in the 'view shed' of the solar farm; that is, viewpoints were not selected in areas predicted to be shielded from views of the solar farm by topography.

The ZVI modelling (provided as Figure 8-10) assumes the proposal could be modelled as 4m high for arrays and 6m high for ancillary infrastructure (i.e. inverters). The modelling undertaken is based on the final infrastructure layout provided. The visibility is then modelled based on the number of points of the infrastructure block that can be seen. 100% means all points can be seen and equates to the highest visibility. The lowest score is 0%; none of the points of the infrastructure block can be seen.

Seven representative viewpoints were identified using the ZVI mapping (refer to Table 8-27 and Figure 8-10). The predicted sensitivity of each viewpoint can be determined, considering its proximity to the proposed proposal site and factors such as use, scenic quality and regional significance. Considering the sensitivity of local viewpoints, the following general assessments were made:

- Within the Agricultural LCU, viewpoints were assessed to be of low sensitivity on low use roads. One viewpoint has moderate sensitivity due to the proximity to the site and views across the site with forest LCU in the background.
- Within the Village LCU, the viewpoints have moderate sensitivity as it is a residential and commercial hub for the locality and includes historic features of the areas past.
- Within the industrial LCU, the viewpoint was assessed as low sensitivity due to the presence of the existing substation and transmission lines.
- No viewpoints were assessed for the Forest LCU, due to its distance from the site and lack of public viewpoints toward the proposal site.

The sensitivity of each viewpoint is tabulated below.

Table 8-4 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	View location	Representative receivers	Proximity	Scenic quality	Sensitivity
1	Agriculture	Public Road	Local traffic along Wollar Road.	Middle Ground	Moderate	**Low**
2	Village	Recreational /residential	Residents of Wollar (Receiver 5) and users of the Memorial Park.	Middle Ground	Moderate	**Moderate**
3	Agriculture	Public Road	Local traffic along Wollar Road and residents of Araluen Road (Receiver 4).	Middle Ground	Moderate	**Low**
4	Agriculture	Public Road	Traffic along Barigan Road and Receiver 6.	Middle Ground	Moderate	**Low**
5	Industrial	Public Road	Local traffic along Barigan Road.	Foreground	Low	**Low**
6	Agriculture	Public Road	Local traffic along Barigan Road and Tichular (Receivers 10, 11 and 12).	Foreground	Moderate	**Moderate**
7	Agriculture	Public Road	Local traffic along Tichular Road and Receiver 11.	Middle Ground	Moderate	**Low**

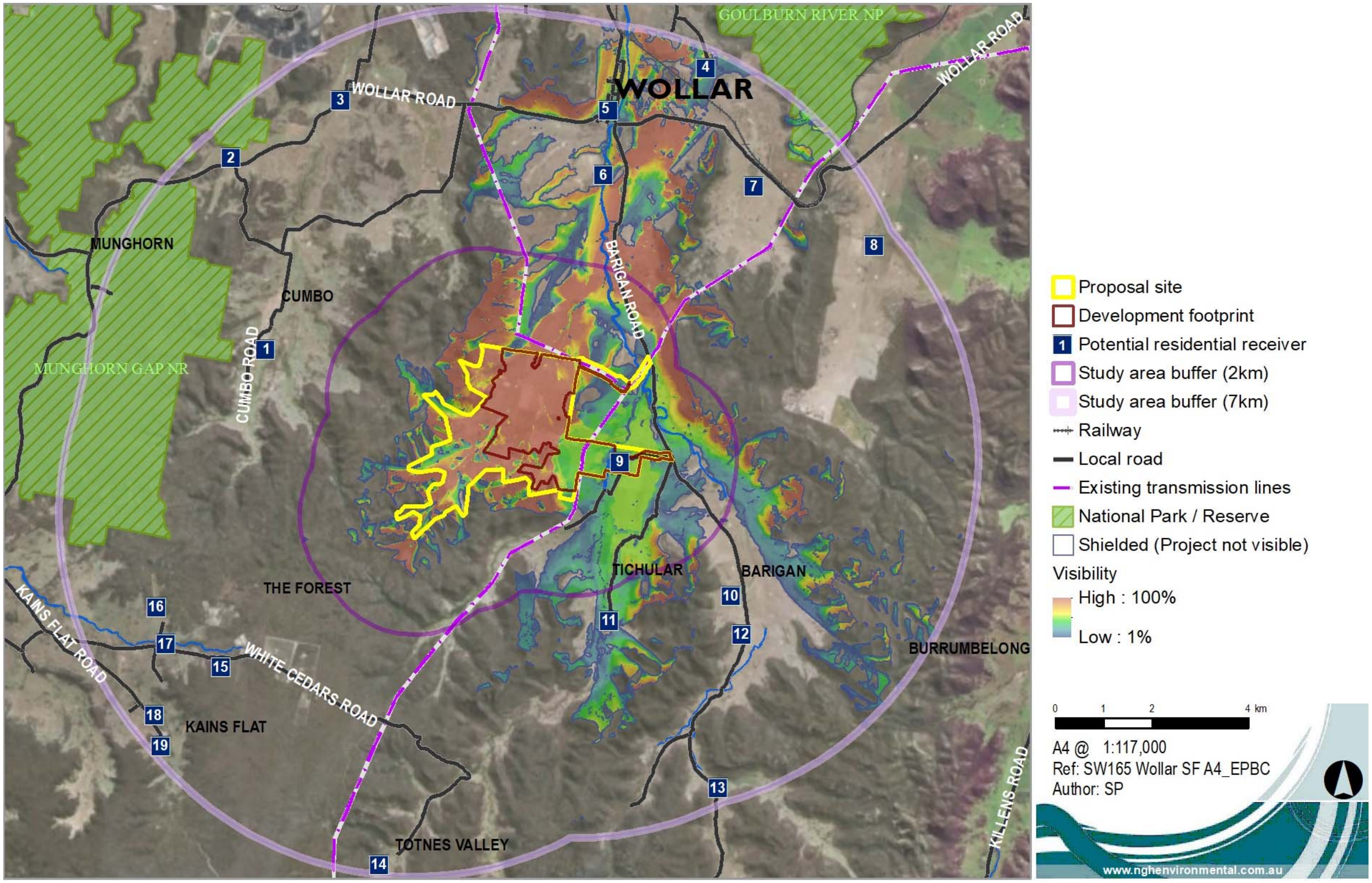

Figure 8-10 ZVI showing existing residential receivers and local roads and the low visibility of the solar farm to these. The exception is a short section of Barigan Road.

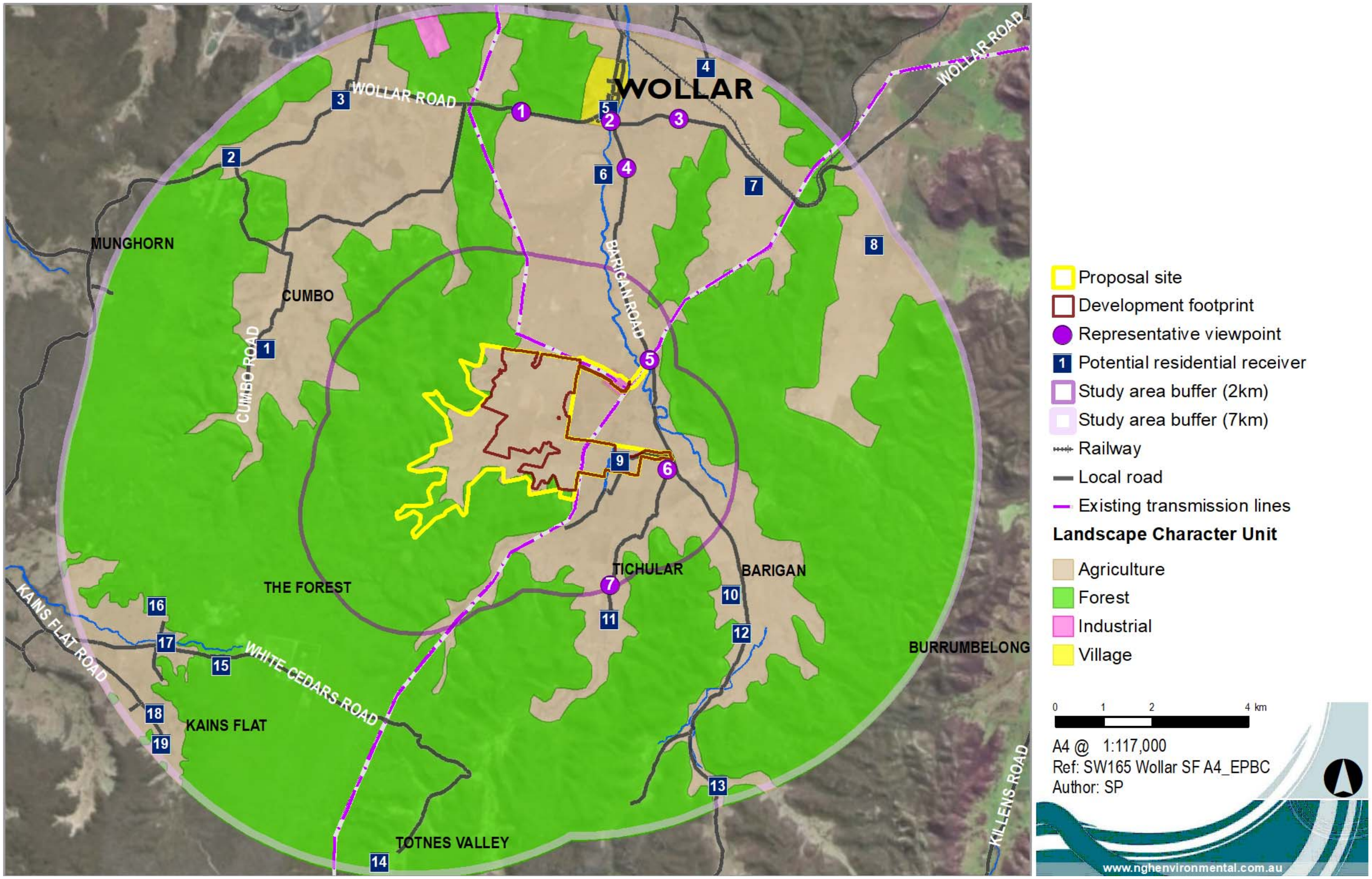

Figure 8-11 LCUs and representative viewpoints.

8.2.3 Potential impacts

Evaluation criteria

Visual LMZs were assigned to each viewpoint. The zones were derived by combining scenic quality, viewer sensitivity and the distance to the proposed proposal site. Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 8-5.

Table 8-5 Visual Landscape Management Zone decision matrix.

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

Each zone has associated objectives to guide management of visual change and to help evaluate impacts of the proposed solar farm. These are shown in Table 8-6.

Table 8-6 Visual Landscape Management Zone management objectives.

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

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

- High contrast: the proposed solar farm would be dominant within the landscape and generally not overlooked by the observer, the visual change would not be absorbed.
- Medium contrast: the proposed solar farm would be moderately dominant and noticed, the visual change would be partially absorbed.
- Low contrast: the proposed solar farm 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 whether the objectives of the visual LMZs 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 low or not perceived.

For high impact viewpoints, mitigation must be considered.

Table 8-7 below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating.

Table 8-7 Visual impact at representative viewpoints with reference to the Wollar Solar Farm, in order of highest impact.

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
6	Agriculture	Public Road	Traffic along Barigan Road and Tichular Road to Receivers 10, 11 and 12	Foreground <2km	B	Protect dominant visual features	Medium	**Medium impact** The array infrastructure would be located approximately 1.4km west from this viewpoint. Due to the topography solar infrastructure would visible. However the view would be broken by existing vegetation screening. The solar infrastructure would be a new type of structure and contrast with the existing agricultural and forest landscape character . Receivers would be people travelling along Barigan Road and Tichular Road. Both roads end at private properties. The people travelling along these roads would likely just be the residents and visitors of the three properties at this part of the road. Due to the impact only being temporary and short term along a road as well as being limited to a small amount of receivers, mitigation measures are not required. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
1	Agriculture	Public Road	Traffic along Wollar Road	Middle ground <7km	C	Reflect existing forms and colours	Low	**Low impact** This location occurs along Wollar Road, south of Wollar. The viewpoint is elevated above the solar farm, which is approximately 5km north west. The solar infrastructure would be a new type of structure and contrast with the existing agricultural and landscape character. However, views of the solar farm would be limited due to the distance and any views of the solar farm would be broken up by the existing vegetation screening. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
5	Agriculture /Industrial	Public Road	Traffic along Barigan Road	Foreground <2km	C	Reflect existing forms and colours	Indistinct	**Low impact** This viewpoint is located along Barigan Road. The proposal site would not be visible from this location. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
2	Village	Recreational /residential	Residents of Wollar (Receiver 5) and users of the Memorial Park	Middle ground <7km	B	Protect dominant visual features	Indistinct	**Low impact** This viewpoint is located in Memorial Park, Wollar. The proposal site would not be visible from this location. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
3	Agriculture	Public Road	Traffic along Wollar Road and residents of Araluen Road (Receiver 4)	Middle ground <7km	C	Reflect existing forms and colours	Indistinct	**Low impact** This viewpoint is located along Wollar Road, north of Wollar. The proposal site would not be visible from this location. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
4	Agriculture	Public Road	Traffic along Barigan Road and Receiver 6	Middle ground <7km	C	Reflect existing forms and colours	Indistinct	**Low impact** This viewpoint is located along Barigan Road. The proposal site would not be visible from this location. **No mitigation required.**

ID	LCU	Viewpoint	Representative receivers	Proximity	LMZ objective		Contrast	Visual impact
7	Agriculture	Public Road	Traffic along Tichular Road and Receiver 11	Middle ground <7km	C	Reflect existing forms and colours	Indistinct	**Low impact** This viewpoint is located along Tichular Road. The proposal site would not be visible from this location. **No mitigation required.**

Visual impact assessment at representative viewpoints

HIGH VISUAL IMPACT

The proposed solar farm would have no areas of high visual impact due to the screening provided by topography, distance and the low number of residents and low use roads near to the site. Mitigation measures are not required for these locations.

MEDIUM VISUAL IMPACT

One viewpoint was assessed as a medium visual impact, viewpoint 6. The viewpoint is located along Tichular Road and it represents traffic to Receivers 10, 11 and 12. The solar infrastructure would 1.4km west from this viewpoint and visible for vehicles travelling along this section of the Tichular Road and, further south vehicles travelling along Barigan Road. Both roads end at private properties and are likely to be only used by the residences of Receivers 10, 11 and 12. The traffic is expected to be low. The views of the solar farm would be broken up by the existing vegetation and view duration would be limited due to the receivers being travelling motorists. Due to the impact only being temporary and short term along a road with low traffic no mitigation is considered for this viewpoint. Mitigation measures are not required for these locations.

LOW VISUAL IMPACT

The remaining six viewpoints were assessed to have a low visual impact. These viewpoints were assessed as due to the undulating terrain, distance of infrastructure from the viewpoint, and existing vegetation between the site and receivers. Mitigation measures are not required for these locations.

Based on the findings of the visual impact assessment, visual screening and the development of a draft Landscaping Plan are not considered to be required. There are no areas of high visual impact and the one area of potential medium visual impact is limited to a low number of receivers and the views would be temporary and short term.

Dark Sky Region mitigation

Additional impacts are relevant to the proposal, given its location within the *Dark Sky Region*. The Dark Sky Region Guidelines have been prepared to ensure the night sky is free of light pollution and increased levels of atmospheric dust which may impact on the observatory. Measures to minimise light pollution include minimising night lighting and dust generation.

No permanent night lighting is proposed during construction or operation. External lighting would be provided around the buildings, and in the high voltage substation but they would only be used on the rare occasions that staff are working on the site during the hours of darkness.

There may be some security lighting at critical locations around the perimeter of the site, but these would only be activated when the automatic security system senses an unauthorised site entry. Task lighting would be provided at PCU's. Construction has potential to increase the levels of dust in the locality temporarily, which can impact visibility in the Dark Sky Region. Excavation would be minimal however the traffic on unsealed tracks is likely to increase local dust levels, particularly in dry conditions. Dust would be supressed during construction through the use of water applications and covering of loads.

During operation, the dust generation would likely be less than for existing agricultural land uses. The arrays themselves as well as the ground cover retained beneath the array would limit dust generation and movement. The unsealed perimeter access track would have low traffic levels during operation and is unlikely to generate substantially amounts of dust.

General measures to minimise light pollution including reducing dust have been included in the mitigation strategies for this proposal.

8.2.4 Safeguard and mitigation measures

Table 8-8 Safeguards and mitigation measures for visual impacts

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical: • Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown. • Pole mounts will be non-reflective. • Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.	Design		
2	During construction, dust would be controlled in response to visual cues.	C		
3	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).		O	

8.3 NOISE AND VIBRATION

8.3.1 Approach

A Construction and Operational Noise and Vibration Assessment for the proposed Wollar Solar Farm was undertaken by Renzo Tonin and Associates. The full report is provided in Appendix I and is summarised below. It includes consideration of noise and vibration impacts from the construction and operation phases of the proposal in accordance with SEARs.

8.3.2 Existing environment

The proposal site is located in a rural setting, approximately 7km south of Wollar village. The surrounding land uses are agriculture (predominantly grazing) and mining. Noise sources associated with the proposal site consist of a low number of local traffic along Barigan Road and agricultural activities such as operation of tractors, quad bikes and 4WD vehicles.

Figure 8-12 shows the locations of the nearest receivers to the proposal site, with the nearest non-involved residential dwelling being 2.8km north (R1).

8.3.3 Noise monitoring

Criteria for the assessment of construction and operation noise are usually derived from the existing noise environment of an area. The NSW Policy for Industry (NPfI) (EPA, 2017) outlines methods for determining the background noise level of an area. This assessment of the proposed works has used long-term noise monitoring.

Noise monitoring was undertaken near the closest residence (L1 Figure 8-12). Long term (unattended) noise monitoring was carried out at L1 between Thursday 22 May and Sunday 10 June 2018. The existing background and ambient noise levels determined from the monitoring are presented in Table 8-9.

Table 8-9 Measured existing background (L90) and ambient (Leq) noise levels, dB(A).

Monitoring location	L_{90} Background Noise Levels			L_{eq} Ambient noise level		
	Day	Evening	Night	Day	Evening	Night
L1 – 96 Maree Road, Tichular	23	26	23	45	40	39

The identified receivers surrounding the subject site are all classified as rural under NpfI guidelines. It was found that the background noise levels were typical for a rural area, with a day RBL less than 40dB(A), an evening RBL of 35 dB(A) and a night RBL less than 30dB(A).

Based on Table 2.1 of the NPfI Guidelines, where background noise levels are less than the minimum assumed Rating Background Noise Levels (RBLs), the minimum assumed RBL's are adopted for all receiver locations. Therefore, the background noise levels relevant to the Proposal are as per the fourth column of Table 8-10 below.

Table 8-10 Rating Background Noise Level, dB(A).

