First Solar.

Environmental Impact Statement

WELLINGTON SOLAR FARM

NOVEMBER 2017

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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

Applicant: First Solar (Australia) Pty Ltd

Proposed Development:

The Wellington Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 174 Megawatts of electricity. Associated infrastructure would include a substation and potentially an Energy Storage Facility.

Land to be developed:

The Wellington Solar Farm proposal site would be located on Lots:

- Lots 89, 90, 91, 92, 99, 102, 103 and 104/DP2987
- Lot 1/DP34690,
- Lot 1/DP520396;
- Lot 2/DP807187
- The portion of the Crown Road Reserve between Lot 2/DP807187 and 91/DP2987 subject to *Road Closure: Public Road Closure Application* [W58925; Ref 17/09541]
- Lot 1/DP1226751, existing Transgrid Substation.

Certification

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

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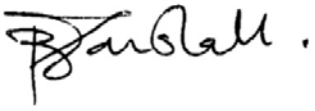
Signature:		
Date:	30/11/2017	30/11/2017

TERMS AND DEFINITIONS

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*
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
AEP	Annual Exceedance Probability
AGO	Australian Greenhouse Office
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
AS	Artefact scatter
ASL	Above sea level
BAR	Biodiversity Assessment Report
BCA	Building Code of Australia
BCC	Biobanking Credit Calculator
BFMC	Bush Fire Management Committee
BFMP	Bush Fire Management Plan
BLM	Bureau of Land Management
BNEF	Bloomberg New Energy Finance
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
CER	Clean Energy Regulator
CHMP	Cultural Heritage Management Plan
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
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DOE	Department of the Environment (Commonwealth)
DOEE	Department of the Environment and Energy (Commonwealth)
DOP	Department of Planning (refer to DPE)
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz *(c.f.)*
EMFs	Electromagnetic fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPA	(NSW) Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPI	environmental planning instruments
EPL	Environment Protection Licence, issued under the POEO Act *(c.f.)*
ERP	Emergency Response Plan
ESA	Environmental Site Assessment
ESD	Ecologically sustainable development
ESF	Energy Storage Facility
FBA	Framework Biodiversity Assessment
FM Act	*Fisheries Management Act 1994*
FPL	Flood Planning Level
FRV	Fotowatio Renewable Ventures,
GBD	General Biosecurity Duty
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gas
GW	Gigawatts
GWh	Gigawatt hours
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
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*
km	kilometres
kV	kilovolts
kW	kilowatts
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LCU	Landscape Character Unit
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LMZ	Landscape Management Zone
m	metres
mm	millimetres
ML	Megalitres
MNES	Matters of National Environmental Significance, under the EPBC Act (*c.f.*)
MW	Megawatt
NEM	National Electricity Market
NML	Noise Management Level
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
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
PAD	potential archaeological deposits
PBP	Planning for Bushfire Protection
PCT	Plant Community Type
PEMP	Project Environmental Management Plan
PHA	Preliminary Hazard 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)
RSWMP	Central West Regional Strategic Weed Management Plan 2017 - 2022
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
T	Tonnes
TMP	Traffic Management Plan
µT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WHO	World Health Organisation
WM Act	*Water Management Act 2000*
WMP	Waste Management Plan
WSP	Water Sharing Plan
ZVI	Zone of Visual Influence

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation, and decommissioning of the proposed Wellington photovoltaic (PV) solar farm (henceforth referred to as Wellington SF or the 'proposal'). The proposal would have an upper capacity of 174 Megawatts (MW AC) of electricity generation.

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).

PROPOSAL OBJECTIVES

The objectives of the Wellington SF proposal are to:

- Select as site which is suitable for commercial scale solar electricity generation, in terms of solar yield, connection to the national electricity grid and environmental (including social) constraints.
- Develop a profitable commercial scale solar electricity generation project and potentially an Energy Storage Facility.
- In producing renewably sourced energy:
    - Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals.
    - Provide a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions.
- Obtain a social license to operate from the local community.
- Provide local and regional employment opportunities and other social benefits during construction and operation.
- Identify opportunities to avoid and minimise environmental impacts in the construction and operation of the project.

PROPOSAL NEEDS AND BENEFITS

Climate change mitigation

Paris Agreement

Under the United Nations Paris Agreement on climate change, Australia has committed to the following greenhouse gas emission reduction targets:

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

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia, representing 35 per cent of emissions (DOEE, 2016). The transition to renewable energy sources will be critical to enable Australia is to meet its Paris commitments. In terms of renewable energy technologies,

solar projects have the capacity to provide faster results because of shorter potential construction and commissioning times (CER, 2017).

Renewable Energy Target Scheme

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 works by creating a market for renewable energy certificates, which drives investment in the renewable energy sector. Renewable energy generators create certificates for electricity generated or displaced. Electricity retailers purchase these certificates to meet their renewable energy obligations.

The RET aims to achieve large-scale renewable generation of 33,000GWh in 2020, meaning that about 23.5% of Australia's electricity generation would be from renewable sources.

The Large-scale Renewable Energy Target component of the RET requires an estimated 6,000MW of new renewable power stations to be built by 2020, which is likely to consist of approximately 75 per cent wind and 25 per cent solar (Commonwealth of Australia, 2016). This would represent a doubling of the total renewable capacity installed since 2001 (Commonwealth of Australia, 2016).

The additional committed new build capacity for renewable energy generation of 3,000MW required in 2016 was not reached (CER, 2017). For the 2020 target to be achieved, around 3,000MW will need to be committed in 2017 and a further 1,000MW in 2018. The 2020 target remains achievable provided investment momentum can be maintained throughout 2017 (CER, 2017).

The proposed 174 MW Wellington SF would directly contribute to meeting the RET renewable energy generation target. On an annual basis, the proposed Wellington SF would provide enough clean, renewable energy for about 46,000 average NSW homes. At the same time, it would displace approximately 305,000 metric tonnes of carbon dioxide per year – the equivalent of taking about 81,000 cars off the road.

NSW goals and policies

The NSW Climate Change Policy Framework (State of NSW and Office of Environment and Heritage, 2016) aims to 'maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change'. The framework endorses and is intended to complement national Paris Agreement targets, and has the following aspirational long-term objectives:

- Achieve net-zero emissions by 2050.
- Ensure NSW is more resilient to a changing climate.

Implementation of the framework encompasses emission reduction and adaptation, and includes the development of an advanced energy action plan, a new energy efficiency plan, a climate change adaptation action plan, and additional policy investigations for sectors with significant opportunities and risks. Under the framework, a draft Climate Change Fund Strategic Plan has been released for public consultation (OEH, 2016a). The proposal would directly contribute to the objectives of the framework by reducing greenhouse gas emissions.

The proposal would also contribute to the New South Wales Renewable Energy Action Plan (NSW Government, 2013), which supports national renewable energy targets. The proposal will progress the three goals of the Action Plan:

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

The proposal would progress these three goals of the Action Plan mostly through the construction, operation and decommissioning of a new solar farm that would generate direct and indirect jobs for the local area and renewable energy industry.

The proposal would further assist in achieving the following goal in NSW 2021: A plan to Make NSW Number One (NSW Government, 2011). It would:

- *Contribute to the national renewable energy target … by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*.

Socio-economic benefits

Employment

The proposal would generate around 200 construction jobs during peak construction as well as indirect supply chain jobs. During the operation and maintenance phase it would employ approximately 1-3 full time staff. In 2012, 24,000 Australians were employed in the renewable energy sector and the industry is set to generate an additional new 18,400 jobs by 2020 (CEC, 2015). Large scale renewable projects create long term employment opportunities, which are rare in many rural communities.