Time of day	Measured Existing Background (L_{90}), dB(A)	Minimum Assumed RBLs, dB(A)[1]	Applicable Rating Background Level, dB(A)
Day	23	35	**35**
Evening	26	30	**30**
Night	23	30	**30**

[1] In accordance with Table 2.1 of the NSW NPfI.

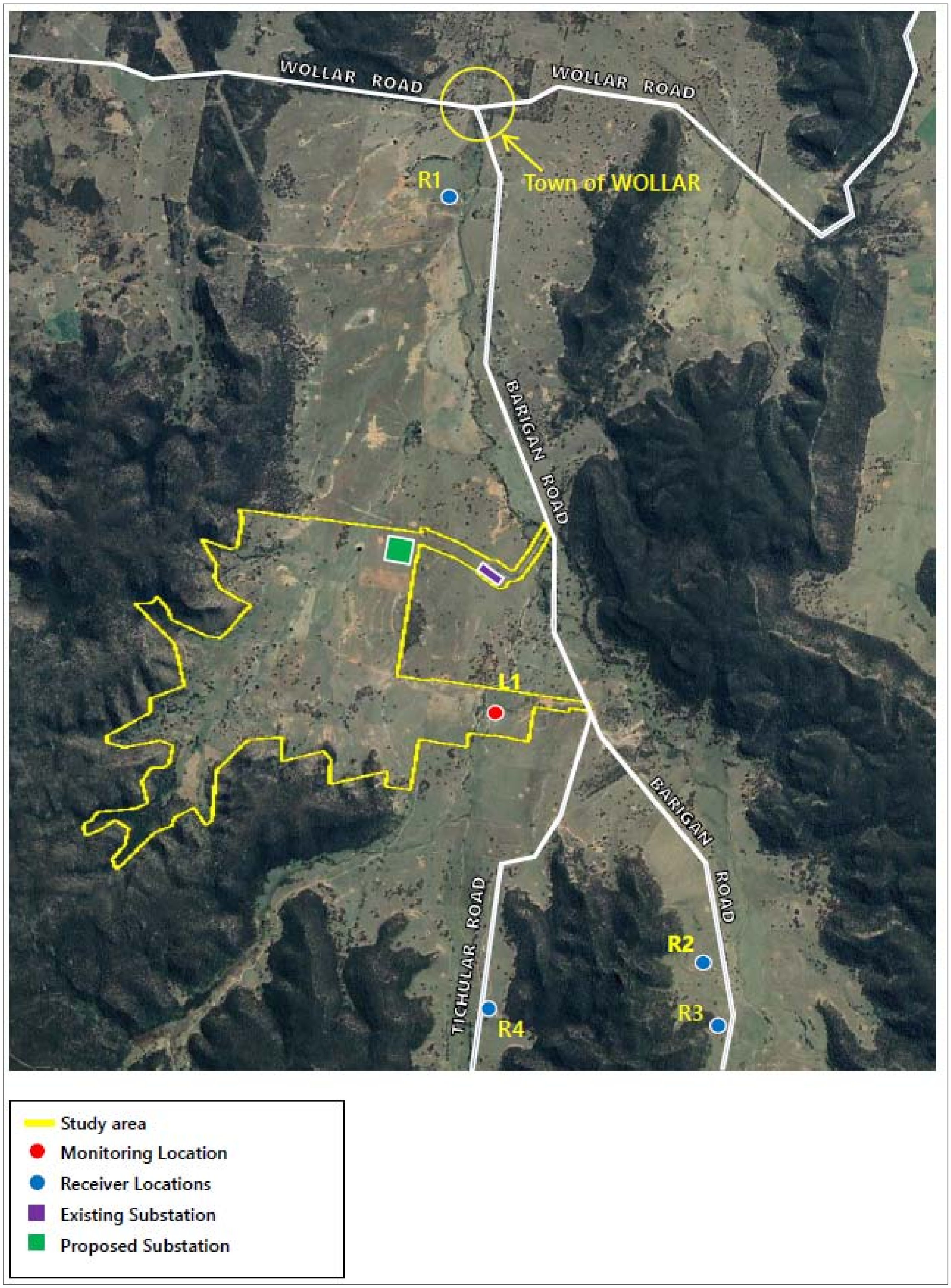

Figure 8-12 Residential receivers and noise monitoring locations adjacent to the proposal site (Renzo Tonin, 2018).

8.3.4 Construction noise impact assessment

Criteria

The NSW *Interim Construction Noise Guideline* (ICNG) (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 construction of the Wollar Solar Farm meets the requirements of a quantitative assessment.

Residential receivers

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers (Table 8-11). The Rating Background Level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period. Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified below.

Table 8-11 Noise management levels at residential receivers

Time of day	Management Level
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected Rating Background Level + 10dB(A)
	Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected Rating Background Level + 5dB(A)

Table 8-12 identifies the adopted construction Noise Management Levels (NMLs) for the nearest noise sensitive residential receivers for the Wollar Solar Farm proposal (refer to Figure 8-12). The NMLs for the receiver locations are derived from the RBLs represented by the background noise levels measured at the monitoring location (Table 8-10) and NSW ICNG (DECC, 2009) criteria (Table 8-11). During standard construction hours, a highly affected noise criteria of 75 dB(A) applies for all receivers.

Table 8-12 Construction noise management levels at residential receivers

Location description	Day L_{A90} background noise level (RBL)	Day noise management $L_{A90\ (15min)}$
All residential receivers (R1-R4)	35 dB(A)[1]	35 + 10 = 45 dB(A)

Construction noise sources

Noise impact predictions take into account the typical noise levels of construction equipment likely to be used for the construction phase. The equipment and their sound power levels to be used within the Proposal site are in Table 8-13.

Table 8-13 Typical construction equipment sound power levels within Proposal site.

Equipment used	Laeq Sound power levels (dBA) per single item	No. Items required
Small Pile Driving Rig	114	10
Crane	110	4
Drum roller	109	4
Padfoot roller	109	4
Wheeled loader	109	3
Dump Truck	108	6
30T Excavator	107	10
Grader	107	6
Chain trencher	104	4
Water truck	104	4
Telehandler	98	4
Forklift	90	4

Construction noise assessment

Noise emissions were determined by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments surrounding the study area. The modelling calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models take into account:

- Location of noise sources and receiver locations.
- Height of sources and receivers.
- Separation distances between sources and receivers.
- Ground type between sources and receivers.
- Attenuation from barriers (natural and purpose built).

Table 8-14 presents the noise levels likely to be experienced at the nearby affected receiver locations during the construction works within the Proposal site. The predicted levels are considered a worst-case scenario with up to three nosiest plants operating concurrently.

Table 8-14 Predicted Laeq 15 min construction noise levels at receiver locations for works with the Proposal site.

Receiver location (refer to Figure 8-12)	Noise management level[1]	Predicted construction noise Level, $L_{Aeq\ (15\ min)}$ [2]	Compliance with criteria? (Yes/No)
Residential receivers			
R1	45	<20-26	Yes
R2		<20-29	Yes
R3		<20-26	Yes
R4		<20-31	Yes

1. Noise management for standard day time construction works (i.e. Monday to Friday 7am to 6pm and Saturday 8am to 1pm).

Based on the construction noise levels presented in the table above, construction noise management levels are complied with when construction works are conducted at closest proximity to the receivers. No specific mitigation measures are required, with the exception of a Noise Management Plan to ensure compliance with the *NSW Noise Policy for Industry* (NPfl) (EPA, 2017)

8.3.5 Operational noise assessment

Background noise monitoring

The background noise data collected to assess construction noise was also used to assess operational noise.

Criteria

The NSW *Noise Policy* for Industry (NPfl) (EPA, 2017) specifies noise criteria relating to intrusive noise impacts and noise level amenity. The assessment criteria under the NPfl for the Wollar Solar Farm is outlined in Table 8-15.

Table 8-15 Proposal specific criteria

Assessment Criteria	Proposal Specific Criteria
Intrusive	Rating background level + 5dBA
Amenity	$L_{Aeq\ period}$ recommended amenity noise levels – 5dBA $L_{Aeq\ period}$ + 3dBA

The operational proposal-specific noise criteria for the solar farm based on the NPfl criteria and guidelines (Table 7-22) is shown in Table 7-23 and Table 7-24.

Table 8-16 Intrusiveness noise criteria

Receiver	Period	Laeq (15 minute) (dBA)
All residential receivers [1]	Day	35 + 5 = 40
	Evening	30 + 5 = 35
	Night	30 + 5 = 35

Notes: Intrusiveness criteria is only applicable for residential receivers.

Table 8-17 Applicable amenity noise criteria

Receiver	Indicative noise amenity area	Time of day	Recommended noise level	
			$L_{Aeq\ Period}$	$L_{Aeq\ 15\ min}$
Residence (R1-R6, R9 and R11-R13)	Rural	Day [1]	50 – 5 = 45	45 + 3 = 48
		Evening [2]	45 – 5 = 40	40 + 3 = 43
		Night [3]	40 – 5 = 35	35 + 3 = 38

Notes: 1. Day is defined as 7.00am to 6.00pm, Monday to Saturday, 8.00am to 6.00pm Sundays and Public holidays

2. Evening is defined as 6.00pm to 10.00pm, Monday to Sunday and Public Holidays.

3. Night is defined as 10.00pm to 7.00am, Monday to Saturday, 10.00pm to 8.00am, Sundays and Public Holidays.

In accordance with the NpfI guidelines, the Proposal noise trigger levels are the lowest (i.e. more stringent) value for the proposal intrusiveness noise levels and proposal amenity noise levels. These have been determined and reproduced in Table 8-18 below.

Table 8-18 Proposal Noise Trigger Levels, dB(A).

Receiver location (refer to Figure 8-12).	$L_{Aeq\ 15\ min}$ Proposal Noise Triggers[1]		
	Day	Evening	Night
Residential receivers			
R1 – Lot 1/DP755455, Wollar	40	35	35
R2 – Lot 65/DP755430, Barigan Rd, Barigan			
R3 – Lot 1/3DP758054, Barigan			
R4 – Lot 94/DP755430, 358 Tichular Rd, Tichular			
R10			

Notes:
1. Monday-Saturday, Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
2. On Sundays and Public Holidays, Daytime 8.00 am – 6.00 pm; Evening 6.00 pm – 10.00 pm; Night-time 10.00 pm – 8.00 am.
3. The Laeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.
4. Proposal Noise Trigger Levels only apply when premises are in use.

To assess the likelihood of sleep disturbance, the potential of maximum noise level events from premises during the night-time period has been considered in this assessment. In accordance with NpfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{Afmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

Operational noise assessment

In order to determine the noise impacts of the operating solar farm, a computer model incorporating all significant noise sources, receiver locations, topographical features of the intervening area, and potential noise control treatments surrounding the study area. The modelling calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

Additionally, in accordance with NPfl noise predictions, three meteorological conditions are considered, including:

- Calm and isothermal conditions (acoustically neutral) – no wind and no temperature inversion.
- Slight to gentle breeze –3m/s wind velocity at 10m from ground level between each noise source and each noise receiver (as per INP default wind conditions). Wind direction was based on wind travelling from the source to the receiver.
- Moderate temperature inversion – applicable for noise predictions during night time periods only.

Table 8-19 and Table 8-20 present the predicted noise levels for the 'worst case scenario' based on concurrent operation all plant and equipment shown in Table 8-13. The tracker motors were time corrected based on their operation of one (1) minute out of a 15 minute period.

Table 8-19 Predicted cumulative Laeq 15min operational noise levels at residential receiver locations, dB(A).

Receiver location (refer to Figure 8-12).	Proposal noise triggers[1]			Predicted operational noise levels, Laeq (15 min)			Comply? (Yes/No)
	Day	Evening	Night	Calm and isothermal conditions	Slight to gentle breeze	Moderate temperature inversion[2]	
R1	40	35	35	<20	24	24	Yes
R2				<20	21	21	Yes
R3				<20	<20	<20	Yes
R4				<20	26	26	Yes

Notes: 1. Criteria for Day, Evening and night periods

2. Applicable for the night time period only.

Table 8-20 Predicted Laeq 15min operational noise levels at other sensitive receiver locations, dB(A).

Receiver location (refer to Figure 8-12).	Proposal noise triggers[1]			Predicted operational noise levels, $L_{Aeq\ (15\ min)}$			Comply? (Yes/No)
	Day	Evening	Night	Calm and isothermal conditions	Slight to gentle breeze	Moderate temperature inversion[2]	
R7	68	68	68	26	32	32	Yes
R8	63	63	63	26	32	31	Yes
R10	63	63	63	31	35	35	Yes

Notes: 1. When in use

2. Applicable for the night time period only.

Based on the predicted noise levels presented in the table above, operational noise levels from the proposed solar farm and the upgraded substation at the nearest receivers each comply under all scenarios and meteorological conditions.

The predicted operational noise levels would additionally be below the sleep disturbance criteria of 40 dB(A) and 52 dB(A). No specific mitigation measures are required, with the exception of a Noise Management Plan to ensure compliance with the *NSW Noise Policy for Industry* (NPfl) (EPA, 2017)

8.3.6 Vibrational assessment

Vibration generating activities would occur only during the construction phase of the solar farm. There are no vibration generating activities expected during the operational phase. As the nearest identified receivers are in excess of 3km from the subject site, structural damage due to vibration and vibration impact on human comfort are not expected and no mitigation measures are required.

8.3.7 Road traffic noise assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP, 2011). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

Vehicle access to the proposed proposal site would be via Wollar Road, Phillip Street, Maitland Street and Barigan Road. Based on information provided by the client, the estimated vehicle movements per day throughout the construction stage are presented in Table 8-17. Furthermore, vehicle movements would only occur during the day time period when construction works occur. Therefore, to determine the average hourly vehicle movements to and from the site, the daily vehicle movements (excluding one off delivery and pick up) were divided by 11 to represent the weekday construction hours from 7am to 6pm. Wollar Road is categorised as sub-arterial road and Barigan Road is categorised as a local road. Criteria for these roads is outlined in Table 8-21

Table 8-21 RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Proposal/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L_{Aeq},(1 hour) 60 (external)	L_{Aeq},(1 hour) 55 (external)
Local road	Existing residences affected by additional traffic on existing local roads generated by land use developments	L_{Aeq},(1 hour) 55 (external)	L_{Aeq},(1 hour) 50 (external)

Table 8-22 Summary of estimated construction traffic volumes during peak (excluding one off delivery and pick up).

Vehicle type	Trips per day
Cars/light vehicles	40 (20 in/20 out)
Trucks/heavy vehicles	Up to 24 (12 in/12 out)

Notes: 1. Average hourly movements (excluding one off delivery and pick up) based on movements per day ÷ 11, representing construction hours from 7am to 6pm

Table 8-23 Predicted road traffic noise contribution levels along public roads, dB(A).

Receiver	Road	Criteria	Truck traffic movements	Speed (km/h)	Distance to Road	Predicted Noise Level	Comply? (Yes/No)
Nearest Residence on Wollar Road, Philip Street and Maitland Street	Sub-arterial	$L_{Aeq(15\ hour)}$ 60 dB(A)	Refer to Table 8-22	50	13.1m	55 dB(A)	Yes
Nearest Residence on Barigan Rd	Local	$L_{Aeq(15\ hour)}$ 55 dB(A)	Refer to Table 8-22	50	460m	35 dB(A)	Yes

From the above table, it can be seen that predicted road traffic noise level contributions from the vehicle movements associated with the construction works comply with the applicable noise criteria at the nearest affected receivers along Wollar Road, Phillip Street, Maitland Street and Barigan Road.

As the construction traffic noise levels are temporary and comply with the RNP criteria set above, it indicates that the traffic noise levels due to the construction works for the solar farm would not adversely affect the existing residences along Wollar Road, Phillip Street, Maitland Street and Barigan Road during construction of the proposed solar farm. No specific mitigation measures are required with the exception of a Noise Management Plan to ensure compliance with the *NSW Road Noise Policy* (RNP, 2011).

8.3.8 Safeguards and mitigation measures

Table 8-24 Safeguards and mitigation measures for noise impacts

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A Noise Management Plan would be developed as part of the CEMP. The plan would include, but not be limited to: • Use less noisy plant and equipment where feasible and reasonable. • Plant and equipment to be properly maintained. • Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. • Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel. • Avoid any unnecessary noise when carrying out manual operations and when operating plant. • Any equipment not in use for extended periods during construction work should be switched off. • Complaints procedure deal with noise complaints that may arise from construction activities. Each complaint	C		

ID	Safeguards and mitigation measures	C	O	D
	would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits. • Establish good relations with people living in the vicinity of the site at the beginning of proposal and maintain. Keep people informed, deal with complaints seriously and expeditiously. The community liaison member of staff should be adequately experienced.			

8.4 HISTORIC HERITAGE

8.4.1 *Approach*

A desktop study was undertaken to identify any historic heritage (Non-indigenous) items or places in proximity to the study area, with a focus on the proposal site and surrounding landscape. Heritage databases searched as part of this assessment are:

- The Australian Heritage Database, this includes items on the National and Commonwealth Heritage Lists, to identify any items that are currently listed within or adjacent to the proposal site.
- The NSW State Heritage Inventory (SHI), this 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 site.
- Heritage schedule of Mid-Western Regional LEP 2012, for locally listed heritage items, that are within or adjacent to the proposal site.

8.4.2 *Results*

The results of the heritage searches listed above indicate that no known historic items or places occur on the site. A summary of the results of the heritage searches are illustrated in Table 8-25. Details of listed items are provided below.

Table 8-25 Summary of heritage listed items in the Mid-Western LGA.

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
Commonwealth Heritage Places	1
NSW State Heritage Register	14
NSW State Agency Heritage Register (section 170)	28
Mid-Western Regional Local Environmental Plan (LEP) 2012	449

Australian Heritage Database

The Australian Heritage Database search was undertaken on the 22 August 2018. No items were found to be listed under the National Heritage List for the Mid-Western Regional LGA. One Commonwealth Heritage Place was found within the LGA, Mudgee Post Office. The Mudgee Post Office is approximately 38km south west of the proposal site. Therefore it would not be impacted by the proposal.

NSW State Heritage Inventory

The SHI database search was undertaken on the 22 August 2018. No known items listed under the World Heritage List were identified for the Mid-Western Regional LGA.

There were 14 items listed under the NSW State Heritage Register and 28 items listed under the NSW State Agency Heritage Register (Section 170) for the Mid-Western Regional LGA. None of these items were identified onsite, with the closest items being in Gulgong and Mudgee, which are approximately 40km and 38km from the proposal site.

Mid-Western Regional Local Environmental Plan 2012

The Mid Western LEP database search was conducted on the 22 August 2018. No local heritage items have been recorded onsite. The closest listed items are located in Wollar, approximately 7km north of the proposal site. The listed items include:

- Barigan Homestead.
- Wandoona Homestead.
- Wollar Catholic Church.
- St Luke's Anglican Church of England.
- St Luke's Anglican Church Cemetery.