The employment benefits extend through the local supply chains to fuel supply, vehicle servicing, uniform suppliers, hotels/motels, B&B's, cafés, pubs, catering and cleaning companies, tradespersons, tool and equipment suppliers and many other businesses. Data from the recent Nyngan and Broken Hill solar projects indicate that local goods and services accounted for approximately 56.3% of the project's procurement spend, including $66 million spent on cables, mounting structures and power conversion equipment from local companies (First Solar, 2014).

Electricity prices

Household electricity bills increased 61% between 2008-09 and 2012-13, due mainly to network expenditure (Commonwealth of Australia, 2016). According to Deloitte, Australian households will pay $510 million more for power in 2020 without renewable growth through the RET and up to $1.4 billion more per year beyond 2020. Renewables increase competition in the wholesale energy market and as in any market, less competition means higher prices.

Variable renewable energy generation such as PV solar operates with no fuel costs and can, with the right policy framework and technological development to manage variability, be used to reduce overall wholesale prices of electricity (Commonwealth of Australia, 2017).

Several studies on the impacts of increased large scale renewable energy generation under the RET have indicated that this is likely to put downward pressure on electricity prices (Australia Institute, 2015). To the extent that competition amongst retailers is limited, and to the extent that the RET creates greater contestability through the creation of economically sustainable new entrant retailers, there will be further downward pressure on the retail margins (Sinclair Knight Merz, 2013).

Solar energy generation is at least as cheap as coal in Australia, and the levelized cost of electricity from solar is set to drop another 66% by 2040. Solar will beat the cost of existing, fully depreciated and un-refurbished coal plants by 2032 (BNEF, 2017).

Local economic benefits

Additionally, the proposal would provide significant local economic benefits including:

- Direct and indirect employment opportunities during construction and operation of the solar farm.
- Embedded electricity generation, to supply into the Australian grid closer to the consumption centres.
- Injection of expenditure in the local area.
- Development of a new land use thereby diversifying the regional economy.

PROPOSAL DESCRIPTION

The Wellington SF proposal site is located approximately 2km north east of Wellington, in western central NSW, within the Dubbo Regional Local Government Area (LGA). The Wellington SF proposal site is located on the following lots:

- Lots 89, 90, 91, 92, 99, 102, 103 and 104/DP2987
- Lot 1/DP34690,
- Lot 1/DP520396;
- Lot 2/DP807187
- The portion of the Crown Road Reserve between Lot 2/DP807187 and 91/DP2987 subject to *Road Closure: Public Road Closure Application* [W58925; Ref 17/09541]
- Lot 1/DP1226751, existing Transgrid Substation.

The extent of the solar array site is 316ha (excluding connection to the substation). The site is bounded by Goolma Road to the east and south. No residential subdivision development has occurred; only one residence is located onsite. The dominant land use onsite and in the local area is agriculture. The steeper landforms onsite and in the area support mainly grazing activities and the flatter landforms are mostly cropped. Sheep (western lots) and cattle (eastern lots) currently graze the site. Native vegetation remnants are present across some areas of the site

There are a number of existing transmission lines within the area, which connect to the existing substation south of Goolma Road. An overhead transmission line passes through the main proposal site, in a northwest – southeast direction. The proposal would require an additional transmission line to connect to the substation, which would be overhead.

The dwelling within the proposal site is located on Lot 90/DP2987. The property is listed as an item of local heritage significance under Schedule 5 of the *Wellington Local Environmental Plan 2012.* To preserve the heritage value of the property, this dwelling would be preserved by the proposal and used as the Operations and Maintenance (O&M) Building for the site. The proposal site also contains dilapidated buildings (potential abattoir and office buildings), which have sometimes been used for storage of grains. These buildings were constructed by a previous landowner and were never completed. An old single room building is located onsite that may have once been used by shearers or as a milk separating shed. Above ground tanks for bore water used for stock are also located within the proposal site.

The proposed Wellington SF would comprise of the installation of a solar plant with an upper capacity of 174MW that would supply electricity to the national electricity grid. The key infrastructure for proposal would include:

- PV modules (solar panels).

- Single Axis horizontal tracking (likely) or fixed mounting frames.
- 30-50 inverter stations with associated transformer.
- An onsite substation or substation within the existing Transgrid substation containing one transformer and associated switchgear.
- A 33kV, 132kV or 330kV transmission line to the adjacent existing Wellington Substation (100m).
- Underground or aboveground electrical conduits and cabling to connect the inverters to the onsite substation, or substation within the existing Transgrid substation.
- 22-33kV underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access track off Goolma Road, approximately 4.6km north east of Mitchell Highway junction.
- Permanent site office and maintenance building with associated vehicle parking.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing up to 2.3m high.
- Energy Storage Facility (ESF) (Lithium-ion cells).
- Native vegetation screening, where required to break up views of infrastructure to specific receivers, will be planted prior to commencement of operations.

The proposal includes an ESF, which will be constructed at the same time as the solar farm, or as part of a staged development within 5 years of the commissioning of the solar farm. Subject to economic and technical considerations, the ESF will comprise banks of lithium-ion cells housed in powerpacks. The facility would have approximately 25MW/100MWh rated capacity. If the ESF is constructed outside the main construction period, a specific traffic management plan, construction noise management plan and community notification procedure would be undertaken to manage any additional impacts.

During the construction period some additional temporary facilities would be located within the site boundary and may include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction worker's transportation. Once the plant has been commissioned, a small car park would remain for the minimal staff required and occasional visitors during operation.

The construction and commissioning phase of the proposal would take approximately 12 months. Approximately 200 workers would be required during the peak construction period.

At the end of its operational life, the proposal site would be decommissioned, all above ground infrastructure to a depth of 500mm would be removed. All areas of soil disturbed during decommissioning would be rehabilitated with the aim of meeting the existing (pre-construction) land capability

KEY ENVIRONMENTAL ASSESSMENT ISSUES

Prior to detailed environmental investigations, a risk assessment was carried out to identify the key environmental risks of the proposal, to guide the depth of investigation in this EIS. The risk assessment identified five environmental aspects as key risks. Specialist investigations were subsequently undertaken in these areas as part of this EIS:

- Biodiversity.

- Aboriginal heritage.
- Visual amenity.
- Noise.
- Historic Heritage.

Summary of higher risk issues

Biodiversity

Biodiversity (flora and fauna) investigations included searches of relevant data bases and a site assessment in line with the *Framework for Biodiversity Assessment* - NSW Biodiversity Offsets Policy for Major Projects (OEH 2014). Two Plant Community Types (PCTs) were identified in the development site, *White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes* (PCT 266) and *Blakely's Red Gum – Yellow Box grassy tall woodland* (PCT 277). Both these PCTs are listed as Endangered Ecological Communities. One threatened species, the Masked Owl (*Tyto novaehollandiae*) was identified in the development site. The assessment concluded that it was unlikely that this species would be dependent on habitat in the development site, therefore species credits were not generated for this species. Impacts from the removal of the identified PCTs would require offsetting in accordance with the NSW Biodiversity Banking and Offsets Scheme.

Aboriginal heritage

Aboriginal heritage investigations included Aboriginal community 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*. 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 recorded 61 stone artefacts in 25 site occurrences. These archaeological features have been recorded as ten artefact scatters and 15 isolated finds. A single scarred tree and a possible hearth were also recorded.