Unlisted heritage items

Although no listed items were identified within the site, it is acknowledged that there may be unlisted items of historic significance on the subject site. No additional potential heritage items were identified within the proposal site during the site inspection.

8.4.3 Potential impacts

Several heritage items were identified during the desktop study as outlined above. Although none of these items are in proximity to the proposal site, they are within the haulage route. A qualified Heritage Consultant advised that these would not be impacted by vibration or dust from construction traffic.

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.

There are no anticipated impacts on any of the above identified heritage items during construction, operation or decommissioning, due to the location of the proposed solar farm.

8.4.4 Safeguards and mitigation measures

A protocol for unexpected finds would be developed for the proposal, as detailed below.

Table 8-26 Safeguards and mitigation measures for Non-Aboriginal Heritage

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
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

8.5 SOCIAL AND ECONOMIC IMPACTS

8.5.1 Existing environment

The proposal site is within the Mid-Western Regional LGA in Central West NSW. The region covers about 9,000km^2 and includes several historic towns, large agricultural land holdings as well as large coal mining operations. Table 8-27 outlines localities that are within close proximity and are relevant to the proposal site.

Table 8-27 Localities close to the proposal site and with relevance to the proposal.

Location	Distance from proposal site	Relevance to proposed solar farm
Wollar	7km north	Wollar is the closest village to the proposal site.
Mudgee	38km south-west	The closest regional centre for residents of Wollar.
Ulan	25km north-west	Host to the Ulan coal mine.
Wilpinjong	11km north-west	Host to the Wilpinjong coal mine.
Moolarben	20km north-west	Host to the Moolarben coal mine.
Beryl	50km north-west	4km south of the closest approved solar farm to the proposal site.
Gulgong	40km north-west	9km south-east of and the closest regional centre to the residents of Beryl.

Industry profile

The Mid-Western Regional Council's publication covering the 2018 economic and business profile provides up to date information about the region. Overall economic growth of more than $100 million per annum is comprised mainly of contributions from mining, construction, agriculture, real estate and health care. Of the 2,625 registered businesses in the region, approximately 445 are engaged in agriculture and approximately 367 in construction. Significant population growth is expected in line with ongoing expansion of the coal mining industry, tourism sector and the establishment of state significant developments.

The *Central West and Orana Regional Plan 2036* (DPE, 2016) describes the region as *"… one of NSW's most diverse regional economies…".* In 2011, the largest gross regional product contributors according to the plan were:

1. Mining, contributing $2.5 billion and 5% of jobs.
2. Agriculture, forestry and fishing, contributing $1.3 billion and 11% of jobs.

Additionally, health care and social assistance contributed $1.1 billion, manufacturing contributed $1 billion and education and training contributed $849 million.

The plan also presents the top three economic opportunities for the Mid-Western Regional Council as:

- Mining.
- Agribusiness.
- Tourism.

The regions coal mining sector is concentrated around Mudgee and Lithgow, and coal mines of particular relevance to the proposal site include the existing mines surrounding Wollar village including Wilpinjong coal mine, Ulan coal mine and Moolarben coal mine and the proposed Bylong Coal Project.

The most recent agricultural census (ABS, 2010-11) showed the total value of agricultural commodities in the Mid-Western Regional LGA to be $48,110,977 (0.41% of NSW) and the total value of agriculture as a whole to be $64,715,602 (0.55% of NSW). Total land in the region used for crops, fruit and vegetables was 10,204 ha (0.14% of NSW) and for beef cattle, dairy cattle, chickens, horses, pigs and sheep was 536,506 ha (0.81%).

The top 3 contributors to agribusiness in 2011 within the Mid-Western Regional LGA were:

1. Wool, contributing $28.4 million.
2. Cereal crops, contributing $27.4 million.
3. Cattle and calves, contributing $16.1 million.

Socio-economic profile

The socio-economic profile of the Mid-Western Regional LGA, Mudgee and Wollar are presented in Table 8-28.

Table 8-28 Socio-economic overview of Mid-Western LGA, Mudgee and Wollar (ABS, 2016; Mid-Western Regional Council, 2018).

Statistic	Mid-Western Regional LGA	Mudgee	Wollar
Population	24,826	10,923	69
Average age	42	37	41
Dominant employment industries	Mining Retail Health Agriculture Construction	Mining Supermarket and grocery stores Primary education Aged care residential services Local government administration	Mining Agriculture
Unemployment rate	4.4%	5.8%	No data available
Highest age group employed	45 – 49	25 – 34	No data available

Statistic	Mid-Western Regional LGA	Mudgee	Wollar
Aboriginal/ Torres Strait Islander population	5.4%	6.2%	No data available
SEIFA index[4]	Ranked 72 5th decile	Ranked 757 3rd decile	Ranked 604 3rd decile

Large-scale renewable energy benefits

In 2017, about 700MW of renewable energy made up of 16 projects were constructed and began generating electricity (Clean Energy Council, 2018). Total large-scale solar capacity reached 450MW at the end of 2017 after four new large-scale projects were completed. The equivalent number of households powered annually through large-scale solar in Australia is 151,243, and through all renewable energy generation sources totals 8,297,986 households. The beginning of 2018 saw an additional 21 large-scale solar projects under construction, contributing to the 6,080 jobs created by renewable projects as a whole as of April 2018.

The successful introduction of battery storage into renewable energy projects was highlight in 2017. The Hornsdale Wind Farm installed the world's largest lithium-ion battery which supplies energy back into the grid. This proved valuable during a large power disruption in January 2018 when the battery delivered 100 MW into the national electricity grid in 140 milliseconds (Clean Energy Council, 2018). The effectiveness of solar power was also further realised in the February 2018 Queensland heatwave during which power generated by rooftop solar contributed between 400MW to 585MW each day to assist in meeting electricity needs across the state.

Electricity consumption in Australia is exceptionally high, resulting in costly electricity bills and frequent disruptions to electricity supply during peak times. The renewable energy sector has responded to this high demand and to the need for viable alternative options for electricity generation contributing to 17% of Australia's overall electricity (Clean Energy Council, 2018).

An analysis of electricity price increases between 2006 and 2016 was undertaken by the Australian National University (ANU). The ANU reported that those states with relatively low levels renewable energy experienced higher electricity prices (NSW, QLD and VIC). States with higher levels of renewable energy, in particular South Australia which generated almost half of its energy from renewables, had a far lower electricity price.

Although electricity prices are anticipated to increase again in 2018, the Australian Electricity Market Commission predicts electricity prices would fall an average of 6.2% over the following two years coinciding with more wind and solar generation. The NSW governments long term goal to reach zero-net emissions by 2050 is supported by the Climate Change Fund Strategic Plan that aims to double renewable energy capacity in NSW to more 10,000 MW by 2021. Reaching this goal would contribute to higher levels of renewable energy and consequently lower electricity prices as experienced by households and businesses in SA.

[4] Socio Economic Indexes for Areas (SEIFA) is a suite of indexes created by the ABS. The Index of Relative Socio-economic Advantage and Disadvantage (IRSDAD) summarises data about economic and social conditions of people and households in an area. Ranking of NSW suburb's and LGA's are used in this report with 1 being most disadvantaged (1st decile) to 2643 being most advantaged (10th decile).

A 10 year Economic Development Plan has been developed by the Mid-Western Regional Council with the aim of encouraging:

'… a strong and diversified economy that delivers lifestyle benefits to the community through supporting business and investment activities that in turn generate opportunities for employment, income and sustainable economic growth" (Mid-Western Regional Council, 2015).

A set of key principles are identified by the Mid-Western Regional Council as essential in influencing economic development. The proposed Wollar Solar Farm would contribute to a number of these, specifically:

- Employment.
- Investment.
- Workforce skills.
- Business development.
- Infrastructure.

Establishing large scale solar in the region would strengthen the economy by diversifying industry which is currently dominated by coal mining and agriculture. This is in line with the *Central West and Orana Regional Plan 2036* which identifies renewable energy as a more sustainable energy source for the region. Additionally, the plan states that growth in solar energy will promote local jobs in smaller communities and development opportunities for future industries.

Community attitudes to renewable energy

Generally, solar energy development enjoys community support. OEH commissioned community research regarding attitudes to renewable energy in 2014 found that 89% of people support the use of renewable energy in the form of solar farms in NSW. Furthermore, 78% of respondents supported having a solar farm within 1-2 km of where they lived. Among the reasons for this were benefits to the environment and local economy. A significant amount (83%) of respondents believed that NSW should produce more of its energy from renewables over the following 5 years (OEH, 2015).

In research carried out by Ipsos for the Australian Renewable Energy Agency (ARENA), 48% of respondents agreed that the local economy is positively impacted by large scale solar facilities and 68% agreed that establishing more large scale solar facilities would reduce Australia's carbon emissions. Making funding available for large scale solar facilities was viewed as a priority over non-renewable energy by 60% of respondents.

The outcomes of this research resulted in five key themes that are important in establishing a social license to operate (SLO). These are noted below and are addressed in the following EIS sections:

1. Reliability and efficiency (Section 4.2).
2. Visual Impacts (Section 8.2).
3. Environmental Impacts (Sections 7.1, 7.2, 7.3, 7.4, 7.5, 8.1, 8.3, 8.4, 8.7 and 8.10).
4. Economic and employment impacts (Sections 2.2 and 8.5).
5. Health impacts (Sections 8.1, 8.6, 8.8 and 8.9).

Proposal consultation activities and results

Section 6.3 provides a detailed summary of consultation and feedback to date undertaken as part of the CCP for the Wollar Solar Farm (Appendix C). All residents with the potential to be impacted were supportive of the proposal, with no significant objections or concerns. Generally, questions and issues raised by the community centred around the following:

- Potential implementation of purpose built work camps may lead to adverse impacts for local landowners.
- Concerns over Increased traffic on Barigan Road during construction due to the narrow width of the road.

These concerns are addressed in this EIS with consideration given to the values of the Community.

During an open house community information session held in Mudgee, feedback forms were distributed to attendees. Of the responses, all were supportive of renewable energy generation, 78% supported diversification of land use and income streams and 71% supported the local economic opportunities provided by solar farms. No respondents raised concerns with relation to visual or noise impacts, effects of natural areas, effects on land use or land values or effects on recreational opportunities.

8.5.2 Potential impacts

Construction

During peak construction, the Wollar Solar Farm would generate approximately 500 jobs directly contributing to strengthening the economy. Up to 500 workers is a maximum estimation, the amount of workers required for proposal would likely be less. Local residents would make up a large proportion of the workforce, with the remaining workers moving to the area for the duration of the construction phase. These benefits are anticipated to extend to local service centres including Mudgee. These townships would provide accommodation, food, fuel and trade equipment and services. Local employment would be maximised by consulting with local employment and training organisations, and potentially supporting training and apprenticeships relevant to the proposal.

ACCOMODATION AND SERVICES

The construction period may place temporary strain on local service, including accommodation, retail outlets and health services. Mudgee and Gulgong would likely be the main town centres providing accommodation for construction staff. The proposal commits to hiring locally (to reduce accommodation and service pressures) and liaising with local representatives to coordinate accommodation services. It is expected approximately 50% of the workforce (approximately 250 workers) would be from the local community.

Mudgee

Mudgee is located approximately 40 mins south-west of the site. In 2016, there were 4,516 private dwellings in Mudgee, including 525 unoccupied private dwellings. Online rental websites indicate 66 properties available to rent (Domain, 2019). Mudgee has multiple accommodation options, including 5-star accommodation, self-contained apartments, guesthouses, hotels and motels. The Social Impact Assessment for the Bylong Coal Project (Hansen Bailey, 2015) concluded that the 71 short-stay accommodation providers within the Mudgee area had an estimated capacity of 1,855 beds. The following accommodation options were included in this assessment:

Table 8-29 Accommodation options within Mudgee area (Hansen Bailey, 2015).

Accomodation type	Number within Mudgee area	Total guest capacity
Caravan Park	3	477
Motel	9	663

Accomodation type	Number within Mudgee area	Total guest capacity
Hotel	3	125
Bed and Breakfast	17	193
Self-contained establishment	39	193
Total	71	1651

In 2016-2017, Mudgee received between 1,500 - 3,800 visitors per month (Mudgee Region, n.d.). The Mudgee Region Tourism Board has identified objectives to increase the visitor economy spend and increase the visitor average length of stay in Mudgee (Mudgee Region Tourism, 2017). Taking a conservative approach if the entirety of the 500 person workforce was not local, they would represent approximately 8 to 30% of tourism traffic and would occupy 15% of the total guest capacity indicated within Table 8-29.

Gulgong

In addition to Mudgee, the town of Gulgong is approximately 45 minutes west of Wollar. In 2016, there were 1,025 private dwellings in Mudgee, including 109 unoccupied private dwellings. Online rental websites indicate 2 properties available to rent (Domain, 2019).

Gulgong has six hotels and motels provide accommodation within Gulgong with one specifically aiming advertising at contractors.

Additional accommodation options in other localities within the vicinity include:

- Three guest houses in Eurunderee (45 minutes to Wollar).
- The Cooyal Hotel in Cooyal (20 minutes to Wollar).
- Didgy Ridge, a single cottage in Cooks Gap (30 minutes to Wollar).
- Goulburn River Stone Cottages, three cottages in Ulan (35 minutes to Wollar).
- Potential private overnight stays through Airbnb or other online platforms.

TRAFFIC

Given the region is a hub for tourism, construction traffic has the potential to have adverse effects on road users visiting the area. Additionally, the residents of Wollar may be impacted by the increase in traffic during the construction period, which may exacerbate existing mine traffic. A Traffic Impact Study has been undertaken and is discussed in Section 8.6.

During construction, the proposal site would be visible to traffic travelling along Tichular Road to the south-east of the site. Construction has potential to increase the levels of dust in the locality temporarily. Excavation would be minimal however the traffic on unsealed tracks is likely to increase local dust levels, particularly in dry conditions. Dust would be supressed during construction through the use of water applications and covering of loads. No night lighting, with the exception of limited security lighting, is anticipated.

Operation and decommissioning

Increased economic security of rural communities may be provided through the conversion of agriculturally compatible rural land to solar power generation by diversifying employment opportunities and income streams. Additionally, solar power generation contributes to State and National greenhouse emission reductions objectives by providing stable and renewable electricity generation.

The operation of the Wollar Solar Farm would also contribute to meeting the goals of the Mid-Western Regional Council 10 year Economic Development Plan by:

- Generating employment opportunities
- Supporting sustainable economic growth
- Contributing to diversification of local industry
- Facilitating investment opportunities

Agriculture is prevalent in the local community, however the soil capability at the proposal site is severely limited and has high limitations for high-impact land uses (Section 7.3). Given the low impact nature of installing solar array modules, solar farms have the potential to provide an alternative stream of income. This is particularly relevant for the proposal site where drought has been a considerable and costly issue.

Adverse socio-economic impacts are anticipated to be minimal during operation and decommissioning. During operation, maintenance staff and associated activities would be consistent but limited. The additional accommodation, traffic and use of services are not likely to be noticeable. Where possible, maintenance staff would be sourced from the local area.

Less staff are likely to be required for decommissioning than during construction. The economic benefits during this stage would be similar to construction, introducing local opportunities for employment, accommodation and services. Additionally, local recycling of infrastructure components would potentially occur during the decommissioning stage.

8.5.3 Safeguards and mitigation measures

Table 8-30 Safeguards and mitigation measures for Social and economic impacts.

C: Construction; O: Operation; D: Decommissioning

ID	Mitigation measures	C	O	D
1	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
2	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
3	Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
4	The Community Consultation Plan would be implemented to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the Proposal and proposal benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.).	C		D

ID	Mitigation measures	C	O	D
	• Protocols to respond to any complaints received.			
5	The Proponent will consult with local employment agencies and training organisations and where practicable, will consider supporting training and apprenticeships.	C	O	D

8.6 TRAFFIC TRANSPORT AND SAFETY

Ontoit (2018) prepared a Traffic Impact Assessment for the proposed construction and operation of the Wollar Solar Farm. The report is summarised below and provided in full in Appendix J.

8.6.1 Existing environment

The proposed solar farm is located within the Mid-Western Regional LGA off Barigan Road approximately 7km south of Wollar village.

Existing road network

Wollar village is accessed via three primary road corridors:

1. Wollar Road from the west which connects to Ulan Road to access the Regional Centre of Mudgee to the south.
2. Wollar Road from the east which connects to Ringwood Road to access the Golden Highway or alternatively continues to access the Bylong Valley Way to access Bylong and Murrumbo.
3. Ulan-Wollar Road from the north that connects to Ulan Road and the Golden Highway to the north or alternatively to Gulgong via Cope Road in the west.

Figure 8-13 illustrates the location of the proposed Solar Farm and key access corridors.

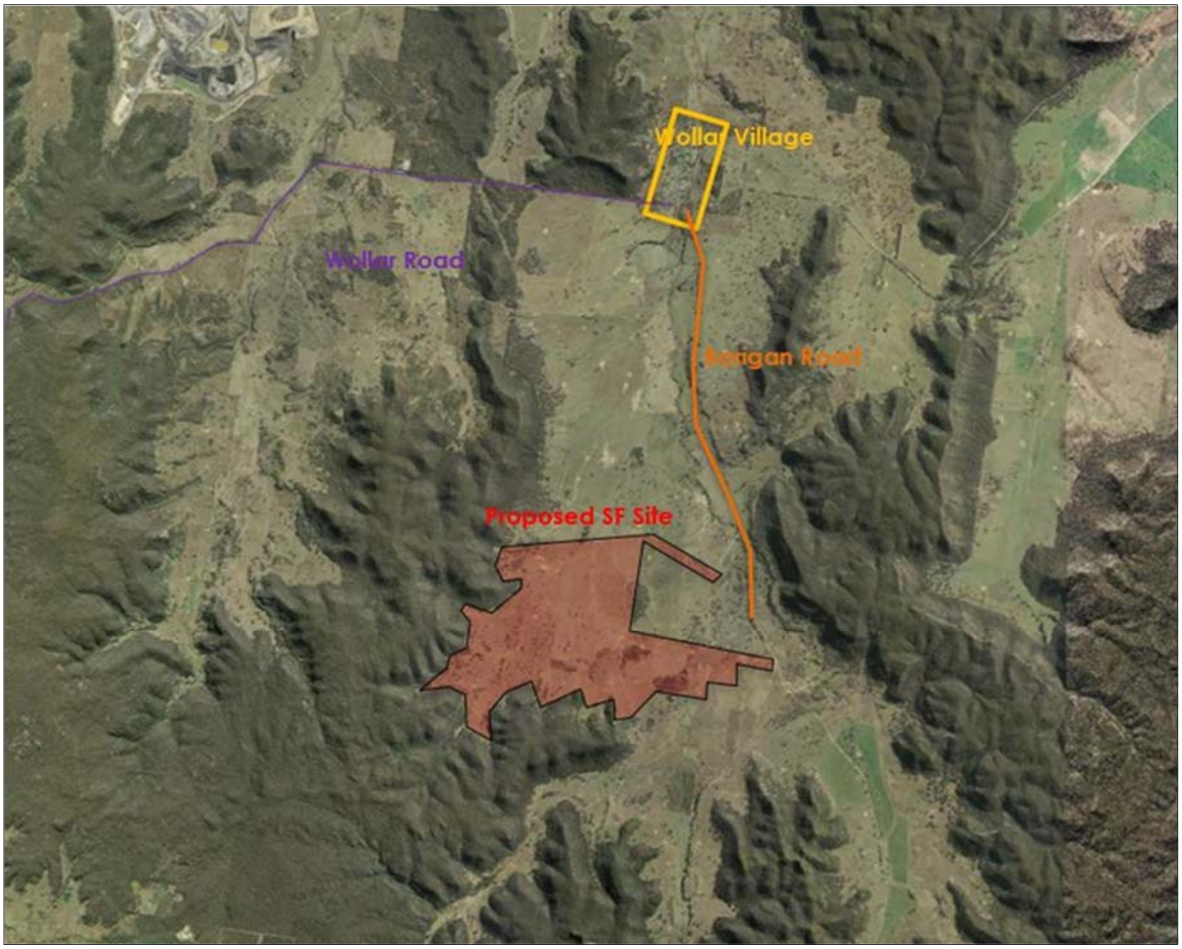

Figure 8-13 Proposed Proposal site and key access corridors (Ontoit, 2018).