It is possible that additional stone artefacts could occur within the proposed development footprint. Based on the land use history, visibility, an appraisal of the results from the field survey and the archaeological background of the area it was concluded that two areas, Potential Archaeological Deposits (PAD) 1 and PAD 2, within the proposal area have potential for subsurface finds. Both of these PAD areas have a higher density of surface artefacts compared to the rest of the proposal area and appear to have a good depth of deposit.

The 15 isolated finds and 10 artefact scatter would be salvaged prior to development of the proposal by an archaeologist with representatives of the registered Aboriginal parties. Further archaeological research would be required for PAD1 and PAD2, as it cannot be avoided.

Visual amenity

Visual impact investigations were undertaken using a transparent and systematic evaluation framework, based on the BLM Visual Resource Management System (Bureau of Land Management, US Department of the Interior n.d.). The assessment also includes reference to ARENA's *Establishing the social licence to operate large scale facilities in Australia* document (2015). These guidelines assisted in addressing the subjectivity of visual assessment and the importance of including community perceptions in the assessment, as much as possible. The assessment included topographical modelling, ground truthing,

incorporates community consultation results and was informed by specific photomontages from representative viewpoints.

A medium impact was determined for seven representative viewpoints. While mitigation is required for high impact locations (none of which were identified), in this instance mitigation has been suggested for four specific medium impact locations. A sparse vegetation screen is proposed to be included in specific sections of Goolma Road, to mitigate cumulative impacts and lessen the contrast of the infrastructure given the close proximity of the solar array infrastructure in this location. Additionally, two areas where small groves could be established have been identified. These will provide a more natural structure to the vegetation; akin to small remnants. The screen would be of varying native species and of varying height to soften not block the view of the site. Breaks in the screen, reflecting natural breaks in existing remnants would be appropriate.

In most locations, the road side representative viewpoints were considered sufficient to assess and consider mitigation for the residences in these locations. However, five residences were identified that this road-side assessment could not adequately investigate. First Solar consulted with the landowners of each residence, discussed the proposal and discussed impact mitigation measures. Where requested, photo montages to illustrate the look of the solar farm from specific locations were undertaken. Additional mitigation was proposed for two residences, which now forms part of the projects mitigation strategy.

Noise

Noise investigations were undertaken in accordance with *NSW Industrial Noise Policy* (EPA, 2000), NSW *Interim Construction Noise Guideline* (DECC, 2009), EPA's *Assessing Vibration: A Technical Guideline* (DECC, 2006) and *NSW Road Noise Policy* (DECCW ,2011). Background noise monitoring was undertaken at the closest receiver to the proposal site. The monitoring location was used to model construction and operational noise impacts for the proposal.

The assessment predicted noise emissions would exceed relevant criteria during construction of the proposed solar farm for Receivers R1 and R7. It is noted that construction noise levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A). Mitigation measures including noise control measures such as distance and screening would limit the potential noise generated to within acceptable levels.

No exceedances of noise limits are predicted during operation or from traffic.

Historic heritage

The results of the heritage investigations found one historic heritage site located within the proposal site, Narrawa Homestead, listed on the Wellington LEP (2012). The local listing for the property has identified that it has historical and aesthetic heritage significance at a local level.

The property, and the region, has historically been the site of agricultural activities and the solar farm will introduce solar panel structures into what has been agricultural farmland. The solar farm will therefore alter the historical context into which the Narrawa Homestead was built and has been associated with since 1908. Whilst this is an impact, the Narrawa Homestead will remain, and the solar farm will eventually be decommissioned with the opportunity of returning the land to agricultural use.

The solar farm 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 historic heritage and specifically upon the locally listed Narrawa Homestead.

Lower risk issues

Nine lower risk issues were investigated, primarily using desktop assessment, in Section 8 of this EIS and include:

- Traffic, transport and road safety.
- Land use impacts (including mineral resources).
- Soils.
- Hydrology (surface and groundwater), water quality and water use.
- Flooding.
- Resource use and waste generation.
- Community and Socio-economic.
- Air quality and climate.
- Hazards

These impacts were assessed as highly manageable.

MANAGEMENT OF 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 a Project Environmental Management Plan, 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.

CONCLUSION

The Wellington SF proposal would result in a number of benefits including:

- Generation of enough clean, renewable energy for about 46,000 average NSW homes.
- Displacement of approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road.
- Diversification of fuel sources for electricity generation on the NEM therefore increasing energy security.
- Creation of local job opportunities.
- Injection of expenditure in the local area.
- Exploitation of a new land use thereby diversifying the regional economy.

The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. Impacts are considered justifiable and acceptable.

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the construction, operation, and decommissioning of the proposed Wellington photovoltaic (PV) solar farm (henceforth referred to as Wellington SF or the 'proposal'). The proposal would have an upper capacity of 174 Megawatts (MW AC) of electricity generation.

NGH Environmental has prepared the EIS on behalf of the proponent, First Solar (Australia) Pty Ltd.

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 79C of the EP&A Act. The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by NSW DPE on 20 July 2017 (refer Section 5.1.1).

1.2 PROPOSAL OVERVIEW

1.2.1 Site location

The Wellington SF proposal site is located approximately 2km north east of Wellington, in western central NSW, within the Dubbo Regional Local Government Area (LGA). The land is agricultural land, and the site has a history of agricultural cultivation. Native vegetation remnants are present across some areas of the site.

There are a number of existing transmission lines within the proposal site, which connect to the existing Wellington substation south of Goolma Road. The proposal would require an additional overhead transmission line to connect the solar farm to the Wellington substation.

Access to the proposal site would be from Goolma Road, on the eastern boundary of the site. The Mitchell Highway, which intersects with Goolma Road approximately 4.6km south of the proposed site entrance, would be the major transport route for haulage and site vehicles during construction and operation of the proposal. The Mitchel Highway and Goolma Road are Oversized Overmass Load Carrying Approved Roads.

The location of the proposal site is illustrated in Figure 1-1. Further information on the proposal site and the locality is provided in Section 3.

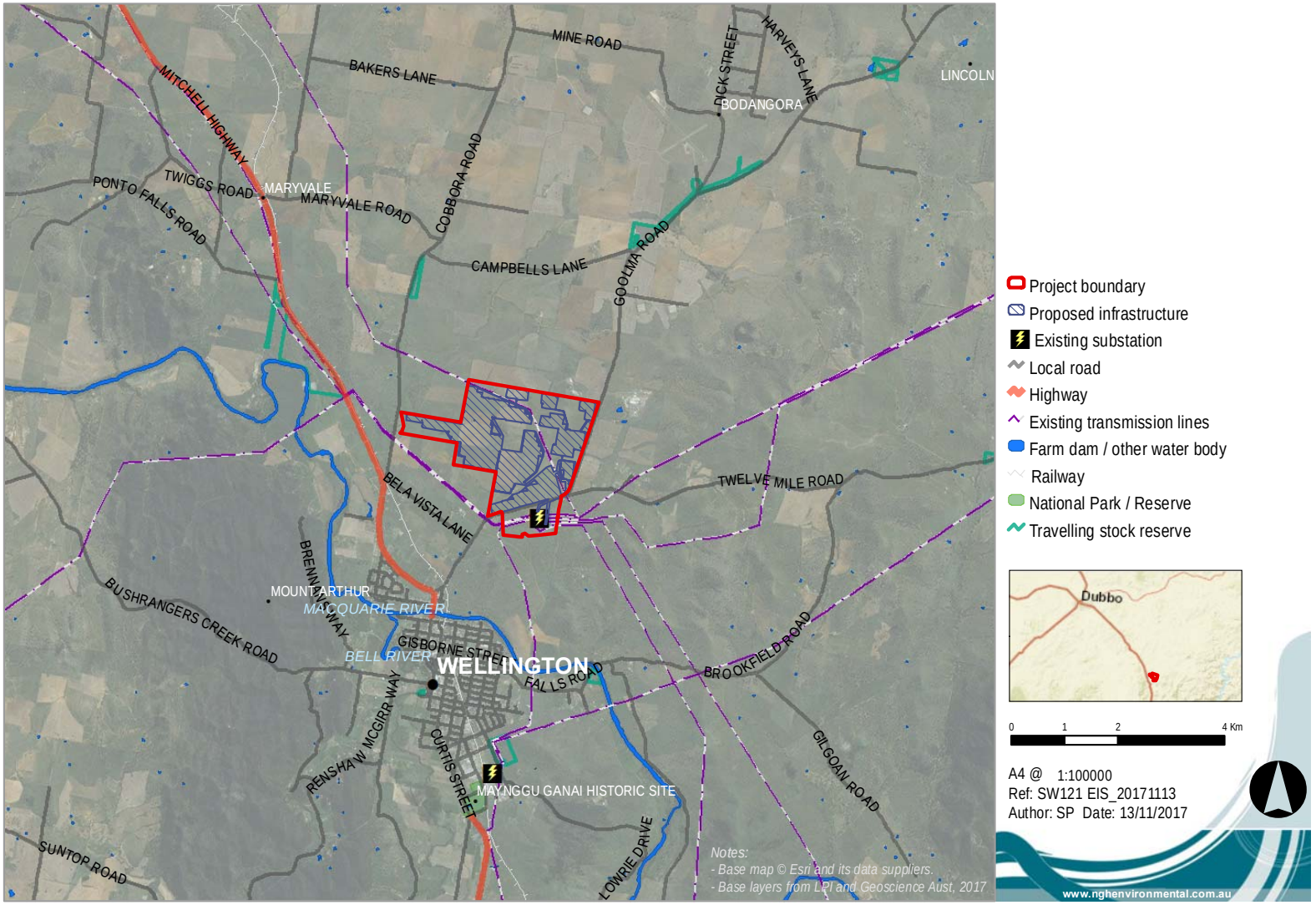


Figure 1-1 Proposal location

1.2.2 Key components of the proposal

The Wellington SF proposal would comprise the installation of a solar plant with an upper capacity of 174MW that would supply electricity to the National Electricity Market (NEM). The power generated would be transmitted via overhead powerline to the existing substation south of Goolma Road.

On an annual basis, the proposed Wellington SF would provide enough clean, renewable energy for about 46,000 average NSW homes while displacing approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road.

The proposal would comprise an array of solar panels, a 132kV substation, and related infrastructure as follows:

- PV modules mounted on a horizontal single axis tracking structure or fixed frame.
- Site office and maintenance building.
- An onsite substation or substation within the existing Transgrid substation containing one transformer and associated switchgear.
- A site access road off Goolma Road, approximately 4.6km north east of Mitchell Highway junction.
- Overhead transmission lines for grid connection to the adjacent substation (33kV or 132kV or 330kV).
- Overhead or underground electrical conduits and cabling to connect the arrays on the array site.
- Internal inverter stations to allow conversion of DC module output to AC electricity.
- Energy Storage Facility (ESF; Lithium-ion cells).
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific nearby receivers, will be planted prior to commencement of operation.

Refer to Section 3.2 for further detail on these elements.

The Wellington SF would be expected to operate for approximately 30 years. The construction phase of the proposal would take approximately 12 months. After the initial 30 year operating period, the solar farm would either be decommissioned, removing all above ground infrastructure and returning the site to its existing land capability, or repowered with new PV equipment. The proposal is considered highly reversible with regard to land capability and land use options.

The Wellington SF design and construction, operation and decommissioning requirements are described in more detail in Section 3.2. An indicative layout is shown in Figure 1-2. Detailed design may lead to some minor layout changes. The layout shown represents the maximum impact areas that would be required. The maximum impact areas shown have been determined following the outcomes of the assessments in this report, particularly the biodiversity assessment, which resulted in removing arrays from the central portion of the site to minimise potential impacts on threatened communities and species.

1.2.3 The proponent

First Solar (Australia) Pty Ltd is a branch of First Solar, which has developed, financed, engineered, constructed and currently operates a number of large grid-connected PV power plants all over the world. First Solar was founded in 1999 and has over 17 Gigawatts (GW) of solar power installed worldwide. In Australia, First Solar has constructed five solar projects and is in the process of developing another six projects including the Wellington SF (First Solar, 2017).