Access to the proposed Proposal site is via the three primary access corridors that connect to Wollar Village. From the village, access to the site is via Barigan Road which links the proposed access roads to the site. Characteristics for each of these roads are different and are briefly described below:

WOLLAR ROAD

- East and west of Wollar Village, is classified as a Regional Road in the RMS Road Classification Hierarchy and consists of:
    - Sealed bitumen road with approximate carriageway width of 7m (Figure 8-14and Figure 8-15).
    - Single traffic lane in each direction.
    - Line marking in the form of centre lines and in some cases road edges.
    - Regular property and commercial development accesses directly off the roads.
    - Posted speeds on open road and in built up areas.
    - Regular unsignalized priority-controlled intersections with local roads.
    - An existing roadway capacity of approximately 600-900 vehicles per hour, per lane.

ULAN-WOLLAR ROAD

- Not a classified road within the RMS Road Classification Hierarchy and is therefore a local council access road, key characteristics include:

- o Sealed bitumen road with approximate carriageway width of 7m (
- o Single traffic lane in each direction.
- o No regular Line marking in the form of centre lines and in some cases road edges.
- o Regular property and commercial development accesses directly off the roads.
- o A number of rail crossings.
- o Posted speeds 100kph on open road and 50kph in built up areas.
- o Regular unsignalized priority-controlled intersections with local roads.
- o An estimated existing roadway capacity of approximately 300-500 vehicles per hour, per lane.

BARIGAN ROAD

- Not a classified road within the RMS Road Classification Hierarchy and is therefore a local council access road, key characteristics include:
    - o Unsealed road with approximate carriageway width of 6-7m (Figure 8-16and Figure 8-17).
    - o Single carriageway road with no formal line marking, requires vehicle to slow and move to one side to enable safe passing.
    - o Regular property and commercial development accesses directly off the roads.
    - o Regular unsignalized priority-controlled intersections with local roads.
    - o An existing roadway capacity of approximately 300 – 500 vehicles per hour.

Figure 8-14 Wollar Road between Ulan Road and Hayes Gap Road (Ontoit, 2018).

Figure 8-15 Wollar Road between Mahons Road and O'Brien's Lane (Ontoit, 2018).

Figure 8-16 Barigan Road immediately after Wollar village (Ontoit, 2018).

Figure 8-17 Barigan Road 2 – 3km south of Wollar village (Ontoit, 2018).

From a broader regional perspective, the proposed proposal site is easily accessible via the regional road network that connects to the regional centres of Mudgee and Gulgong. Both Mudgee and Gulgong are accessible via Wollar Road and Ulan Road. Further to this, Ulan Road provides direct connections to both the Castlereagh Highway, which provides a direct connection to Sydney; Port Botany, and the Golden Highway, which provides direct access to Newcastle and the Port of Newcastle. These regional connections will likely play a critical role during the establishment of the solar farm.

Existing vehicle volumes

Local area traffic data was sourced from two locations:

- The 2015 Wilpinjong Extension Project – Road Transport Assessment (GTA Consultants).
- A site visit conducted on 7 August 2018.

Figure 8-18 illustrates the location of survey traffic data that was collected during the 2015 counts and from the recent site visit.

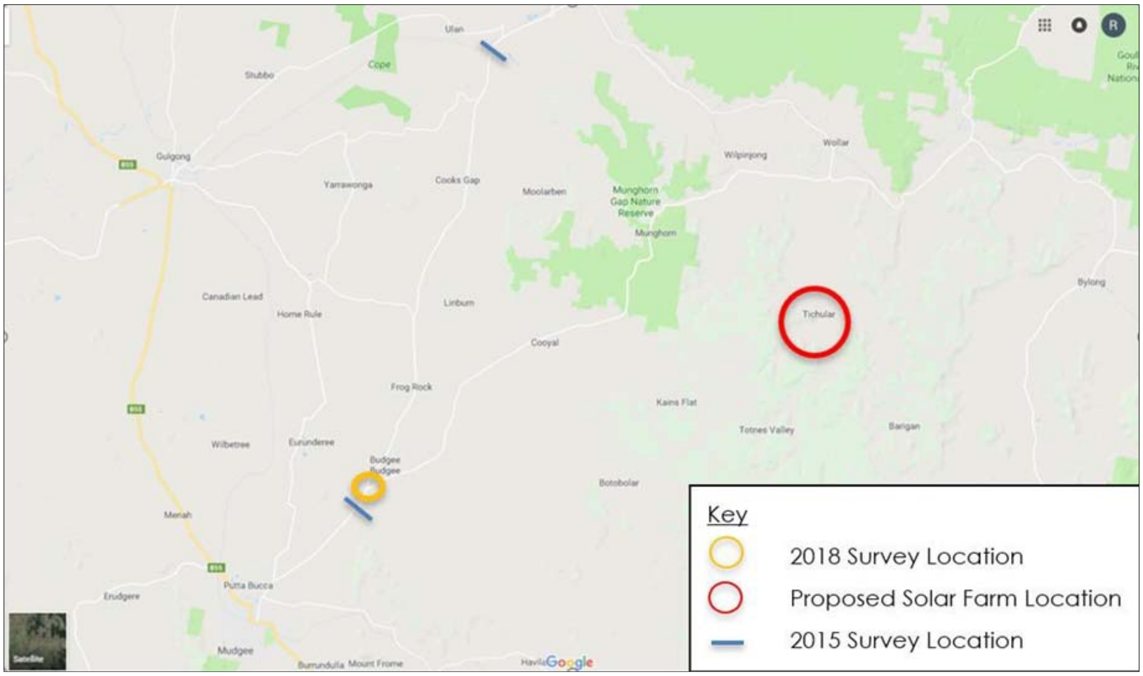

Figure 8-18 Location of survey traffic data collection in 2015 (GTA Consultants) and 2018 (Ontoit).

Given the above information, traffic survey data was collected to establish a robust baseline for the primary road corridors; Ulan Road and Wollar Road. In addition, comprehensive 24-hour, 7-day data was collected in 2015 (Attachment A.1 of Appendix J) which was utilised to determine the location and timing of the 2018 surveys. As such, the 2018 surveys were focused at the Ulan Road / Wollar Road intersection; to enable a comparison between the existing 2015 data and to obtain recent movement and turning data for the Ulan Road – Wollar Road corridor. The 2018 surveys were focused on:

- The AM Peak Period – determined to be 5am-6am consistently from the 2015 traffic counts; and
- A PM Count – the 2015 traffic surveys had varying PM peak periods which were dependent on location. Therefore, the 2018 count was undertaken between 3pm and 4pm to obtain a typical weekday PM traffic volume count (this was also consistent with the southbound Ulan Road, south of Wollar Road 2015 count PM peak Period).

The results of the 2018 traffic surveys are illustrated in Figure 8-19.

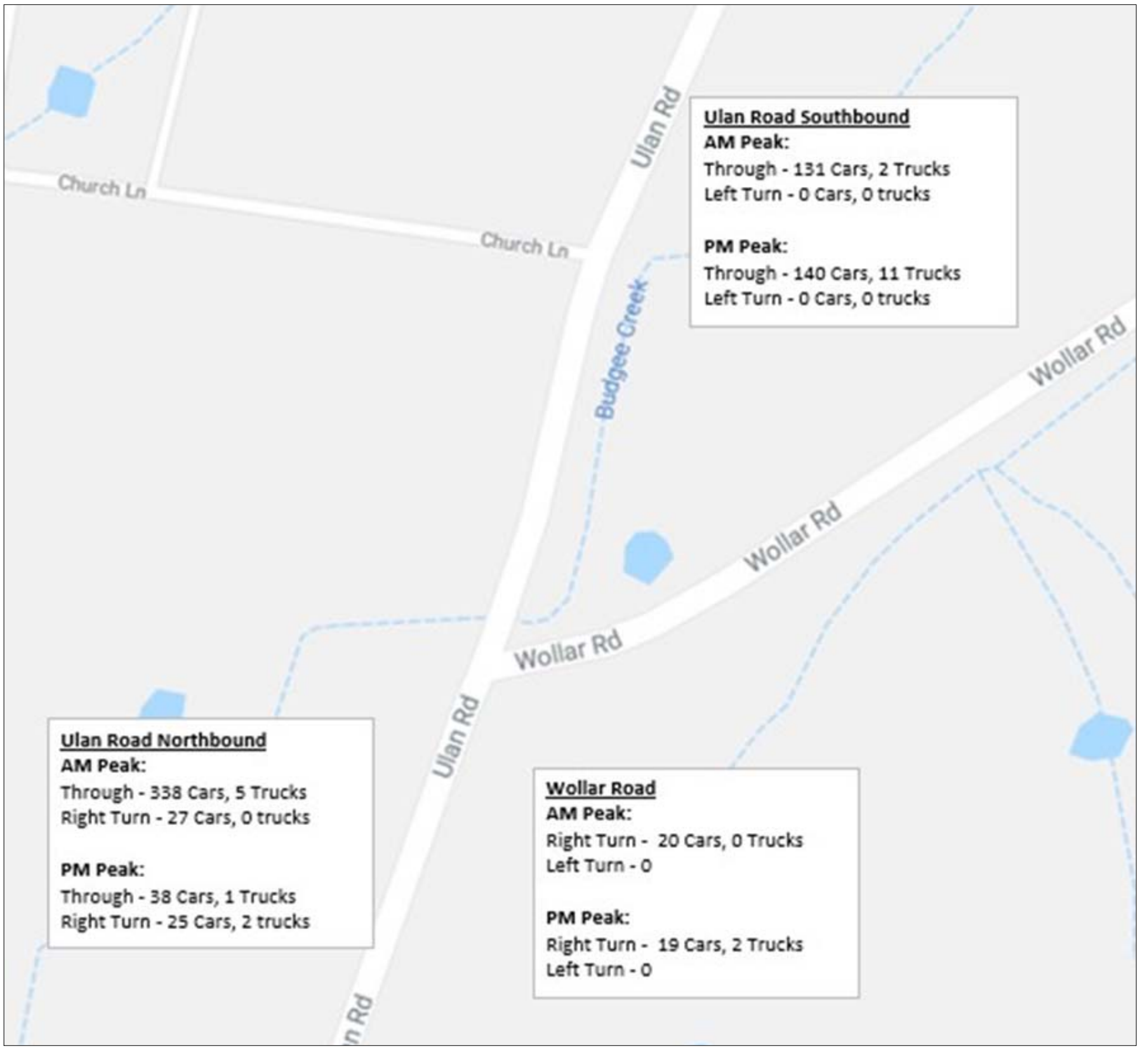

Figure 8-19 Summary of 2018 survey counts for AM and PM peak periods (Ontoit, 2018).

A comparison on the 2018 vs 2015 traffic surveys was undertaken for Ulan Road to assist in establishing a robust baseline in traffic activity in the region over the past three years. In addition, the comparison was undertaken to identify any impacts associated with adjacent development and land uses such as the Wilpinjong Mine Extension.

In 2015, the 'Wilpinjong Extension Project – Road Transport Assessment' (WEP RTA) identified an increase of 200 vehicles in the AM peak hour along Ulan Road south of the intersection with Wollar Road by 2017. The 2018 count identified a growth of 135 vehicles, approximately 40% increase, in northbound traffic and a further 66 additional vehicles southbound, approximately 100% increase. This equates to a total growth of 201 vehicles along Ulan Road in the AM Peak period which is consistent with the forecasts presented in the WEP RTA. It is therefore a reasonable conclusion that all the growth along Ulan Road can be attributed to the expansion of the Wilpinjong Mine.

In the PM peak the WEP RTA identified an additional 163 vehicles. The 2018 surveys indicated a decrease of 83 vehicles northbound, approximately 60% decrease and an increase of 17 vehicles southbound, approximately 11% increase. Whilst the 2018 counts are not consistent with the WEP RTA forecasted traffic growth, it should be noted that this could be explained by our PM traffic count focusing on 3-4pm as opposed to the 6-7pm noted in the RTA. Overall, we can conclude that the primary impact of the expansion of the mine has been on the AM peak period.

Access

Two access points are proposed for the solar farm:

- Construction and operational access (Northern Access) would be along an existing unnamed access road to the Wollar substation. This access is currently an unsealed road approximately 4 – 5m in width (Figure 8-20, Figure 8-21, Figure 8-22 and Figure 8-23).
- Construction and operational access for light vehicles only (Southern Access) would be via Maree road, an existing unsealed road approximately 4 – 5m in width (Figure 8-24 and Figure 8-25).

Figure 8-20 Existing substation access road (Ontoit, 2018).

Figure 8-21 Existing Wollar substation access road.

Figure 8-22 Existing substation access road intersection with Barigan Road.

Figure 8-23 Existing substation access road intersection with Barigan Road (Ontoit, 2018).

Figure 8-24 Existing Maree Road access (Ontoit, 2018).

Figure 8-25 Existing Maree Road access.

Crash Data

Existing road crash data was sourced from the Transport for NSW road safety website. A review of historic crash data (between 2011 and 2016) was undertaken focussing on the primary corridors to and from the proposed Proposal site at Wollar. Crash data was analysed for:

- Ulan Road between Mudgee and Golden Highway;
- Wollar Road between Ulan Road and Barigan Road; and
- Ulan-Wollar Road between Ulan Road and Wollar Village.

No crashes have been recorded on Ulan-Wollar Road, therefore analysis focused on Ulan Road and Wollar Road.

Crashes have occurred along the key corridors to the proposed Proposal site. Analysis focused on the number of Serious and Fatal crashes recorded on Ulan Road and Wollar Road. Analysis of these incidences concluded that:

- On Ulan Road, the majority of serious and fatal crashes that occurred were due to driver error or drivers not driving to the conditions of the road carriageway. Despite the number of crashes over the last five years along Ulan Road the overarching trend is declining year on year; and
- On Wollar Road, the majority of serious and fatal crashes that occurred were due to driver error or drivers not driving to the conditions of the road carriageway. There is no overarching trend for Wollar Road based on the total yearly crashes as they have remained fairly consistent over the last five years.

Rail crossings

There are no existing rail crossings along the primary approach route which includes Ulan Road, Wollar Road and Barigan Road.

Whilst there are several rail crossings along Ulan-Wollar Road, the volumes of traffic expected to approach from this route is minimal and would therefore have a negligible impact on their operation. Analysis indicates that the chances of a vehicle encountering a train along this corridor is very low.

The current train timetable for the corridor is understood to be 1 train every 30 minutes or up to 3 trains an hour. Given the low volume of train activity on the line, as well as the low traffic volume increase along the Ulan-Wollar Road corridor, there would likely be minimal impact on vehicular traffic using this corridor to access the Solar Farm.

Parking

No existing formal parking facilities at the proposed solar farm location were identified during the August 2018 site visit.

Active travel

During the August 2018 site visit, no active travel infrastructure or use was observed. No formal facilities exist on the primary approaches or at the proposed Solar Farm location.

Public transport

No regular public transport routes have been identified linking to the Village of Wollar. However, there is an existing School Route that provides a service for Wollar Village children to access Mudgee School.

8.6.2 Potential impacts

The Roads and Maritime Services 'Guide to Traffic Generating Development' does not outline specific trip generation rates for the construction and operation of a Solar Farm. As such, traffic generation demand has been determined through the analysis of the forecasted employee, workforce and goods and service vehicle deliveries provided by the proponent.

Given the estimated, very low, volume of traffic demand during the operational phase, the transport capacity and distribution analysis focusses on the estimated peak construction phase vehicle volumes

Construction

The potential traffic, transport and safety risks associated with the construction phase of the proposed solar farm relate to increased traffic generation which may lead to impacts on:

- Increased parking requirements.
- Development related Traffic Network Distribution.
- Future road capacity.
- Intersection capacity and operation.
- Public transport impacts.
- Pedestrian and cycle impacts.
- Cumulative traffic impacts.

INCREASED TRAFFIC GENERATION

During peak construction, the following are anticipated:

- Peak workforce of 500 people.
- Up to 82 heavy goods vehicles deliveries a day (plus an additional eight movements at commencement and end of the construction phase).

- Up to two oversized vehicle movements (One off delivery and pickup) a day.
- Up to 40 buses a day to transport the workforce to and from the site.
- A further 60 private vehicles are expected as a result of the workforce.

As presented in Table 8-31, it is anticipated that the peak travel demand during the construction phase would be 98 vehicles and would occur during the morning peak period between 5am and 6am.

Table 8-31 Estimated “worst case” peak hour vehicle demand for the construction phase.

Mode	Daily Trip Generation	Estimated Peak Hour Trips
Shuttle Bus (25 seats)	40	20
Private Vehicles	60	60
Heavy Vehicles (at commencement and conclusion only)	8	2
Heavy Goods Vehicles	82	16
Oversized Vehicles	2	0
TOTAL	**192**	**98**

In estimating peak hour trips, the following assumptions were made:

- There would be 10 inbound and 10 outbound bus movements in the peak period;
- All the workforce travelling by private vehicles would arrive during the peak period; and
- 10% of the daily estimated heavy goods vehicle trips are made in the peak hour (inbound and outbound movement).

It is not anticipated that these peak figures would be a consistent daily demand throughout the 12 – 18 month construction phase. However, to analyse a ‘worst case scenario,’ the peak vehicle demand has been estimated to ensure sufficient capacity in the surrounding transport infrastructure is in place to support the additional vehicle demand resulting during the construction phase.

INCREASED PARKING REQUIREMENT

The Mid-Western Regional Council DCP does not specify parking rates specifically for Solar Farm Developments, however the proposed Solar Farm would need to provide sufficient capacity for a temporary parking facility during construction. It is proposed that all parking, during the construction phases, is contained on-site and no off-site vehicle parking is allowed.