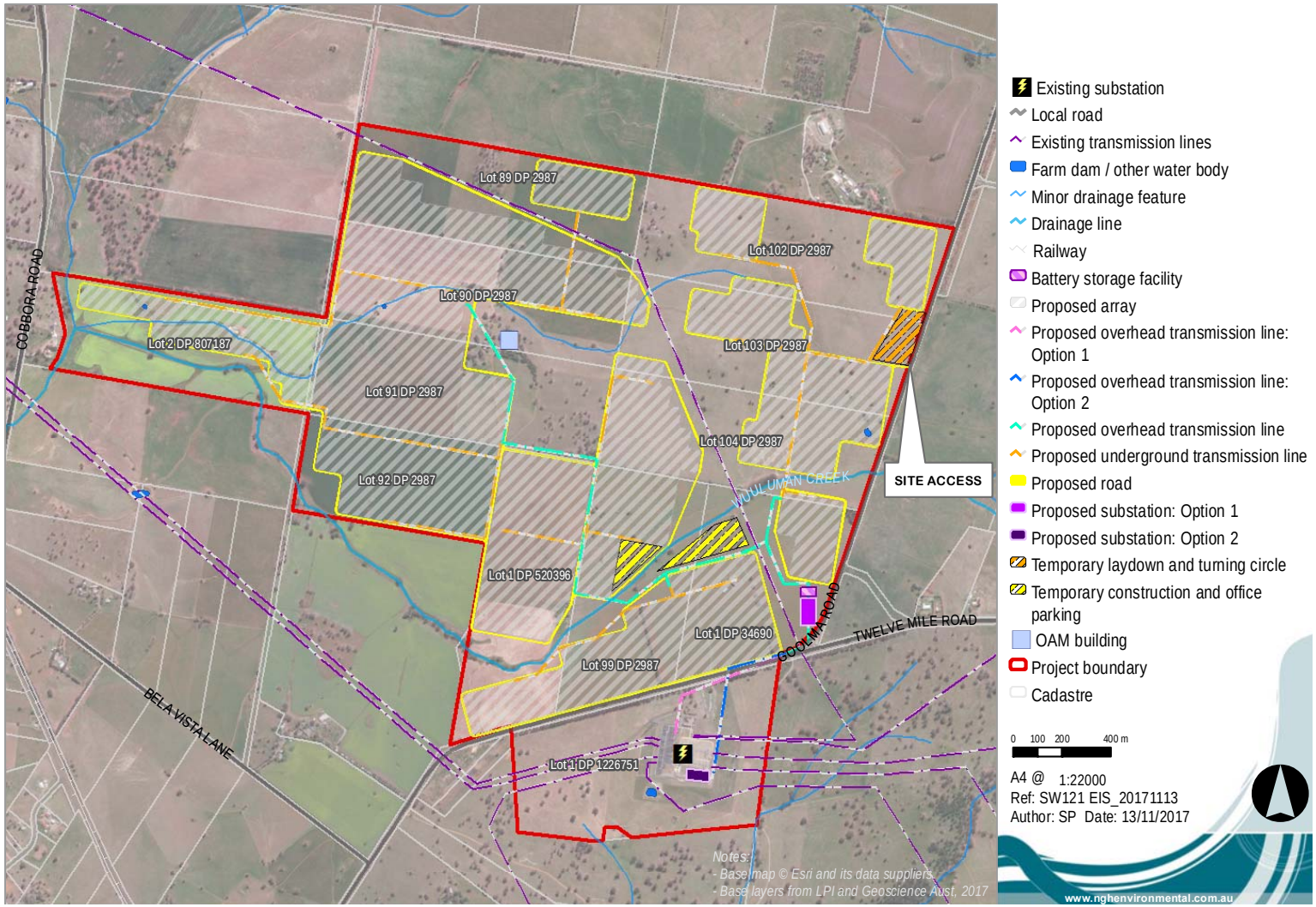


Figure 1-2 Indicative proposal layout

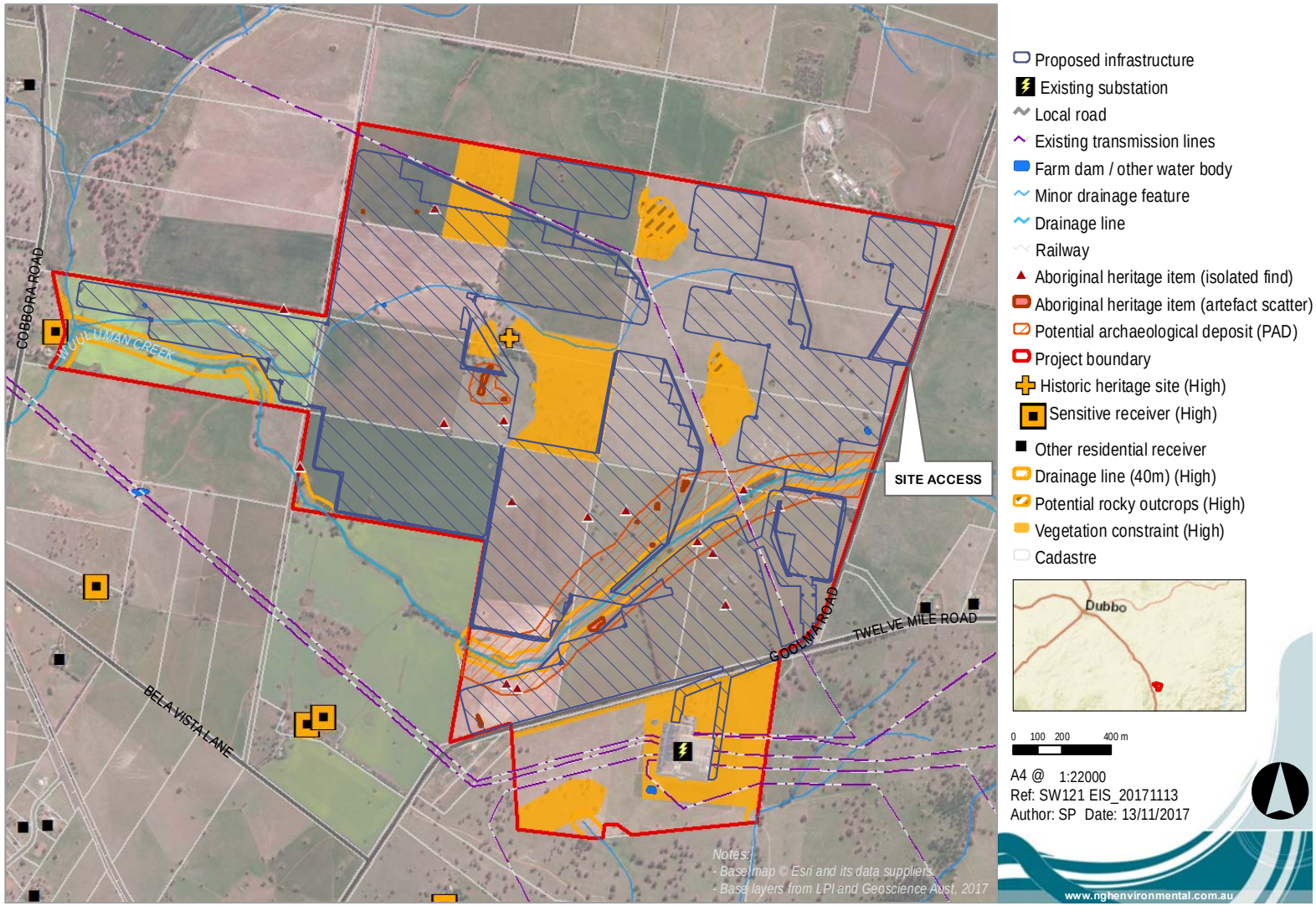


Figure 1-3 Proposal layout in regard to site constraints

2 OBJECTIVES AND BENEFITS, ALTERNATIVES AND JUSTIFICATION FOR THE PROPOSAL

2.1 PROJECT OBJECTIVES

The objectives of the Wellington SF proposal and how this has been achieved is outlined in Table 2-1.

Table 2-1 Objectives of the Wellington SF proposal

Objective	How will the proposal achieve this objective?
Select as site which is suitable for commercial scale solar electricity generation, in terms of solar yield, connection to the national electricity grid and environmental (including social) constraints.	The selected site is adjacent to an existing substation, electricity transmission lines and good access to a haulage route. The site is relatively flat and is geologically and hydrologically compatible with the development of solar infrastructure.
Develop a profitable commercial scale solar electricity generation project.	The selected site has favourable solar irradiation and the close proximity to the existing substation makes this a commercially profitable project.
In producing renewably sourced energy: • Assist the NSW and Commonwealth Governments to meet Australia's renewable energy targets and other energy and carbon mitigation goals. • Provide a clean and renewable energy source to assist in reducing greenhouse gas (GHG) emissions.	The proposal would provide enough clean, renewable energy for about 46,000 average NSW homes while displacing approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road.
Obtain a social license to operate from the local community.	Community engagement activities have been undertaken to inform the community and capture feedback to assist develop the most appropriate project. The feedback received to date has been included within this EIS.
Provide local and regional employment opportunities and other social benefits during construction and operation.	200 construction jobs would be created during peak construction and during operation the proposal would employ approximately 1-3 full time staff.
Identify opportunities to avoid and minimise environmental impacts in the construction and operation of the project.	The maximum impact area presented is responsive to the site's key environmental constraints: • Biodiversity, including grasslands • Heritage • Waterways

2.2 PROJECT NEED AND BENEFITS

2.2.1 Climate change mitigation

Paris Agreement

Under the United Nations Paris Agreement on climate change, Australia has committed to the following greenhouse gas emission reduction targets:

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

Electricity generation is the largest individual contributor of greenhouse gas emissions in Australia, representing 35 per cent of emissions (DOE, 2016). The transition to renewable energy sources will be critical to enable Australia is to meet its Paris commitments. In terms of renewable energy technologies, solar projects have the capacity to provide faster results because of shorter potential construction and commissioning times (CER, 2017).

Renewable Energy Target Scheme

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 works by creating a market for renewable energy certificates, which drives investment in the renewable energy sector. Renewable energy generators create certificates for electricity generated or displaced. Electricity retailers purchase these certificates to meet their renewable energy obligations.

The RET aims to achieve large-scale renewable generation of 33,000GWh in 2020, meaning that about 23.5% of Australia's electricity generation would be from renewable sources.

The Large-scale Renewable Energy Target component of the RET requires an estimated 6,000MW of new renewable power stations to be built by 2020, which is likely to consist of approximately 75 per cent wind and 25 per cent solar (Commonwealth of Australia, 2016). This would represent a doubling of the total renewable capacity installed since 2001 (Commonwealth of Australia, 2016).

The additional committed new build capacity for renewable energy generation of 3,000MW required in 2016 was not reached (CER, 2017). For the 2020 target to be achieved, around 3,000MW will need to be committed in 2017 and a further 1,000MW in 2018. The 2020 target remains achievable provided investment momentum can be maintained throughout 2017 (CER, 2017).

The proposed 174MW Wellington SF would directly contribute to meeting the RET renewable energy generation target. On an annual basis, the proposed Wellington SF would provide enough clean, renewable energy for about 46,000 average NSW homes. At the same time, it would displace approximately 305,000 metric tonnes of carbon dioxide per year – the equivalent of taking about 81,000 cars off the road.

NSW goals and policies

The NSW Climate Change Policy Framework (State of NSW and Office of Environment and Heritage, 2016) aims to 'maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate

change'. The framework endorses and is intended to complement national Paris Agreement targets, and has the following aspirational long-term objectives:

- Achieve net-zero emissions by 2050.
- Ensure NSW is more resilient to a changing climate.

Implementation of the framework encompasses emission reduction and adaptation, and includes the development of an advanced energy action plan, a new energy efficiency plan, a climate change adaptation action plan, and additional policy investigations for sectors with significant opportunities and risks. Under the framework, a draft Climate Change Fund Strategic Plan has been released for public consultation (OEH 2016a). The proposal would directly contribute to the objectives of the framework by reducing greenhouse gas emissions.

The proposal would also contribute to the New South Wales Renewable Energy Action Plan (NSW Government, 2013), which supports national renewable energy targets. The proposal will progress the three goals of the Action Plan:

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

The proposal would progress these three goals of the Action Plan mostly through the construction, operation and decommissioning of a new solar farm that would generate direct and indirect jobs for the local area and renewable energy industry.

The proposal would further assist in achieving the following goal in NSW 2021: A plan to Make NSW Number One (NSW Government, 2011). It would:

- *Contribute to the national renewable energy target … by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*.

2.2.2 Socio-economic benefits

Employment

The proposal would generate around 200 construction jobs during peak construction as well as indirect supply chain jobs. During the operation and maintenance phase it would employ approximately 1-3 full time staff. In 2012, 24,000 Australians were employed in the renewable energy sector and the industry is set to generate an additional new 18,400 jobs by 2020 (CEC 2015). Large scale renewable projects create long term employment opportunities, which are rare in many rural communities.

The employment benefits extend through the local supply chains to fuel supply, vehicle servicing, uniform suppliers, hotels/motels, B&B's, cafés, pubs, catering and cleaning companies, tradespersons, tool and equipment suppliers and many other businesses. Data from the recent Nyngan and Broken Hill solar projects indicate that local goods and services accounted for approximately 56.3% of the project's procurement spend, including $66 million spent on cables, mounting structures and power conversion equipment from local companies (First Solar, 2014).

Electricity prices

Household electricity bills increased 61% between 2008-09 and 2012-13, due mainly to network expenditure (Commonwealth of Australia, 2016). According to Deloitte, Australian households will pay

$510 million more for power in 2020 without renewable growth through the RET and up to $1.4 billion more per year beyond 2020. Renewables increase competition in the wholesale energy market and as in any market, less competition means higher prices.

Variable renewable energy generation such as PV solar operates with no fuel costs and can, with the right policy framework and technological development to manage variability, be used to reduce overall wholesale prices of electricity (Commonwealth of Australia, 2017).

Several studies on the impacts of increased large scale renewable energy generation under the RET have indicated that this is likely to put downward pressure on electricity prices (Australia Institute, 2015). To the extent that competition amongst retailers is limited, and to the extent that the RET creates greater contestability through the creation of economically sustainable new entrant retailers, there will be further downward pressure on the retail margins (SKM, 2013).

Solar energy generation is at least as cheap as coal in Australia, and the levelized cost of electricity from solar is set to drop another 66% by 2040. Solar will beat the cost of existing, fully depreciated and un-refurbished coal plants by 2032 (BNEF, 2017).

Local economic benefits

Additionally, the proposal would provide significant local economic benefits including:

- Direct and indirect employment opportunities during construction and operation of the solar farm.
- Embedded electricity generation, to supply into the Australian grid closer to the consumption centres.
- Injection of expenditure in the local area.
- Development of a new land use thereby diversifying the regional economy.

2.3 ALTERNATIVES CONSIDERED

Alternatives considered include the 'do nothing' option, alternative site locations, technology alternatives and the size of the proposal (generating capacity).

2.3.1 The 'do nothing' option

The consequences of not proceeding with the proposed Wellington SF would be to forgo the identified benefits outlined above. This would result in:

- Loss of opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- Loss of a renewable energy supply that would assist in reaching the RET.
- Loss of additional electricity generation and supply into the Australian 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.

Doing nothing would avoid the environmental impacts associated with the development and operation of the proposal. These include construction noise, traffic and dust, visual impacts and a reduction in agricultural production at the site for the lifetime of the solar farm. However, these impacts are considered to be manageable and would not result in a substantive impact to the environment in the long term.

Given the benefits of the proposal, set out above, and the level of environmental impact (as assessed within this EIS), the do nothing option is not the preferred option.

2.3.2 Alternative site locations

First solar (Australia) Pty Ltd have reviewed numerous sites within NSW for the solar farm proposal and determined that the Wellington site represented an opportunity for the development of a large scale PV solar plant.

Considerations during initial site investigations included:

- Access to electrical network
- Availability of suitably sized lots
- Existing land use and quality
- Soil capability and limitations
- Site vegetation
- Flood risk and location relevant to waterways
- Location of nearby sensitive receivers
- Locality population density

The Wellington proposal site has been selected based on its close proximity to an existing electricity substation with sufficient connection capacity, suitable site access and haulage route options and availability of suitable land within a low population density area.

2.3.3 Technology alternatives

Solar farm technology options considered for the Wellington SF proposal included:

- Fixed mounting structures
- Single axis mounting structures
- String Inverters
    - Numerous brands and size options were considered
- Central inverters
    - Numerous brands and size options were considered

Throughout the development phases of their projects, First Solar optimises the entire Balance of System (BOS), which consists of all of the non-module components of the solar power plant. By aligning all of the BOS inputs with the module roadmap and incorporating feedback from Engineering Procurement Construction and Operations & Maintenance experiences, First Solar has uncovered opportunities to optimise the entire power plant, resulting in increased energy yield.

Photovoltaic modules

With over 17GW deployed world-wide, First Solar's advanced thin-film PV modules are the industry benchmark for utility-scale applications and are proven to outperform conventional silicon based solar modules. They offer a reliable and proven technology that have been validated by numerous independent engineers and backed by financial institutions worldwide. Having secured billions of dollars in project financing due to their robust performance and environmental attributes, First Solar modules have a proven energy yield advantage over typical crystalline silicon solar modules, generating up to 15% more annual energy than competing solar modules with the same power rating. The leading contributor to First Solar's performance advantage is due to the superior temperature coefficient of cadmium telluride ("CdTe") which

delivers higher energy yields at elevated temperatures compared to conventional solar module technologies.

First Solar's thin-film modules have recently become the first and only thin-film modules, and one of five PV modules in the world, to pass the Thresher reliability and Long-term Sequential tests, indicating best in class long term performance, degradation, and durability in the harshest operating conditions. The combination of better energy yields and world leading reliability drives a lower LCOE by maximising value and minimising risk.