DEVELOPMENT RELATED TRAFFIC NETWORK DISTRIBUTION

As presented in Table 8-32, the largest increase in traffic volumes are anticipated to occur during the construction phase and to start and end at Mudgee, which is the largest regional town within the Mid-Western Reginal LGA. In comparison, all other origins and destinations are expected to experience a minor increase in traffic relative to this corridor. Given the anticipated low volume increases from other areas, the traffic impact analysis focussed on the Mudgee to Wollar road corridor which consists of:

- Ulan Road;
- Wollar Road; and
- Barigan Road.

Table 8-32 Predicted origin and destination of the additional traffic during the construction phase of the Solar Farm.

Origin / Destination	Inbound / Outbound	Trip Distribution Share (%)	Estimated Additional Traffic Volume (number of vehicles)
Mudgee	Inbound	90%	86
Mudgee	Outbound	90%	23
Newcastle	Inbound	8%	7
Newcastle	Outbound	8%	2
Other	Inbound	2%	2
Other	Outbound	2%	0
TOTAL	**N/A**	**100%**	**120**[5]

FUTURE ROAD CAPACITY

The primary access corridor for vehicular traffic to the proposed Proposal site is expected to be Ulan Road – Wollar Road – Barigan Road. Given the rural nature of Ulan Road and Wollar Road, their existing estimated capacity would be between 600-1000 vehicles per hour (300-500 per lane). Barigan Road would be slightly lower due to being narrower width, unsealed and a lower posted speed limit, but would still be capable of carrying 300-500 vehicles per hour.

Existing capacities of access roads were compared to estimated future peak traffic volumes during the construction phase 12 – 18 months (6 – 9 months peak construction) and future traffic conditions, as presented in Table 8-33.

[5] 95 inbound trips and 25 outbound trips. Assuming only the bus and heavy goods vehicle movements would be both inbound and outbound movements during peak period.

Table 8-33 Existing and future traffic volume and conditions.

Road	Capacity	Existing AM Peak Volume	Estimated Future AM Peak Volume (during construction)	Future Traffic Conditions During Future AM Peak Volume (during construction)
Ulan Road (south of Wollar Road) Northbound	300-600	370	456	Would continue to operate above a satisfactory level
Ulan Road (south of Wollar Road) Southbound	300-600	154	177	Would continue to operate above a satisfactory level
Wollar Road Eastbound	250-450	27	113	Would continue to operate above a satisfactory level
Wollar Road Westbound	250-450	20	43	Would continue to operate above a satisfactory level
Barigan Road Southbound	300-500*	n/a	95	Likely to continue to operate within capacity. Note: given the nature of the vehicles that will be travelling along the corridor, there may be minor delays if no mitigation measures are implemented to accommodate bi-directional traffic or passing lanes.
Barigan Road Northbound		n/a	25	

INTERSECTION CAPACITY AND OPERATION

There are two intersections along the primary access corridor that would experience a growth in traffic use during the twelve-month construction period:

- Ulan Road – Wollar Road: a priority-controlled intersection which has a right turn storage for vehicles travelling northbound on Ulan Road; and
- Wollar Road – Barigan Road: a priority-controlled intersection.

The recent site visit observed minimal traffic travelling through the Wollar Road/Barigan Road intersection with the predominant movement from between Wollar Road east and west of the intersection. A single vehicle was observed using Barigan Road and therefore existing traffic levels are extremely low. These observations are consistent with existing traffic assessment undertaken in the area. As such, it is anticipated that the increase in traffic through this intersection Would not impact on the operation and if any delays are experienced; they would be minimal and only during the 12 – 18 month construction period.

Whilst no SIDRA modelling was undertaken, based on estimated traffic flows, the intersection is expected to continue to operate within capacity.

PUBLIC TRANSPORT IMPACTS

Given there is no existing public transport linkages servicing the proposed Proposal site, no impact on public transport routes or provisions is anticipated.

PEDESTRIAN AND CYCLE IMPACTS

No impacts are anticipated on pedestrian and cycle access to the proposed Solar Farm.

CUMULATIVE TRAFFIC IMPACTS

There are a number of industrial activities in the vicinity of the Village of Wollar, particularly relating to agriculture and mining activities.

Recent traffic surveys indicated a rise in traffic volumes on Ulan Road, particularly since 2015. There is a direct correlation between the observed traffic flows on Ulan Road and the forecasted traffic flows contained within the surveys. As such, it is reasonable to assume that the 2018 existing road conditions reflect the peak traffic demand from nearby mining activity. Therefore, no further increase in traffic is predicted and the numbers presented in this TIA would be reflective of the cumulative traffic growth in the region.

Passing facilities such as pull in bays on Barigan Road would be implemented at strategic locations between the Village of Wollar and the Northern Access. This upgrade would enable vehicles to pass in a controlled and safe manner and improve the flow of vehicles along the corridor, which would be particularly important for larger heavy goods vehicles.

Operation

Once construction is complete, the Solar Farm trip demand would significantly decrease. It is anticipated that once established, the Solar Farm would have:

- Five (equivalent) full time employees.
- Several operational and maintenance light vehicles accessing each day.

INCREASED PARKING REQUIREMENT

Whilst the Mid-Western Regional Council DCP does not specify parking rates specifically for Solar Farm Developments, the proposed Solar Farm would need to provide a permanent parking facility for operational and maintenance vehicle parking upon commissioning of the solar farm. It is proposed that all parking, during the operational phases, is contained on-site and no off-site vehicle parking is allowed. The mitigation measures presented in Section 8.6.3 are considered sufficient to manage this impact.

DEVELOPMENT RELATED TRAFFIC NETWORK DISTRIBUTION

The estimated peak traffic volume during the operational phase is eight vehicles. Given the estimated, very low volume of traffic demand during the operational phase, no significant increase in traffic volumes are anticipated at nearby towns.

FUTURE ROAD CAPACITY

The future road capacity has been assessed against estimated peak traffic volumes, which are anticipated to occur during the construction phase. An analysis of existing and future traffic volume and conditions during peak traffic volume is presented in Table 8-33. The travel demand during the operational phase is anticipated to be significantly less than the construction phase.

INTERSECTION CAPACITY AND OPERATION

No intersections along the primary access corridor are anticipated to experience a growth in traffic use during the operational phase. Therefore, whilst no SIDRA modelling was undertaken, based on estimated traffic flows, the intersection is expected to continue to operate within capacity.

PUBLIC TRANSPORT IMPACTS

Given there is no existing public transport linkages servicing the proposed Proposal site, no impact on public transport routes or provisions is anticipated.

PEDESTRIAN AND CYCLE IMPACTS

No impacts are anticipated on pedestrian and cycle access to the proposed Solar Farm.

CUMULATIVE TRAFFIC IMPACTS

Given the minimal traffic generation anticipated during the operational phase and the reasonable assumption that the 2018 existing road conditions reflect the peak traffic demand for the area, no further increase in traffic is predicted and the numbers presented in this TIA would be reflective of the cumulative traffic growth in the region.

Decommissioning

During the decommissioning phase, the majority of plant at the Solar Farm would be scrapped, as it would have reached the end of its useful life. Subsequently, this would result in a reduction of 30% traffic density from the construction phase. The reduction in traffic can be primarily achieved as a result of only transporting scrap (e.g. glass, steel, copper) from the site which would results in a higher packing density and therefore fewer vehicles would be required.

8.6.3 Safeguards and mitigation measures

The primary impacts of the proposed Solar Farm would be the result of the 12 – 18-month construction period. It is likely that the additional construction traffic would result in short journey time delays and possible localised minor congestion particularly on Ulan Road and Wollar Road and at the intersection between these two corridors. Once fully operational, the facility would have a negligible impact on the road traffic conditions due to the small amount (5) of full-time employees.

Specific measures are outlined below to manage the potential impacts identified.

Table 8-34 Mitigation measures for traffic impacts.

PC: Pre-construction C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	• The following upgrade would be completed in consultation with Mid-Western Regional Council. • Passing facilities will be implemented at strategic locations between Wollar village and the Northern Access.	C		

2	• A Haulage Plan would be developed with input from the roads authority, 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).
	  • Consideration of cumulative traffic loads due to other local developments.
	  • Traffic controls (signage and speed restrictions etc.).
		PC		D

ID	Safeguards and mitigation measures	C	O	D
3	• Upon determining the haulage route(s) for construction vehicles associated with the proposal, and prior to construction, undertake a Road Dilapidation Report. The report would: • Assess the current condition of the road(s). • Describe mechanisms to restore any damage that may result due to traffic and transport related to the construction of the Proposal. • Be submitted to the relevant road authority for review prior to the commencement of haulage.	PC	PO	
4	• A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Mid-Western Regional Council and Roads and Maritime. The plan would include, but not be limited to: • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Identify specific road hazards associated with the area including not limited to fog, wet weather, frost and wildlife. • Pedestrian management – Site access is to be restricted to authorised personnel only and existing employees on site. Pedestrian access to and around the site is to be maintained at all times. Within the site pedestrian travel paths are to be maintained to key areas such as building entrances and be free from trip hazards. • Scheduling of deliveries. • Construction of temporary car parking facilities. • Community consultation regarding traffic impacts for nearby residents and school bus operators. • Consideration of impacts to the railway. • Traffic control plans (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

8.7 BUSHFIRE

8.7.1 Existing environment

The proposal site has been predominantly cleared of overstorey vegetation for agricultural purposes and is comprised mostly of grassland and patches of trees. The topography of the proposal site is generally flat to gently undulating with some steep areas. The elevation is 360 – 570m ASL. The land immediately surrounding the proposal site is higher in elevation.

The proposal site is categorised as bushfire prone land, the majority of which is identified as category 2 vegetation. A small proportion of the south-western boundary of the proposal site is identified as category 1 vegetation; this vegetation category extends throughout the area. A bushfire in February 2017 resulted in removal of much of the vegetation that surrounded the proposal site. This may have stimulated the native seed bank, as high diversity in native pastures has been recorded recently onsite, even with continued grazing and low rainfall.

The Mid-Western Regional LGA falls within the Cudgegong Bush Fire Management Committee (BFMC). The bushfire season generally begins in October and ends in March. The Rural Fire Service (RFS) Bushfire Risk Management Plan for the Cudgegong region reports 150 bushfires on average a year, one of which may be considered major (BFMC, 2012).

The main sources of fire ignition in the Cudgegong BFMC area are:

- Thunderstorm activity, particularly dry electrical storms.
- Accidental ignition, particularly through machinery and equipment.
- Escaped private burns.

The main bushfire hazards for the proposal site include the following:

- Vegetation along the south-western boundaries and in the surrounding hills and valleys as well as remnant patches of trees throughout the proposal site.
- Existing transmission lines transecting the proposal site at the north-eastern corner and south-eastern boundary.
- The substation proposed to be constructed in the north-eastern corner of the site.
- Car accidents and incorrect cigarette disposal along the minor local roads passing the site are Barigan Road and Tichular Road and have the potential to ignite bushfires.

The closest non-involved residence to the proposal site is 2.8km away, and there is a low density of receivers within 7km. The proposal includes construction of a new access point (extended from the existing TransGrid substation access) which would provide an additional thoroughfare in the event of a fire.

8.7.2 Potential impacts

Construction and decommissioning

The potential for increased bushfire risk may coincide with the construction and decommissioning stages of the proposal. Ignition sources during these stages include:

- Earthworks and slashing machinery causing sparks.
- Hot works activities such as welding, soldering, grinding and use of a blow torch.
- Sparks and contact ignition from vehicles in long combustible vegetation.
- Smoking and careless disposal of cigarettes.
- Use of petrol powered tools.
- Operating plant fitted with power hydraulics on land containing combustible material.
- Electrical faults during testing and commissioning.
- Storage of chemicals and hazardous materials.

The development footprint proposed within the proposal site is predominantly on flat land in a low fuel environment and is located at approximately 30 m from the south-western boundaries where tree cover is highest. As such, bushfire risks during construction and decommissioning are considered to be low and would be managed through the mitigation measures recommended in this EIS.

Operation

The operational stage of the proposal has the following associated bushfire risks:

- Powerline failure or contact with vegetation within clearances.
- Overheating in the substation.
- Grass fire ignition from vehicles and maintenance machinery.
- Poor groundcover management and associated high fuel loads.

During operation of the solar farm, bushfire and structural fire risks are considered manageable provided the following strategies are adopted:

- Control of grass fuels including maintenance of groundcover beneath panels.
- Maintenance of equipment.
- Application of best practice and technical standards.
- Design of electrical components to minimise ignition potential.

LITHIUM-ION BATTERIES

All energy storage systems carry risks associated with the uncontrolled release of energy. While lithium-ion batteries offer significant advantages over competing commercialised storage technologies in terms of energy density, efficiency and charging times, these advantages also elevate the risk of fire. The Lithium-ion based Energy Storage Facility will be designed with proper disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate the fire risk to the required level of safety.

Operating strategies spanning proper planning, risk assessment, storage methods, maintenance protocols, and response protocols are the other important factors in mitigating Lithium-ion fire risks (Butler, 2013).

Fire risks

Lithium-ion cells contain highly flammable electrolytes within a metal prismatic can or metalized pouch that have seals designed for a 10 to 20-year service life. The ambient operating temperature range for Lithium-ion systems can span -10 to 50 degrees Celsius but the cells inside the containers are kept within a smaller range, 10 to 30 degrees Celsius, through the enclosure's thermal management system that is sized to keep the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway' triggering new chemical reactions through breakdown of the electrolyte, additional heat generation and ultimately the venting of gases containing carbon monoxide, carbon dioxide and hydrogen.

Gas combustion occurs when the electrolyte vapours or combustible decomposition products come into contact with air and there is an ignition source, or the temperature reaches the autoignition point of 350-400°C (Recharge, 2013). Monitoring of module temperature and voltage combined with a well-designed controls system prevents excessive overcharging and heating by taking the system offline before critical conditions are reached. Since thermal runaway in one battery cell can initiate thermal runaway in adjacent cells it is important to design features that prevent propagation of fire among modules in the event that a fire is initiated.

Fire causes

Battery overheating may be caused by a range of factors including electrical shorting, rapid discharge, overcharging, manufacturers defect, poor design and mechanical damage (Butler, 2013). LIB do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault (Department of Commerce, 2017). The main failure modes for these battery systems are either latent (manufacturing defects, operational heating, etc.) or abusive (mechanical, electrical, or thermal) (Blum and Long, 2016).

A large majority of incidents involving Lithium-ion batteries have been due to failure to adhere to packing and transport requirements, use by non-professionals for innovative applications or use in non-controlled storage conditions (Recharge, 2013).

Risk and incident management

Factors listed in Department of Commerce (2017) to avoid and mitigate battery fire impacts include:

- Building codes applicable to batteries (national and local), changes to floor loadings and National Construction Code requirements for battery installations.
- Manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature.
- Adequate ventilation.
- Containment of electrolyte spills.
- Adequately fire-rated walls are used to avoid or delay the spread of fire.
- Adequate access/egress for installation and maintenance.
- Adequate mechanical protection.

Battery location and spatial design are also important safety factors. Large-scale Lithium-ion energy storage systems can further mitigate widespread impact by isolating different parts of a system.

Fire containment and suppression systems need to be employed to deal with a potential battery fire event, applying the Suppression through Cooling, Isolation, and Containment (SCIC) approach (Butler, 2013). However, while most current systems have automated and manually triggered fire suppression systems, the technology is new and there is limited knowledge about the usefulness of the suppression systems in the event of fire (Blum and Long, 2016).

Lithium-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler, 2013).

Though the specific battery manufacturer and model has not yet been determined, each battery module within the implemented solution would have its temperature and voltage monitored.

The fire suppression system within the Energy Storage System would comprise the storage and release of inert gas within each battery container using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

There would be spare aircon units in storage on site for replacement. In the event of failure of one of the units, the system would be able to maintain safe operating temperatures. If all aircon units fail, the auto shutdown of the batteries would prevent overheating.

Standards and guidelines

The installation of lithium-ion batteries has been identified as in need of relevant standards and Standards Australia is developing a new standard (AS/NZS 5139) for smaller scale battery installations (Standards Australia, 2017). The Clean Energy Council provides requirements for accredited installers, the Australian Energy Storage Council has produced a Guide for Energy Storage Systems, and the WA Department of Commerce has released a guide for electrical contractors in relation to battery storage systems (Department of Commerce, 2017).

It is unlikely that the proposal would present a substantial bushfire and structural fire threat, or represent and unacceptable hazard in the event of a bushfire affecting the proposal site. Implementation of the mitigation measures in this EIS are considered sufficient in managing the identified risks.

8.7.3 Safeguards and Mitigation measures

Table 8-35 Mitigation measures for bushfire.

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	• Copper conductors would be used where necessary to electrically bond the metal structures to earth to protect personnel and equipment in the event of lightning strikes and electrical faults.	Design		
2	• Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	C	O	D
3	• Develop a Bush Fire Management Plan to include but not be limited to: ◦ Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting). ◦ Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements. ◦ Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies. ◦ Document all firefighting resources maintained at the site with an inspection and maintenance schedule. ◦ Monitoring and management of vegetation fuel loads. ◦ A communications strategy incorporating use of mobile phones, radio use (type, channels and call-signs), Fire Danger Warning signs located at the entrance to the site compounds, emergency services agency contacts. • In developing the Bush Fire Management Plan, NSW RFS would be consulted on the volume and location of water supplies, fire-fighting equipment maintained on-site, fire truck connectivity requirements, proposed APZ and access arrangements, communications, vegetation fuel levels and hazard reduction measures.	C	O	D
4	• An APZ of minimum 10m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4m wide gravel access track.	C	O	

ID	Safeguards and mitigation measures	C	O	D
	• Average grass height within the APZ would be maintained at or below 5 centimetres on average throughout the October-March fire season. Average grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 centimetres throughout the fire season.			
5	• The overhead powerlines at the site would be managed by maintaining appropriate vegetation clearance limits to minimise potential ignition risks, in accordance with the *ISSC 3 Guideline for Managing Vegetation Near Power Lines*.		O	
6	• Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment would include fire extinguishers, a 1000 litre water cart retained on site on a precautionary basis, particularly during any blasting and welding operations. Equipment lists would be detailed in Work Method Statements.	C		
7	• The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
8	• Following commissioning of the solar farm, the local RFS and Fire and Rescue brigades would be invited to an information and orientation day covering access, infrastructure, firefighting resources on-site, fire control strategies and risks/hazards at the site.		O	
9	• The perimeter access track would comply with the requirements for Fire Trails in the PBP guidelines. All access and egress tracks on the site would be maintained and kept free of parked vehicles to enable rapid response for firefighting crews and to avoid entrapment of staff in the case of bush fire emergencies. Access tracks would be constructed as through roads as far as practicable. Dead end tracks would be signposted and include provision for turning firetrucks.	C	O	D
10	• A Hot Works Permit system would be applied to ensure that adequate safety measures are in place. Fire extinguishers would be present during all hot works. Where practicable hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D
11	• Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	C	O	D

ID	Safeguards and mitigation measures	C	O	D
12	• Prior to operation of the solar farm, an Emergency Response Plan (ERP) would be prepared in consultation with the RFS and Fire and Rescue NSW. This plan must include but not be limited to: • Specifically addresses foreseeable on site and off site fire events and other emergency incidents. • Risk control measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment). • Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. • Two copies of the ERP are stored in a prominent 'Emergency Information Cabinet' which is located in a position directly adjacent to the site's main entry point/s. • Once constructed and prior to operation, the operator of the facility would contact the relevant local emergency management committee (LEMC).		O	
13	• Fire risks associated with the lithium-ion energy storage facility would include: • Locating the Energy Storage Facility as far as practicable from any sensitive receptors or large stands of vegetation. • Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems. • Installing reliable integrated fire detection and fire suppression systems (inert gas). • Ensuring the battery containers are not vulnerable to external heat effects in the event of a bushfire. • Designing appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility. • Compliance with all relevant guidelines and standards. • Preparation of a specific Battery Fire Response Plan, under the general Bushfire Management Plan, in consultation with fire authorities, fire suppression		O	

ID	Safeguards and mitigation measures	C	O	D
	experts and in reference to relevant standards and guidelines. • Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades.			