First Solar Modules or utility grade silicon modules will be considered in the photovoltaic module selection.

Inverters

A solar inverter, or PV inverter, converts the variable direct current (DC) output of a PV solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid. Main types of Inverters are:

- String Inverters: Small size inverters (1-25kW) which are directly connected to the PV modules. String inverters have the advantage of easy installation and maintenance tasks. However, they are not preferred for installation in large scale PV plants due to the large amount of equipment required, lower performance ratios and higher prices.
- Central inverters: Large inverters with a capacity approximately 4MW. Skilled personnel are required to install and maintain these inverters, but the performance ratio is higher, and they are cheaper than string inverters making them ideal for large scale PV plants.

First Solar was the first to utilise 1500V inverters in utility scale projects and has worked with the leading global Inverter manufactures such as SMA, Ingeteam and GE.

For this proposal, it is proposed to use 1500V central inverters.

Mounting system

PV modules must be installed utilising a mounting structure that could be fixed or may incorporate a mechanism that enable the modules to track the path of the sun:

- **Fixed Structure**: No movement of the modules. Structure is installed, to align the modules at an optimal orientation and tilt/angle for the site to improve the production.
- **Single axis tracking system**: Structure includes a mechanism to enable the modules to track the sun from east to west, in order to follow sun path. The tilt/angle of the module is fixed.
- **Dual axis tracking system:** Structure includes a mechanism to enable the modules to track the sun from east to west and north to south. This tracking ensures the module surface is always presented perpendicular to solar radiation, and therefore gains the maximum radiation

The mounting system are generally installed on steel piles that have been driven or screwed into the ground. In this way, there is generally very little ground disturbance associated with the pile installation.

Table 2-2 A comparison of the benefits of the different mounting technologies is included below.

Element	Fix	Single axis tracking system	Dual axis tracking system
Land area required	Low	Medium	Very high
Production	Medium	High	High
High generation output window	Noon +- 2 hours	From sunrise + 30 min to sunset -30 min	From sunrise + 30 min to sunset -30 min
Investment (CAPEX)	Low	Medium	Very high
Operational expenses (OPEX)	Low	Low	High
Wind resistance	Very high	Very high	Low
System reliability	Very high	Very high	Medium

First Solar produced energy yield predictions for both the fixed and single axis tracking structures that were used to undertake a cost benefit analysis of the alternate mounting structures. The output of the analysis concluded that the single axis tracking structure provided the lowest cost of energy for the Wellington site.

The single axis tracking is what is proposed, however the final supplier and technology is yet to be selected.

Energy storage technology

There are several alternative technologies that could be used for the proposed Energy Storage Facility. Battery technology was selected over mechanical or physical storage methods (flywheel, pumped hydro, liquid air, compressed air) or thermal storage (such as hot water or molten salt) because it enables modular installation without major infrastructure or specialised landform features. Batteries generally have lower weight and physical volume and better scalability compared to other technologies. Disadvantages of batteries include their relatively limited life, some batteries are made from hazardous materials, and sensitivity to climatic conditions (Finkel *et al*. 2017).

The lithium-ion ('Li-ion') battery is currently the preferred technology for storing energy generated from wind and solar sources (Australian Academy of Science, 2017), and is likely to dominate battery chemistry for the next 20 years (Randell Environmental Consulting, 2016). The shift to Li-ion batteries is because of their greater energy density (which means they are smaller and lighter), expected longer life spans and ability to undergo deeper discharges, reducing the capacity required (Helen Lewis Research, 2016). Li-ion batteries have a very long lifetime compared to other battery technologies, with 5,000 or more charge cycles (Finkel *et al*. 2017).

Alternative battery technologies include lead acid and relatively new technologies such as hydrogen, molten-state, sodium-ion, flow (vanadium redox, hydrogen bromide or zinc bromide) and salt water batteries. Many of the competing technologies are either still in technical or commercial development, environmentally unfriendly or offer low energy and power density compared to Li-ion.

Li-ion battery cells were selected for the Wellington SF site because they provided the optimal combination of:

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

Li-ion technology is established and proven, compact, lightweight, highly efficient, very high energy density, economically attractive, commercially available and easily installed with low maintenance requirements.

2.3.4 Size of the proposal

First Solar have undertaken extensive grid modelling to determine the optimal size of the Wellington SF to ensure constraint free operation and dispatch into the National Electricity Market. This included steady state studies and load flow analysis to verify thermal and voltage limits in the network and assess the impact of the additional generation for Wellington SF. Through the finalisation of connection application planning process First Solar will continue to liaise with TransGrid to ensure the final plant layout and size is matched to the existing grid infrastructure.

2.3.5 Preferred option

The preferred option is detailed in Section 3.

It provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the proposal. The current plant design includes First Solar's thin film modules mounted on a single axis tracking structure connected to 1500-1800V central inverters.

2.4 JUSTIFICATION

The proposed Wellington Solar Farm will provide significant economic and environmental benefits, in addition to creating direct and indirect jobs and developing skills in a growing industry, and supporting small businesses.

On an annual basis, the proposed Wellington Solar Farm will provide enough clean, renewable energy for about 46,000 average NSW homes while displacing approximately 305,000 metric tons of carbon dioxide; the equivalent of taking about 81,000 cars off the road. When in operation, the Wellington Solar Farm will generate electricity with negligible water use, air emissions and waste production, resulting in the smallest carbon footprint of any PV technology available.

The proposed Wellington Solar Farm supports Australia in its efforts toward providing 23.5 per cent of its energy from renewable resources by 2020, while further establishing regional NSW as a leader in renewable energy.

2.4.1 Supporting the NSW Government's renewable energy goals

The NSW Government's support for renewable energy has successfully bridged the commercialisation gap for large-scale solar and created a credible path to sustainable deployment in NSW without ongoing

financial support. The successful delivery of regional projects, including Australia's flagship solar plants at Nyngan and Broken Hill in NSW, has provided significant economic and environmental benefits, in addition to creating jobs and developing skills in a growing industry, supporting small businesses, and providing clean energy to NSW. The lessons learnt from these projects continue to drive down costs and increase the commercial competitiveness of NSW solar energy.

Given the unprecedented cost reduction achieved in large-scale solar in recent years and the current positive investment environment, there is no doubt that large-scale solar will contribute significantly to the state's renewable energy goals. As NSW looks to continue this positive momentum and achieve its renewable energy objectives of accelerating advanced energy, it is imperative that NSW supports steady and repeated quality project deployment in NSW every year. Steady project deployment is the single strongest driver of solar electricity price cost reductions. It gives developers, construction companies and financiers the confidence to invest in NSW projects. This investment provides exposure to local civil, mechanical and electrical subcontractor construction labour force, electricity regulators and network service providers, planning authorities, and heavy industries that participate in the solar value chain which is crucial to optimise solar project costs in NSW.

The proposed Wellington Solar Farm strikes the ideal balance between a competitive levelised cost of energy and certainty of delivery. The unique combination of a quality project and experienced project participants will ensure the state's goals are met by lowering costs today, demonstrating a clear path to future cost reductions, and accelerating the NSW solar industry to economic and commercial sustainability.