8.8 ELECTRIC AND MAGNETIC FIELDS

8.8.1 Existing environment

Electric and magnetic fields (EMFs) are produced whenever electricity is used. EMFs also occur naturally in the environment, such as the Earth's magnetic field and discharges during thunderstorms (WHO, 2012).

Electric fields are produced by voltage and magnetic fields are produced by current. When electricity flows, EMFs exist close to the wires that carry electricity and close to operating electrical devices and appliances (WHO, 2007). Electric and magnetic field strength reduces rapidly with distance from the source.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, n.d.). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project, established by the World Health Organisation, has thus far concluded that there are no substantive health consequences from exposure to Extremely Low Frequency (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.

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 would provide protection against known adverse health effects. To prevent health-relevant interactions with Low Frequency 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 would also be met (in the body) (ICNIRP, 2016). Reference levels for occupational and general public exposure are shown in Table 8-36.

Table 8-36 ICNIRP reference levels (ICNIRP, 2010).

Exposure characteristics	Electric field strength (kVolts per metre – kV/m)	Magnetic flux density (microteslas - µT)
Occupational	10	1000
General public	5	200

The proposal includes six main types of infrastructure that could create EMFs:

1. Solar arrays (up to 1600V DC).
2. Power Conversion Stations (up to 5MW capacity).
3. Underground cables.
4. 330 kV overhead transmission lines.
5. 330 kV onsite substation.
6. Energy storage facility with a capacity of up to 30 MWh (i.e. 30 MW power output for one hour).

Typical and maximum EMF levels for these types infrastructure are discussed below. Strength attenuates with distance from the infrastructure and electric field levels for underground infrastructure are lessened by the shielding that the fill (approximate depth of 900mm) provides.

Solar arrays

Research into electric and magnetic fields undertaken at utility scale PV installations in California[6] by Chang and Jennings (1994), indicated that magnetic fields were 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.

The proposal would require installation of DC wiring between panels and the PCUs. This cabling would be underground and would have a voltage of around 1600V. The potential for electromagnetic interference as a result of the solar array cabling is considered to be negligible.

Power Conversion Units

Up to 58 PCUs would be installed across the site. The units would have an output of approximately 5MW. The PCUs would have an AC power frequency output that is 50Hz. In addition, the PCUs would be located within the fenced proposal site with no public access and would operate only during the day reducing the total time that EMFs are generated by the solar panel infrastructure (Figure 1-4).

Underground cabling

The electric and magnetic fields generated by underground cabling are expected to be low and restricted to the proposal site.

Overhead powerlines

Figure 8-26 displays the typical electric fields emanating from different voltage overhead powerlines. The proposal site has existing 330kV powerlines at the north east corner that connect to the existing Wollar 500/330kV substation. The proposed solar farm would connect to the existing 330kV powerlines through the proposed onsite substation (Figure 1-5).

[6] Note the U.S.A electricity supply operates at 60 Hz frequency.

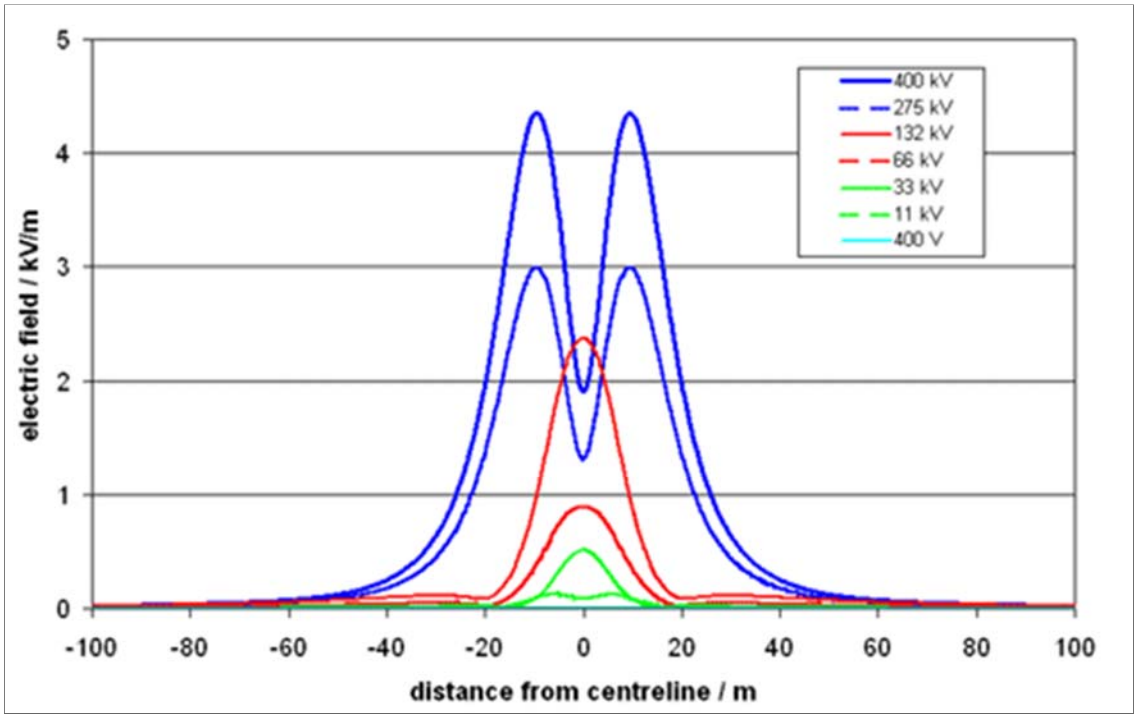

Figure 8-26 Typical electric fields from overhead powerlines (EMFs.info 2017).

Substation

For the substation and transformers the magnetic fields at distances of 5-10m from the substation fence are generally indistinguishable from typical background levels in a home. The closest non-involved residence is 3.9km north of the proposed substation location. Works undertaken to facilitate the connection of the transmission line would require mitigation measures to ensure reduced exposure.

Energy Storage Facility

Lithium-ion batteries are not associated with high levels of EMF and the EMF produced by the proposed ESF would be well below ICNIRP reference levels.

8.8.2 Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the proposal. Staff would be exposed to EMFs over intermittent periods during works at and around the existing 330kV transmission line. Exposure to EMFs during the construction would be short term, therefore the effects are likely to be negligible.

Operation

During operation, EMF sources would include overhead transmission lines, underground cabling, and the solar array incorporating PCUs.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Through prudent design and siting of 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.

By prudently designing and siting 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.

8.8.3 Mitigation measures

Table 8-37 Mitigation measures for hazards.

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
2	All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
3	Design of electrical infrastructure would minimise EMFs.	C		

8.9 AIR QUALITY AND CLIMATE

8.9.1 Existing environment

Air quality

Air quality for the Mid-Western Regional LGA is generally expected to be good and typical of that found in a rural setting of NSW. Existing sources of air pollution within the LGA would include:

- Vehicle emissions – expected to be low for the site considering the low traffic amounts in the vicinity of the site and low intensity of land use and low density of settlement.
- Dust during dry periods – expected to be higher in dry and windy weather, generated from traffic on unsealed roads and bare areas of ground.
- Mining activities – dust from haulage, on unsealed roads and from stock piles (none of which occur in close proximity to the site).
- Agricultural activities, particularly stubble burning and harvests. Cropping is limited in the immediate area.

During colder months, there may be a small increase in air contaminants due to smoke emissions from the operation of solid fuel heating. As above, locally this would be negligible given the low density of settlement.

A search of the National Pollutant Inventory (Australian Government, 2017) identified five facilities within the Mid-Western Regional LGA that are required to record emissions. The facilities include three coal mines, one gas manufacture and one quarry. The closest facility is the Wilpinjong Coal Mine, approximately 11km north west of the proposal site.

The proposal site is located within the 200km radius of the *Dark Sky Region* and approximately 150km south of the Siding Spring Observatory. The Dark Sky Region is centred upon the site of this observatory, which is considered Australia's most important visible-light observatory. The Dark Sky Region Guidelines have been prepared to ensure the night sky is free of light pollution and increased levels of atmospheric dust which may impact on the observatory.

The proposed solar farm is located on land zoned as RU1 Primary Production. The land surrounding the proposal site is predominately grazed with crops for feed to the north, east and south. Land to the west is forested Crown Land. One residence is located within the proposal site, this is owned by the current landowner. No residences are within 2km of the proposal site. The closest receiver is 2.8km from the site. As such, the proposal is located in a low density area. Traffic on the surrounding roads of the proposal site would be limited to private transport, with heavy vehicles being used in the harvest season or cattle transport.

Climate

The proposal site is located within the Sydney Basin Bioregion. The Sydney Basin is dominated by temperate climate characterised by warm summers with no dry season (NSW National Parks and Wildlife Service, 2003). The closest climate data for the proposal site is the Mudgee Airport weather station (site number 062101). Table 8-38 outlines the available data for this weather station from the Bureau of Meteorology (BOM):

Table 8-38 Mudgee Airport weather station (site number 062101).

Aspect	Annual Mean	Mean Minimum Range	Mean Maximum Range
Temperature[7]	22.7°C maximum 8.2 °C minimum	15.9 °C (January) to 1.2 °C (July)	30.8 °C (January) to 14.4 °C (July).
Rainfall[8]	663.2mm	34.6mm (April)	80.5mm (December)
Wind[9]	NA	7.4km per hour (9am) 14.8km per hour (3pm)	11.5km per hour (9am) 18.7km per hour (3pm)

[7] Based on data collected between 1991 – 2018.

[8] Based on data collected between 1994 – 2018.

[9] Based on data collected between 1991 – 2010.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases in the atmosphere. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall declines in south eastern Australia and more extreme weather events including intense rainfall, severe drought and harsher fires (CSIRO, 2016). 2017 was Australia's third-warmest year on record, and in much of south eastern Australia, rainfall was below average (BOM, 2017). At the global level, 2016 was the hottest year on record, and the third hottest year in a row (Steffan *et al*., 2017). The annual mean air temperature in Australia is projected to increase by 2.8-5.1°C by 2090 (above the 1986-2005 period) (CSIRO, 2015).

In 2014, the NSW OEH published climate change projection snapshot reports for the NSW and ACT governments as part of the NSW and ACT Regional Climate Modelling (NARCliM) project. The study focused on projections for two future 20 year time periods: 2020-2039 as the near future and 2060-2079 as the far future. The snapshot included the analysis of over 100 climate variables, including temperature, rainfall and wind.

The projected climatic changes by 2030 (near future) for the Central West and Orana region of NSW, which the proposal site is located in, included the following:

- Maximum temperatures are projected to increase by 0.4 to 1.0 degrees Celsius.
- Minimum temperatures are projected to increase by 0.5 to 0.9 degrees Celsius.
- The number of hot days would increase and cold night decrease.
- Rainfall is projected to decrease in spring and increase in autumn.
- The risk of fire is projected to increase during summer, spring and winter.

Rural and regional communities are disproportionately affected by the impacts of climate change, through worsening extreme weather events and impacts to capacity, productivity and resilience in some rural industries (Climate Council, 2016). A significant proportion of Australian exports are agricultural products that are sensitive to global warming impacts (AGO, 2003). Some incremental adaptations in agricultural enterprises would be straightforward, but the more transformational adaptive changes may be risky and expensive, especially for individual farmers (Climate Council, 2016).

8.9.2 Criteria

It is noted that POEO Act regulates pollution including air pollution. It requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4 mg/m/m2 are also specified.

8.9.3 Potential impacts

Construction and decommissioning

AIR QUALITY

Air quality can be affected by dust and emissions generated during the construction works. The sources of dust and emissions at the proposal site during construction would include:

- Excavation and earthworks, such as ground breaking, levelling (cutting and filling), piling works, trenching, etc. – generally, the impacts would be in discrete areas and located well away from receivers.

- Vehicle movements over unsealed surfaces including internal and external access tracks. Up to 50km of track would be installed. There are currently a limited number of unsealed informal tracks onsite.
- Dust from uncovered stockpiled powdery materials or truckloads.
- Emissions (e.g. Nox, Sox and CO) and particulates from vehicles, diesel generators, heavy plant and other mechanical equipment.
- Stored VOCs and other volatile hazardous materials such as paints, fuels and solvents. These would be limited.

Dust and air emissions can be a nuisance to nearby receivers including residences, farm workers and motorists. No residences are within 2km of the proposal site. The closest non-involved receiver is 2.8km from the site. There is also only one residential receiver along Barigan Road that would potentially be impacted by dust generated by the proposal's traffic. The receiver is approximately 535m set back from the unsealed road. Other receivers would be workers on adjacent properties and motorists along Barigan Road.

The degree of impact can be influenced by weather and climate. Work carried out during long periods of dry weather and high winds have a greater potential to generate dust which can impact air quality (refer to Table 8-38. Construction work during summer months may require greater dust suppression measures to manage any increased impacts.

The construction phase is expected to be approximately 12 months in duration. The air quality impacts from construction works on the proposal site, are considered to be negligible due the proposed minor earthworks and the distance from receivers (greater than 2km). Potential air quality impacts are likely to occur along Maree Road and Barigan Road due to the roads being unsealed, and are used by motorists. However, the potential impacts are considered manageable with the implementation of mitigation measures.

Construction works are expected to have a negligible impact on the *Dark Sky Region* and users of the Siding Spring Observatory. This is due to the minor earthworks proposed, and the implementation of mitigation measures to supress dust and emissions that have potential to impact visibility in the area. Additionally, no permanent night lighting is proposed, limited security lighting is anticipated.

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.

CLIMATE AND CLIMATE CHANGE

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 and the scale of the solar farm proposed suggests this contribution would be negligible in a local or regional context.

Operation

AIR QUALITY

Operational and maintenance process of the solar farm would generate very low emissions of pollutants. Specifically, the source of these pollutants is vehicle emissions from staff vehicles and maintenance equipment. However, it is likely that no vehicles would be present at the site on a permanent basis, with only occasional visits by standard vehicles. Fuel would also be required for temporary power generation in the event of an unplanned outage.

Maintenance activities during operation would result in some minor, localised dust generation from vehicles travelling on the unsealed access roads. A groundcover management plan would be implemented to reduce dust production from disturbed areas. The impacts on local and regional air quality are expected to be negligible during normal operation.

CLIMATE

Concerns have been previously raised regarding the possibility of the heat created from solar arrays resulting in a heat island effect. 'Heat island' is defined as an area having higher average temperature than its surroundings owing to the greater absorption, retention and generation of heat by buildings, pavements and activities. This is usually used in reference to the impact of an urban area on its rural surroundings. Studies have shown that Photovoltaic (PV) panels convert incident solar radiation into heat and this can alter the air-flow and temperature profiles near the panels. Whether such changes may subsequently affect the thermal environment of near-by populations of humans and other species have been questioned (Fthenakis and Yu, 2013). However, to date there have been limited empirical studies on the potential for a heat island effect in utility scale solar farms.

The limited studies that do exist also show results that can be seen as contradictory, as they are so site and project specific. Some studies suggest that PV systems can actually cause a cooling effect on the local environment, depending on the efficiency and placement of the PV panels while others demonstrate a warming effect (Barron-Gafford, Minor, Allen, Cronin, Brooks, and Pavao-Zuckerman, 2016). Other studies conclude that whilst air temperatures may increase within the solar farm itself, they rapidly decrease to the ambient temperature beyond the perimeter of the solar farm (Fthenakis and Yu, 2013).

Fthenakis and Yu (2013) undertook an analysis of the potential for large solar farms to generate a heat island effect and increase air temperature within the solar farm area. The study found at the centre of the solar farm, the annual average air temperature at a height of 2.5m increased by up to 1.9^{0}C. However, this increase in temperature dissipated at a height of 5m. Additionally, the solar farm completely cooled overnight.

The research suggested a small potential effect on climate within the proposal site. This effect may actually enhance retention of ground cover in very cold or hot conditions onsite. No impacts on adjacent properties and agricultural activities would occur.

CLIMATE CHANGE

The proposal would, as part of the transition to renewable energy sources, contribute to reducing greenhouse gas emissions and the mitigation of the negative effects of climate change. On an annual basis, the proposed Wollar Solar Farm would provide enough clean, renewable energy for about 104,926 average NSW homes. At the same time, it would displace approximately 515,564 metric tonnes of carbon dioxide.

The operation of the solar farm would produce minimal CO_2 emissions when compared to conventional coal and gas fired power stations, refer to Table 8-39.

Table 8-39 Comparison of CO_2 equivalent emissions produced per kilowatt hour.

Generation method	Emissions produced (grams CO_2 equivalent per kWh)	Source
PV solar farm	19-59	Wright and Hearps (2010)

Generation method	Emissions produced (grams CO_2 equivalent per kWh)	Source
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema *et al*. (2006)

8.9.4 Safeguards and mitigation measures

Table 8-40 Safeguards and mitigation measures for climate and air quality impacts

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Track width of internal tracks would be minimised during detailed design.	Design		
2	Dust generation by vehicles accessing the site and earthworks at the site would be suppressed using water applications or other means as required.	C		D
3	Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
4	All vehicles and machinery used at the site would be in good condition, fitted with appropriate emission controls and comply with the requirements of the POEO Act, relevant Australian standards and manufacturer's operating recommendations. Plant would be operated efficiently and turned off when not in use.	C	O	D
5	Fires and material burning is prohibited on the proposal site.	C	O	D

8.10 RESOURCE USE AND WASTE GENERATION

8.10.1 Resource use

Estimated resource use

The key resources and estimated quantities (pending the completion of the detailed proposal design) required to construct the proposed Wollar Solar Farm are listed in Table 8-41. The majority of the required resources would be used during the construction of the proposed solar farm. During operation and decommissioning, resource requirements would relate to maintenance activities including the use of machinery, vehicles and water resources. Water resources would be required throughout construction, operation and decommissioning. Water use is considered in Section 8.1 of this EIS.

Table 8-41 Resource requirements for the Wollar Solar Farm.

Resource	Quantity
Gravel (access tracks)	90,400m^3
Sand (bedding for cables)	10,800m^3
Concrete	500m^3
Estimated no of solar panels	922,432
Water during construction	150 – 180ML

8.10.2 Waste

POLICY POSITION

In NSW, waste management and pollution are regulated under the *Protection of the Environment Operations Act 1997* (POEO Act) and the *Protection of the Environment Operations (Waste) Regulation 2005.* Unlawful transportation and deposition of waste is an offence under Section 134 of the Act. Littering is an offence under Section 145 of the Act.

The NSW *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) contains waste minimisation and management objectives, including:

- Encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ESD.
- Ensure that resource management options are 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 ESD.

8.10.3 Potential impacts

Construction

RESOURCE USE

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 considering 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 in light of 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 8.1.

WASTE

The management of waste during the construction phase would observe the objectives of the WARR Act.

Solid waste is one of the major pollutants caused by construction. A number of different construction activities associated with the proposal would produce solid wastes, including:

- Spoil from trenching.
- 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 the definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction and decommissioning phases would be classified as building and demolition waste within the class general solid waste (non-putrescibles). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescibles) in accordance with the POEO Act. Waste produced during construction would be disposed of at an appropriately licensed waste facility. Green waste from tree clearing would be mulched for use in rehabilitation at the site or removed from the site.

The impact from waste generation, on regional waste facilities is assessed to be moderate without the implementation of any recycling or re-use measures. However, with the implementation of a Waste Management Plan and identification of recycling waste facilities in the LGA, the impacts from construction waste disposal on regional landfills, the biological environment and social environment is assessed to be minor.

Operation

RESOURCE USE

Electricity production using PVs 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.

Some balance of system electrical components (e.g. inverters, transformers, electrical cabling) and the battery storage facility would likely need replacement over the proposed life of the solar farm, requiring further use of metal and plastic based products.

Over the expected 30 year lifespan of the solar farm, the operational demand on natural resources would be minimal, as such the impacts are considered negligible.

WASTE

During operation, the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels and lubricants, and metals may require replacement over the operational life of the Wollar Solar Farm. These materials would be reused or recycled wherever practicable. Given the minimal amount of moving parts and limited wear and tear of equipment, the operational waste streams generated by the solar farm would be very low and impacts to regional waste disposal facilities would be minor.

Decommissioning

During decommissioning, all above ground infrastructure and materials would be removed, with the possible exception of the 330kV substation. It is noted that the 330kV substation would at that time form part of TransGrid's transmission link between Wollar and Wellington. Some fencing may also remain at the request of the landowner. Underground cables buried at 500mm deep and greater would likely remain in situ.

The following materials would either be recycled or reused:

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the PCUs, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Buildings and major electrical equipment would be removed for resale or reuse, or for recycling as scrap. Items that cannot be recycled or reused, such as excess of above, would be disposed in accordance with applicable regulations and to appropriate facilities.

The proposed energy storage facility would be accompanied with MSDS (Material Safety Data Sheets) which details the exact chemical composition and disposal/recycling requirements of facility components. Potential hazardous waste is discussed in Section 8.11. It is noted that lithium-ion batteries are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randell Consulting 2016). Lithium-ion batteries do not contain any heavy metals. They do contain valuable material that can be recycled. The Australian Battery Recycling Initiative (ABRI) website indicates four companies which provide a collection and recycling service for used lithium-ion batteries.

The majority of the proposal components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

8.10.4 Safeguards and mitigation measures

A Waste Management Plan would be developed to minimise waste and maximise the opportunity for reuse and recycling. Potential impacts are to be addressed with regards to the mitigation measures in Table 8-42.

Table 8-42 Safeguards and mitigation measures for resource use and waste generation impacts.

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	A Waste Management Plan (WMP) would be developed 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 identify that 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.	C	O	D

ID	Safeguards and mitigation measures	C	O	D
	• Requirements for hauling waste (such as covered loads).			
2	Septic system is installed and operated according to the Mid-Western Regional Council regulations.	C	O	

8.11 HAZARDOUS MATERIALS AND DEVELOPMENT

8.11.1 *Potential impacts*

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 Guidelines (DOP, 2011) lists industries that may fall within SEPP 33; the guidelines do not include solar farms and/or energy storage facilities. Appendix 2 of the guidelines provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. Information relevant to the risk screening and the checklist is provided below.

RISK SCREENING

The SEPP 33 screening procedure is based on the quantity of dangerous goods stored or transported, the frequency of transportation movements and, in some cases, the distance of the materials from the site boundary. The guidelines require goods to be classified according the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The ADG Code lists the following classes of dangerous goods:

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

A development which exceeds screening thresholds in the guidelines would be considered potentially hazardous, and a PHA would need to be submitted with the development application. For quantities below the given thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage during construction and operation of the proposed solar farm are identified in Table 8-43, with ADG Code classification, relevant quantity and transportation thresholds, and storage arrangements. The proposed storage sites would be located at the O&M building and the Energy Storage Facility would be located south of the onsite substation (refer to Figure 1-4). In terms of the class, transportation and storage of dangerous goods, the proposal would not exceed SEPP 33 thresholds, would not be considered potentially hazardous and would not require the preparation of a PHA.

Table 8-43 Dangerous goods and SEPP 33 thresholds relevant to the proposal.

Hazardous material	Storage threshold	Transport threshold		Onsite storage arrangements for the proposal	Exceeds SEPP 33 thresholds?
		Movements	Quantities		
Class 2.1 Flammable gases					
LPG	10 tonnes or 16m^3 (above ground)	>500 cumulative >30/week	2-5 tonnes	Up to 45kg cylinders beside control building, 20 m from boundary.	No
Class 2.2 Non-flammable, non-toxic gases					
Inert fire suppression gas	NA	NA	NA	Compressed in steel bottles in Energy Storage Facility.	No
Class 3 – Flammable liquids (PGII)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	3-10 tonnes	Stored in a bunded Area.	No
Class 6.1 Toxic substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1-3 tonnes	Secure operations storage building.	No
Class 9 Miscellaneous dangerous substances and articles					
Li-ion batteries	NA	>1000 cumulative >60/week	No limit	Energy Storage Facility buildings in a secure compound.	No

Class 2.2 Non-flammable, non-toxic gases

The inert gas stored in compressed form in the Energy Storage Facility for fire suppression would belong to Class 2.2 Non-flammable, non-toxic gases. Gases within this class/division are excluded from the SEPP 33 risk screening process and are not considered to be potentially hazardous with respect to off-site risk. These materials have a Workcover notification threshold of 10,000 litres.

The use of inert gases for fire suppression in enclosed spaces carries asphyxiation risks for staff, site visitors and emergency personnel. Gases commonly used are blends of argon, nitrogen and carbon dioxide. Inert gases are used to reduce oxygen content to below 15% to extinguish fires. Levels below 18% are hazardous for humans, and levels below 10% are extremely dangerous. The risk of accidental asphyxiation can be minimised by:

- Proper installation and operation.
- Regular equipment inspection maintenance.
- Provision of warning signs and information to staff.
- Staff and emergency responder training (including during maintenance and rescue/first aid).
- Fixed or personal oxygen monitoring equipment.
- Activation of an audible and visible internal and external alarm prior to gas release.
- Incorporation of an odour in the gas.
- Effective ventilation and air exchange.
- Safe and effective purging system.

Energy Storage Facility – Lithium-ion Batteries

The proposed Energy Storage Facility would provide electricity storage capacity of approximately 2MWh for each container (40 foot) subject to final specifications. The location and description of the Energy Storage Facility is provided in Section 4.2. The average life of the lithium-ion PV solar batteries is assumed to be 15 years. Batteries may require replacement up to a maximum of two times during the life of the solar farm. The batteries are designed for outdoor use, generally only require a secure foundation i.e. concrete slab, and specified clearances for service access. The batteries are designed for excellent energy density, the ability to operate at any state of charge and reliability and safety (Photon energy, 2017).

Lithium-ion batteries are classified as a Class 9 miscellaneous dangerous goods and Class 9 hazardous goods (both new and waste batteries). They pose little threat to people or property, although they may pose an environmental hazard (DOP, 2011). Class 9 goods are excluded from the SEPP 33 risk screening process.

Lithium-ion batteries are classified as hazardous waste under the Commonwealth *Hazardous Waste Act 1989*, and are classified as Dangerous Goods under the ADG Code. The ADG Code requires dangerous goods to be carried in a secure, safe and environmentally controlled manner. The code specifies 'special provisions' and 'packing instructions' applying to the transportation of Lithium-ion batteries. The *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998* (the NEPM), which sets the regulatory framework for transporting 'controlled wastes' between Australian states and territories, does not currently cover Lithium-ion batteries.

Waste lithium-ion batteries are not currently regulated as a hazardous waste by state governments and hence transport within the state is not required to be tracked in hazardous waste tracking systems (Randell Consulting, 2016). Lithium-ion batteries do not contain any heavy metals. They do contain valuable material that can be recycled. Recycling processors for lithium-ion batteries are similar to recycling of other electronic device battery packs (Photon energy, 2017). The Australian Battery Recycling Initiative (ABRI) website indicates four companies which provide a collection and recycling service for used lithium-ion batteries.

The major hazard offered by lithium-ion battery technologies is fire, as a result of the flammability of the substances used in the battery (Recharge, 2013). Fire risks associated with lithium-ion batteries are discussed in Section 8.7. Class 9 materials have a Workcover notification threshold of 10,000 litres or kilograms, the proposal is above this threshold. Workcover notification will be required.

Other risk factors

The proposal would not involve the storage or transport of incompatible materials, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, storage or processing operations involving high (or extremely low) temperatures. There are no known past incidents (or near misses) involving hazardous materials and processes at solar farms.

Potentially offensive industry

The proposal would result in vehicle and machinery exhaust emissions during the construction phase, as in any construction project. The emissions occur outside, in a rural locality, and would be readily dispersed. The emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would also largely be confined to standard working hours during the construction phase and would not be hazardous to employees or neighbouring residents. Noise impacts have been assessed in Section 8.3. Water pollution risks are assessed as low, subject to identified mitigation measures, with longer term benefits following cessation of cultivation and establishment of groundcover across the site.

8.11.2 Mitigation measures

Table 8-44 Mitigation measures for hazards.

C: Construction; O: Operation; D: Decommissioning

ID	Safeguards and mitigation measures	C	O	D
1	Design of the Energy Storage Facility would be undertaken to address fire risks (spacing and setbacks).	Design		
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: _The storage and handling of flammable and combustible liquids_.	C	O	D
3	Protocols would be developed for lithium-ion battery storage, maintenance, and incident response to mitigate Li-ion fire risks.	C	O	D
3	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	C	O	D

8.12 CUMULATIVE IMPACTS

8.12.1 Existing environment

Cumulative impacts relate to the combined effect of impacts from several activities on a particular value or receiver. They may occur concurrently or sequentially. Considering the Wollar Solar Farm proposal, the relevant cumulative impacts are those associated with other known or foreseeable developments occurring in proximity to the Proposal.

Major projects listed on the Major Projects Register within the Mid-Western LGA are presented in Table 8-45

Table 8-45 Major Projects within the Mid-Western Regional LGA (orange indicates potential cumulative impact).

Project title	Status	Potential for cumulative impact
Mudgee Hospital Redevelopment	More information required to finalise assessment.	Yes. Construction may be concurrent with the Wollar Solar Farm
Ulan Coal Mine **MOD 4**	Assessment.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.
Moolarben Mine **Moolarben Coal 1 – MOD 14**	More information required.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.

Project title	Status	Potential for cumulative impact
Moolarben Mine **Moolarben Coal 2 – MOD 3**	More information required.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.
Bylong Coal Mine **Bylong Coal Project**	Recommendation made.	Yes. Construction may be concurrent with the Wollar Solar Farm
Uungula Wind Farm	SEAR's issued.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.
Bowdens Silver Mine	SEAR's issued.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.
Bylong East Duplication	SEAR's issued.	No. Construction is unlikely to coincide with that of the Wollar Solar Farm.
Wilpinjong Coal Mine **Wilpinjong Extension Project**	Determination.	No. Although construction may overlap, haulage and transport routes are different to those of the proposed solar farm.

Construction of the Bylong Coal Project and the Mudgee Hospital Redevelopment could potentially occur at the same time as the proposed Wollar Solar Farm.

8.12.2 Potential impacts

Potential cumulative impacts are primarily associated with the following issues:

- Traffic impacts.
- Pressures on local facilities, goods and services.

Traffic impacts

The existing traffic volumes within the road network relevant to the proposal site (refer Section 8.6) would have included the operation of the Ulan, Moolarben and Wilpinjong mine, and the construction and operation of the Wilpinjong Extension Project.

Cumulative traffic impacts may occur if construction of the solar farm occurs concurrently with the Bylong Coal Project. The Bylong Coal Project – Response to Submissions Revised Traffic and Transport Impact Assessment (2016) undertook studies on multiple traffic volume scenarios. The results indicated that no more than 100 additional vehicles during peak our would be present throughout the construction phase. As such, Wollar Road would not exceed its vehicle capacity, even during peak periods.

Consultation with community liaison representatives for the Bylong Coal Project and Mudgee Hospital Redevelopment would be ongoing to ensure this influx is managed appropriately so as to not place stress on stakeholders including road users within the region.

Pressures on local facilities, goods and services

The construction of the Bylong Coal Project and the Mudgee Hospital Redevelopment will result in a large influx of workers required for the projects. The Bylong Coal Project is anticipated to require 650 workers during peak construction and the Mudgee Hospital Redevelopment anticipated to require 180 workers during peak construction. It is proposed that workers would be accommodated in Mudgee and other surrounding towns throughout the construction period. This has the potential to put substantial strain on local facilities, good and services. Additionally, the use of accommodation for workers would reduce the amount of accommodation available for tourists visiting the region.

Consultation with community liaison representatives for the Bylong Coal Project and Mudgee Hospital Redevelopment would be ongoing to ensure this influx is managed appropriately so as to not place stress on stakeholders including business owners in Mudgee.

Solar is an expanding industry, with great potential for regional economies. An issue raised during community consultation related to the potential for the proposal to entice the limited number of local skilled renewable energy technicians away from existing local enterprises. While the aim of the proposal is to maximise local employment, consideration of the potential to adversely impact local operations is required.

8.12.3 Environmental safeguards

The cumulative impacts identified for this proposal are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

9 ENVIRONMENTAL MANAGEMENT

9.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The environmental risks associated with the proposed Wollar Solar Farm would be managed by implementing a proposal-specific suite of mitigation measures detailed in Sections 7 and 8 and summarised below.

All commitments and mitigation measures would be managed through the implementation of a Project Environmental Management Strategy (EMS). The EMS would comprise a Construction Environmental Management Plan (CEMP), an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). These plans would be prepared sequentially, prior to each stage of works by the contractor (CEMP, DEMP) and proponent (OEMP).

The EMS would include performance indicators, timeframes, implementation and reporting responsibilities, communications protocols, a monitoring program, auditing and review arrangements, emergency responses, induction and training and complaint/dispute resolution procedures. The monitoring and auditing program would clearly identify any residual impacts after mitigation. Adaptive management would be used to ensure that improvements are consolidated in updated EMPs.

9.2 CONSOLIDATED MITIGATION MEASURES

The mitigation measures contained in this report comprise proposal-specific safeguards, recommendations from specialist assessment reports and reference to a range of best practice guidelines and regulatory requirements. The measures are to be incorporated in proposal plans and designs, contract specifications and the Construction Environmental Management Plan, Operation Environmental Management Plan and Decommissioning Environmental Management Plan as appropriate. The mitigation measures are consolidated below. Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Table 9-1 Consolidated list of mitigation measures.

Table 9-2 Consolidated list of mitigation measures.

ID	Safeguards and Mitigation Measures	C	O	D
Biodiversity				
1	• Hollow-bearing trees would not be removed during breeding season (spring to summer) for threatened hollow dependant fauna. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure no impacts to fauna would occur	C		
2	• A tree clearing procedure would be implemented to minimise harm to resident fauna.	C		
3	• Procedure for relocation of habitat features to adjacent area for habitat enhancement would be implemented.	C		
4	• Approved clearing limits to be clearly delineated with temporary fencing or similar prior to construction commencing. • No stockpiling or storage within dripline of any mature trees. • Access and laydown in areas of Box-Gum Woodland TEC will be minimised to reduce impacts. • Exclusion fencing and signage or similar would be installed around habitat to be retained.	C		
5	• Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		
6	• Avoid Night Works where possible	C	O	

ID	Safeguards and Mitigation Measures	C	O	D
	• Direct lights away from vegetation			
7	Dust management would be implemented as follows: • Daily monitoring of dust generated by construction activities • Construction would cease if dust observed being blown from site until control measures were implemented • All activities relating to the proposal would be undertaken with the objective of preventing visible dust emissions from the development site	C		
8	A Weed Management procedure would be developed for the proposal to prevent and minimise the spread of weeds. This would include: • Management protocol for declared priority weeds under the Biosecurity Act 2015 during and after construction • Weed hygiene protocol in relation to plant, machinery, and fill • Any occurrences of pathogens such as Myrtle Rust and Phytophthora would be monitored, treated, and reported. • The weed management procedure would be incorporated into the Biodiversity Management Plan.	C	O	
9	• Site induction and toolbox talks for ecologically sensitive areas would be undertaken.	C		
10	Preparation of a Biodiversity management plan that would include protocols for: • Protection of native vegetation to be retained • Best practice removal and disposal of vegetation • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist • Weed management • Unexpected threatened species finds • Exclusion of vehicles through sensitive areas. • Rehabilitation of disturbed areas	C		
11	Landscape plantings will be comprised of local indigenous species.		O	

ID	Safeguards and Mitigation Measures	C	O	D
12	• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced to minimise fauna strike.	C	O	
13	• Offsets requirements set out in this assessment would be retired, in consultation with OEH and DoE.	C	O	
Aboriginal heritage				
1	The development must avoid the possible cultural site (Wollar SF Cultural Site 1). A minimum 20m buffer should be in place around this tree to prevent any inadvertent impacts to the tree canopy and root system.	Design C	 O	 D
2	The development must avoid the grinding groove (Wollar SF GDG 1). A minimum 15m buffer should be placed around this site to prevent any inadvertent impacts.	Design C	 O	 D
3	The development would avoid the modified tree (Wollar SF ST 1) and possible modified tree (Wollar SF ST 2). A minimum 15m buffer should be in place around these trees to prevent any inadvertent impacts to the trees canopy and root systems.	Design C	 O	 D
4	If complete avoidance of the 12 artefacts scatters, 25 isolated finds and the two previously identified AHIMS sites (#36-3-0335 and #36-3-0336) recorded within the proposal site is not possible, the artefacts within the development footprint must be salvaged prior to the proposed work commencing and moved to a safe area within the property that will not be subject to any ground disturbance.	C		
5	The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties and be consistent with Requirement 26 of the *Code of practice for Archaeological Investigation of Aboriginal Objects in New South Wales.* A new site card/s would need to be completed once the artefacts are moved to record their new location on the AHIMS database.	C		
6	The Aboriginal community requests that a Cultural Smoking Ceremony take place to cleanse any artefacts salvaged and the reburial location.	C		
7	If the raised sandy deposits of Wollar SF AFT 11 are to be impacted a subsurface salvage testing/excavation program must be conducted. Excavated material may need to be analysed off site and this is most likely to be undertaken in NGH offices, where the material will be analysed and then subsequently returned to site for reburial.	C		
8	A minimum 5m buffer should be observed around all artefact scatters and isolated find sites that can be avoided, including those outside the development footprint.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
9	WSD should prepare a Cultural Heritage Management Plan (CHMP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm and management of known sites and artefacts. The Plan should include the unexpected finds procedure to deal with construction activity. Preparation of the CHMP should be undertaken in consultation with the registered Aboriginal parties.	C		
10	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		
11	Further archaeological assessment would be required if the proposal activity extends beyond the Heritage study area as detailed in this report, including the whole of Lot 24 DP 755430 and an additional portion of Lot 91 DP 755430. This would include consultation with the registered Aboriginal parties and may include further field survey.	C	O	D
Land and soil assessment				
1	Undertake a soil survey prior to construction to inform the CEMP and sub-plans, rehabilitation and operational aspects.	PC		
2	As part of the CEMP, a Soil and Water Management Plan (SWMP) (with erosion and sediment control plans) would be prepared, implemented and monitored during the proposal, in accordance with Landcom (2004), to minimise soil (and water) impacts. These plans would include provisions to: • Install, monitor and maintain erosion controls. • Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability. • Manage topsoil 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. • Minimise the area of disturbance from excavation and compaction; rationalise vehicle movements and restrict the location of activities that compact and erode the soils as much as practical. Any compaction caused during construction would be treated such that revegetation would not be impaired. • Manage works in consideration of heavy rainfall events; if a heavy rainfall event is predicted, the site should be stabilised, and work ceased until the wet period had passed.	C		

ID	Safeguards and Mitigation Measures	C	O	D
	• Areas of soil disturbed by the proposal would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.			
3	A Groundcover Management Plan would be developed in consultation with an agronomist and to ensure final land use includes perennial grass cover establishment across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: • Soil handling, restoration and preparation requirements. • Plant Species election. • Soil preparation. • Establishment techniques. • Maintenance and monitoring requirements. • Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – i.e. A target of 70% live grass cover would apply to protect soils, landscape function and water quality. Additional measures would be implemented where practical when live grass cover falls below 70%. Grass cover would be monitored on a fortnightly basis using an accepted methodology. • Contingency measures to respond to declining soil or groundcover condition. I.e. any grazing stock would be removed from the site when cover falls below the target of 70% live ground cover. • Identification of baseline conditions for rehabilitation following decommissioning. • Preserve the native composition as much as possible	C	O	D
4	The array would be designed to allow sufficient space between panels to establish and promote groundcover beneath the panels and allow for implementation of weed controls.		Design	
5	A Spill and Contamination Response Plan would be developed as part of the overall Emergency Response Plan to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to: • Respond to the discovery of existing contaminants at the site (e.g. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. • Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act).	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• Manage the storage of any potential contaminants onsite. • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation. • Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. • Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. • Monitor and maintain spill equipment • Induct and train all site staff.			
6	The transformers will be oil-fill, with waterproof bunds built around them to manage oil spills.		Design	
7	A protocol would be developed in relation to discovering buried contaminants within the proposal site (e.g. pesticide containers). It would include stop work, remediation and disposal requirements.	C	O	D
8	A Rehabilitation Plan would be prepared to ensure the array site is returned to at least or better than pre-solar farm land and soil capability. The plan would be developed with reference to the base line soil testing and with input from an agronomist to ensure the site is left stabilised, under a cover crop or other suitable ground cover. The soil survey would be based on: • *Australian Soil and Land Survey Handbook* (CSIRO, 2009) • *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008) • *The land and soil capability assessment scheme: second approximation* (OEH, 2012)			D
9	A pest and weed management plan would be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Mid-Western Regional Council and NSW DPI requirements.	C	O	
10	Consultation with local community, to minimise impact of the Proposal on adjacent agricultural activities and access.	C	O	D
Compatibility with Existing Land Uses				
1	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C	O	D
2	Consultation with proposal site exploration licence holders regarding the proposal and potential impacts.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
3	Consultation with relevant parties involved in existing or proposed developments associated with the Wilpinjong mine, Ulan mine, Moolarben mine and Bylong mine.	C	O	D
4	Consultation with DPI-Lands would be ongoing and the following would be undertaken: • Prior to construction, a lease will be applied for to allow construction to commence within Crown roads on the proposal site. • Prior to construction, the Proponent will apply to purchase the Crown roads associated with the proposal site.	PC		
Historic heritage				
1	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
Water use and water quality				
1	Design waterway crossings and services crossing in accordance with the publications: • *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). • *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). • *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012). • *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (NSW DPI, 2012).	C	O	D
2	All fuels, chemicals, and liquids would be stored at least 40m from any waterways or drainage lines, not on sloping land and would be stored in an impervious bunded area.	C	O	D
3	The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
4	All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D
5	Roads and other maintenance access tracks would incorporate appropriate water quality treatment measures such as vegetated swales to minimise the opportunity of dirty water leaving the site or entering the waterways.	C		D
Hydrology and flooding				

ID	Safeguards and Mitigation Measures	C	O	D
1	The design of buildings, equipment foundations and footings for electrical componentry and panel mounts would be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including: • The solar array mounting piers are designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event plus 500mm freeboard, giving regard to the depth and velocity of floodwaters. • The mounting height of the solar module frames would be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, would be located above the 1% AEP flood level. • Where electrical cabling is required to be constructed below the 1% AEP flood level it would be capable of continuous submergence in water. • The proposed perimeter security fencing would be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater. • Security fencing would be designed so as to create two separate fenced compound on either side of Spring Flat Creek. • Flood warning signs and flood level indicators would be installed on each approach to the existing low-level crossing at the Southern Access. A weatherproof flood refuge building or structure would be constructed within the site on the western side of Wollar Creek.		Design	
2	An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the Proposal. The plan would: • Detail who would be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies.	C	O	D
3	A Business Floodsafe Plan would be prepared prior to construction in general accordance with the NSW SES Business Floodsafe Toolkit and Plan".	C	O	D
Visual amenity and landscape character				

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures</th><th>C</th><th>O</th><th>D</th></tr>
<tr><td>1</td><td>The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:
• Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown.
• Pole mounts will be non-reflective.
Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.</td><td colspan="3">Design</td></tr>
<tr><td>2</td><td>During construction, dust would be controlled in response to visual cues.</td><td>C</td><td></td><td></td></tr>
<tr><td>3</td><td>Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).</td><td></td><td>O</td><td></td></tr>
<tr><td colspan="5">Noise and vibration</td></tr>
<tr><td>1</td><td>A Noise Management Plan would be developed as part of the CEMP. The plan would include, but not be limited to:
• Use less noisy plant and equipment where feasible and reasonable.
• Plant and equipment to be properly maintained.
• Provide special attention to the use and maintenance of ‘noise control’ or ‘silencing’ kits fitted to machines to ensure they perform as intended.
• Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
• Avoid any unnecessary noise when carrying out manual operations and when operating plant.
• Any equipment not in use for extended periods during construction work should be switched off.
• Complaints procedure deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
• Establish good relations with people living in the vicinity of the site at the beginning of proposal and maintain. Keep people informed, deal with complaints seriously and expeditiously. The community liaison member of staff should be adequately experienced.</td><td>C</td><td></td><td></td></tr>
<tr><td colspan="5">Social and economic impacts</td></tr>
<tr><td>1</td><td>Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.</td><td>C</td><td></td><td></td></tr>
<tr><td>2</td><td>Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.</td><td>C</td><td></td><td>D</td></tr>
</table>

ID	Safeguards and Mitigation Measures	C	O	D
3	Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
4	The Community Consultation Plan would be implemented to manage impacts to community stakeholders, including but not limited to: • Protocols to keep the community updated about the progress of the Proposal and proposal benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.). Protocols to respond to any complaints received.	C		D
5	The Proponent will consult with local employment agencies and training organisations and where practicable, will consider supporting training and apprenticeships.	C	O	D
Traffic transport and safety				
1	The following upgrade would be completed in consultation with Mid-Western Regional Council. • Passing facilities will be implemented at strategic locations between Wollar village and the Northern Access.	C		
2	A Haulage Plan would be developed with input from the roads authority, 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). • Consideration of cumulative traffic loads due to other local developments. Traffic controls (signage and speed restrictions etc.).	PC		D
3	Upon determining the haulage route(s) for construction vehicles associated with the proposal, and prior to construction, undertake a Road Dilapidation Report. The report would: • Assess the current condition of the road(s). • Describe mechanisms to restore any damage that may result due to traffic and transport related to the construction of the Proposal. • Be submitted to the relevant road authority for review prior to the commencement of haulage.	PC	PO	
4	A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Mid-Western Regional Council and Roads and Maritime. The plan would include, but not be limited to: • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction.	C		D

ID	Safeguards and Mitigation Measures	C	O	D
	• Identify specific road hazards associated with the area including not limited to fog, wet weather, frost and wildlife. • Pedestrian management - Site access is to be restricted to authorised personnel only and existing employees on site. Pedestrian access to and around the site is to be maintained at all times. Within the site pedestrian travel paths are to be maintained to key areas such as building entrances and be free from trip hazards. • Scheduling of deliveries. • Construction of temporary car parking facilities. • Community consultation regarding traffic impacts for nearby residents and school bus operators. • Consideration of impacts to the railway. • Traffic control plans (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.			
Bushfire				
1	Copper conductors would be used where necessary to electrically bond the metal structures to earth to protect personnel and equipment in the event of lightning strikes and electrical faults.		Design	
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	C	O	D
3	Develop a Bush Fire Management Plan to include but not be limited to: • Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting). • Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements. • Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies. • Document all firefighting resources maintained at the site with an inspection and maintenance schedule. • Monitoring and management of vegetation fuel loads.	C	O	D

ID	Safeguards and Mitigation Measures	C	O	D
	• A communications strategy incorporating use of mobile phones, radio use (type, channels and call-signs), Fire Danger Warning signs located at the entrance to the site compounds, emergency services agency contacts. In developing the Bush Fire Management Plan, NSW RFS would be consulted on the volume and location of water supplies, fire-fighting equipment maintained on-site, fire truck connectivity requirements, proposed APZ and access arrangements, communications, vegetation fuel levels and hazard reduction measures.			
4	An APZ of minimum 10m would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4m wide gravel access track. Average grass height within the APZ would be maintained at or below 5 centimetres on average throughout the October-March fire season. Average grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 centimetres throughout the fire season.	C	O	
5	The overhead powerlines at the site would be managed by maintaining appropriate vegetation clearance limits to minimise potential ignition risks, in accordance with the *ISSC 3 Guideline for Managing Vegetation Near Power Lines*.		O	
6	Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment would include fire extinguishers, a 1000 litre water cart retained on site on a precautionary basis, particularly during any blasting and welding operations. Equipment lists would be detailed in Work Method Statements.	C		
7	The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
8	Following commissioning of the solar farm, the local RFS and Fire and Rescue brigades would be invited to an information and orientation day covering access, infrastructure, firefighting resources on-site, fire control strategies and risks/hazards at the site.		O	
9	The perimeter access track would comply with the requirements for Fire Trails in the PBP guidelines. All access and egress tracks on the site would be maintained and kept free of parked vehicles to enable rapid response for firefighting crews and to avoid entrapment of staff in the case of bush fire emergencies. Access tracks would be constructed as through roads as far as practicable. Dead end tracks would be signposted and include provision for turning firetrucks.	C	O	D
10	A Hot Works Permit system would be applied to ensure that adequate safety measures are in place. Fire extinguishers would be present during all hot works. Where practicable hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D
11	Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	C	O	D

<table>
<tr><th>ID</th><th>Safeguards and Mitigation Measures</th><th>C</th><th>O</th><th>D</th></tr>
<tr><td>12</td><td>Prior to operation of the solar farm, an Emergency Response Plan (ERP) would be prepared in consultation with the RFS and Fire and Rescue NSW. This plan must include but not be limited to:
Specifically addresses foreseeable on site and off site fire events and other emergency incidents.
Risk control measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method of shutting down and isolating the PV system (either in its entirety or partially, as determined by risk assessment).
Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.
Two copies of the ERP are stored in a prominent 'Emergency Information Cabinet' which is located in a position directly adjacent to the site's main entry point/s.
Once constructed and prior to operation, the operator of the facility would contact the relevant local emergency management committee (LEMC).</td><td></td><td>O</td><td></td></tr>
<tr><td>13</td><td>Fire risks associated with the lithium-ion energy storage facility would include:
Locating the Energy Storage Facility as far as practicable from any sensitive receptors or large stands of vegetation.
Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems.
Installing reliable integrated fire detection and fire suppression systems (inert gas).
Ensuring the battery containers are not vulnerable to external heat effects in the event of a bushfire.
Designing appropriate separation and isolation between battery containers and between batteries and other infrastructure, including gravel surfacing around the facility.
Compliance with all relevant guidelines and standards.
Preparation of a specific Battery Fire Response Plan, under the general Bushfire Management Plan, in consultation with fire authorities, fire suppression experts and in reference to relevant standards and guidelines.
Facilitation of first responder training in the management of Lithium-ion battery fires at the site for local brigades.</td><td></td><td>O</td><td></td></tr>
<tr><td colspan="5">Electric and magnetic fields</td></tr>
<tr><td>1</td><td>All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.</td><td>C</td><td></td><td></td></tr>
</table>

ID	Safeguards and Mitigation Measures	C	O	D
2	All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
3	Design of electrical infrastructure would minimise EMFs.	C		
Air quality and climate				
1	Track width of internal tracks would be minimised during detailed design.		Design	
2	Dust generation by vehicles accessing the site and earthworks at the site would be suppressed using water applications or other means as required.	C		D
3	Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
4	All vehicles and machinery used at the site would be in good condition, fitted with appropriate emission controls and comply with the requirements of the POEO Act, relevant Australian standards and manufacturer's operating recommendations. Plant would be operated efficiently and turned off when not in use.	C	O	D
5	Fires and material burning is prohibited on the proposal site.	C	O	D
Resource use and waste generation				
1	A Waste Management Plan (WMP) would be developed 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 identify that 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
2	Septic system is installed and operated according to the Mid-Western Regional Council regulations.	C	O	
Hazardous materials and development				
1	Design of the Energy Storage Facility would be undertaken to address fire risks (spacing and setbacks).		Design	

ID	Safeguards and Mitigation Measures	C	O	D
2	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: *The storage and handling of flammable and combustible liquids*.	C	O	D
3	Protocols would be developed for lithium-ion battery storage, maintenance, and incident response to mitigate Li-ion fire risks.	C	O	D
4	The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific ‘special provisions’ and ‘packing instructions’ applying to the transportation of Li-ion batteries.	C	O	D

10 CONCLUSION

10.1 PROPOSAL OVERVIEW

The proposed Wollar Solar Farm would be located 7km south of Wollar, NSW. The site access would be via Barigan Road and the existing TransGrid access (Northern Access) and Maree Road (Southern Access). The Proposal would connect to the existing Wollar substation west of Barigan Road.

The Wollar Solar Farm proposal involves the construction, operation and decommissioning of a ground-mounted PV solar farm which would generate approximately 290MW (AC) to be supplied directly to the national electricity grid. Development of the solar farm would make use of existing electricity infrastructure and contribute to Australia's transition to a low emission energy generation economy. The proposal is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its current land capability, for agricultural or other alternative land uses.

10.2 BENEFITS OF AND NEED FOR THE PROPOSAL

The proposed Wollar Solar Farm would result in a number of benefits including:

- Supporting Commonwealth and NSW climate change commitments.
- Generation of enough clean, renewable energy for about 104,926 average NSW homes.
- Displacement of approximately 515,564 metric tonnes of carbon dioxide.
- Improved electricity reliability, security and cost.
- Creation of local job and training opportunities.
- Injection of expenditure in the local area and spread of benefits through a local community fund.
- Diversification of the regional economy by introducing new land use.

In summary, there is a clear need for the proposal to meet Australia's greenhouse gas reduction, renewable energy targets and electricity needs. The proposal would bring local benefits such as job opportunities and local expenditure.

10.3 ENVIRONMENTAL IMPACTS AND MANAGEMENT

The key environmental risks have been investigated through specialist investigations, and include:

- Biodiversity impacts.
- Aboriginal heritage impacts.
- Soil impacts.
- Flooding impacts.

Consultation with the local community is included in this environmental assessment. Overall, there has been considerable support for the proposal within the community.

All residents with the potential to be impacted were supportive of the proposal, with no significant objections or concerns. No respondents raised any concerns with relation to visual or noise impacts, effects on natural areas, effects on land use or land values, effects on recreational opportunities.

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.

10.4 ABILITY TO BE APPROVED

This EIS indicates that the proposal can be approved, subject to the identified mitigation measures. In summary, this is because:

- The proposal meets relevant planning requirements, as set out in Section 5.
- The environmental risks associated with the proposal are well understood and manageable, as set out in Sections 7 and 8. Specifically, the proposal has demonstrated consideration of avoidance and minimisation of key environmental features as part of the layout and mitigation strategy development. The impacts are largely reversible, and offsetting would be undertaken to ensure an overall 'not net biodiversity loss' outcome for the proposal.

Consideration has been given to the compatibility of the proposal with the existing electricity network and the compatibility of the site for the generation of solar energy. This ensures construction and operating costs are reduced, maximising the viability of the proposal and its contribution to meeting energy needs into the future. Considerations during initial site investigations included:

- Proximity to and capacity of the electrical transmission network.
- Availability of an abundant solar resource.
- Availability of suitable land (i.e. topography, aspect, presence of native vegetation).
- Suitability in terms of the interests of other stakeholders and the environment.

The consequences of not proceeding with the proposed Wollar Solar Farm would result in:

- Loss of opportunity to reduce GHG emissions and move towards cleaner renewable electricity generation.
- Loss of a renewable energy supply that would assist in reaching the RET.
- Loss of additional electricity generation and supply into the National grid.
- Loss of social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the solar farm.

The preferred option assessed in this EIS provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the proposal. Furthermore, the proposal is consistent with the principles of ESD and forms an important part of Australia's transition to renewable energy generation.

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APPENDIX A SECRETARYS ENVIRONMENTAL ASSESSMEMENT REQUIREMENTS

APPENDIX B PROPOSAL PLANS

APPENDIX C COMMUNITY CONSULTATION PLAN

APPENDIX D COMMUNITY CONSULTATION NEWSLETTER AND FEEDBACK FORM

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APPENDIX F BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT (BDAR)

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APPENDIX H HYDROLOGICAL AND HYDRAULIC ANALYSIS

APPENDIX I NOISE ASSESSMENT

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