2.4.2 Location

The Wellington Solar Farm is located approximately two kilometres north of Wellington and will benefit directly from existing supply chains and operations and maintenance hubs, and validated NSW solar performance data resulting from NSW government support of the Nyngan and Broken Hill solar plants. The proposed 493 hectare (ha) site for the Wellington Solar Farm is situated on Goolma Road and was selected based on its excellent solar resource, proximity to existing electrical infrastructure (avoiding the need to build new transmission lines), and low impact to existing land use and infrastructure. The site location is in a low population area and the project layout has been designed to minimise impact to the local community. Furthermore, the site, on the western side of The Great Dividing Range, provides an increased the level of irradiance, therefore improving the overall energy production of the plant. These factors make it an ideal location for a solar power plant.

2.4.3 Proving out international cost improvements

First Solar is active in all global solar markets, is the largest constructor of utility-scale solar in the world, and is one of the few current market participants that has successfully built utility-scale solar projects in NSW. This means it is uniquely positioned to bring cost improvements seen in other markets to Australia, and the learnings from these projects continue to contribute to industry knowledge sharing and cost reductions.

First Solar is actively translating recent international cost reductions to Australia, by working to enable Engineering Procurement Construction (EPC) cost improvements. This will be achieved by supporting contractors to accurately price and model the deployment of advanced technologies, such as 1500V inverters, solar tracker technology, and higher efficiency thin film modules, to optimise capital expenditure and operational performance. Similarly, First Solar is focused on translating international financing benchmarks to Australian lenders. This will ensure globally competitive debt terms. Given EPC and

financing assumptions are the largest drivers of cost reduction in large-scale solar, it is critical that any project in this process can leverage both aspects in a replicable way. The Wellington Solar Farm will drive down the cost of solar PV electricity in Australia and create a path to cost parity by demonstrating and localising international technology and validating the ability to secure commercial off-take and thus reducing financing cost hurdles.

The intended commercial structure of the Wellington Solar Farm is totally replicable, utilising a Power Purchase Agreement (PPA) from a RET liable entity, commercial debt, a common developer/IPP model, and an EPC contractor with established presence in Australia *without* Australian Renewable Energy Agency's (ARENA) funding. This positions the NSW Government to leverage the resulting cost reductions to ensure periodic deployment of solar technology to fully realise cost parity with other generation technologies in NSW.

2.4.4 Connection point and NSW network

The Wellington Solar Farm makes use of existing electricity infrastructure to minimise impacts to the environment and the community. It will connect to the 132kV Section at the existing substation that is owned and operated by TransGrid and is directly adjacent to the proposal site on the southern side of Goolma Road. A short 33kV or 132kV overhead line will be constructed to facilitate connection to Wellington Solar Substation and the designated Network Connection Point is the TransGrid 132kV section at Wellington Substation.

The site is well positioned to make use of existing transmission networks that are a familiar site feature. One existing electricity transmission line passes through the proposal site, mostly in a north-south direction and in alignment with the existing Wellington substation. The Wellington Substation is connected to the Woolar 330kV substation and the Wallerawang via a 330kV transmission line and to the Beryl, Parkes, Molong and Orange North 132kV substations by a 132kV line. It is further connected to Dubbo via two existing 132kV transmission lines.

The existing Wellington Substation provides an ideal location for a connection to the National Electricity Market as there is adequate existing local load consumed via the 132kV connections to utilise a large portion of the generation and the 330kV connections provide a direct link to the NSW 330kV backbone to enable low loss transmission of the remaining energy to end users. The NSW transmission infrastructure generally runs in a north south direction along the east coast and is connected to both the Queensland and NSW networks via 330KV interconnectors. The Wellington Substation represents the most north west point of the 330KV network and provides a direct link into 500kV and 330KV NSW transmission infrastructure. TransGrid have advertised the existing capacity for generation in the 132kV network around the Wellington region as 500MW and the Wellington project is positioned to utilise this.

As electricity flows through the transmission and distribution networks, energy is lost due to electrical resistance and the heating of conductors. The impact of network losses on market spot prices is mathematically represented as transmission and distribution loss factors. The losses are equivalent to approximately 10% of the total electricity transported between power stations and market customers shared between these market participants.

Energy losses on the network must be factored in at all stages of electricity production and transport, to ensure the delivery of adequate supply to meet prevailing demand and maintain the power system in balance. In practical terms, this means more electricity must be generated than indicated in simple demand forecasts to allow for this loss during transportation.

Due to the retirement of existing coal fired generators in New South Wales, Victoria, and South Australia the amount of energy flowing from Queensland south via the interconnectors to service the southern stated demand has significantly increased. This has resulted in the NSW transmission corridor being heavily loaded in the north of the state and has resulted in high transmission loss factors being applied to generation located within the network north of Sydney. This has a direct impact on the financial viability of generation projects in the north of NSW, with losses of up to 12% borne solely by generators compared with 3-5 % seen historically. This loss factor is calculated each year by the Australian Energy Market Operator and is highly contingent on changes to demand and generation from other market participants. This introduces significant risk to the long term performance of the generator, often underappreciated in generator site selection. This will only be exacerbated by the planned retirement of the more baseload generation in NSW.

The Wellington site's central location in the network and proximity to the major load centre and market settlement node of Sydney significantly mitigates this transmission and distribution loss factor risk, representing an ideal location for a generator, allowing it to contribute to the ongoing security, reliability and affordability of NSW electricity supply.

While grid-supplied electricity consumption is expected to remain stable (AEMO 2016), the proposal would benefit network reliability and security by providing embedded electricity generation closer to local consumption centers, contributing to a more diverse mix of energy sources and potentially regulating inputs (including improving the security of supply) to the grid using an Energy Storage Facility.

Energy storage using batteries and power conversion systems are one of the technical solutions for the integration of non-synchronous, variable renewable energy sources into the network (Finkel et al. 2017). Energy storage can improve reliability by storing electricity when it is cheap and supply is high, and discharging at times of peak demand, and when supply from variable generators is low. Storage can also support power system security, by providing services such as frequency control (including 'fast frequency response') and voltage control (Finkel et al. 2017).

The Energy Storage Facility which may be constructed for Wellington Solar Farm would be capable of storing energy for release when the use or cost is beneficial. The facility would have an approximately 25MW/100MWh rated capacity, provided by banks of lithium-ion batteries. The facility would provide network services including 'energy smoothing' and frequency control integration, improved reliability as well as energy arbitrage. 'Energy arbitrage' is the price mechanism allowing energy to be stored during periods of low demand and then discharged during periods of high demand.

3 DESCRIPTION OF THE PROPOSAL

This section sets out the existing site context, including land use and zoning relevant to the proposal as well as the detailed description of the proposal's infrastructure components, including construction, operational and decommissioning requirements.

3.1 PROPOSAL SITE CONTEXT

3.1.1 Solar array site

The Wellington SF proposal site is located approximately 2km north east of Wellington, in western central NSW, within the Dubbo Regional Local Government Area (LGA). The Wellington SF proposal site is located on the following lots:

- Lots 89, 90, 91, 92, 99, 102, 103 and 104/DP2987
- Lot 1/DP34690,
- Lot 1/DP520396;
- Lot 2/DP807187
- The portion of the Crown Road Reserve between Lot 2/DP807187 and 91/DP2987 subject to *Road Closure: Public Road Closure Application* [W58925; Ref 17/09541]
- Lot 1/DP1226751, existing Transgrid Substation.

There are two landowners, one owning parcels to the east and the other parcels to the west.

The extent of the development footprint is 316 ha (includes all transmission line options and excludes substation option within the existing Transgrid substation) as illustrated in Figure 1-1 and on the preliminary constraints mapping provided in Figure 1-3. The site is bounded by Goolma Road to the east and south.

The proposal site is located on land across three land use zones, as identified in the *Wellington Local Environmental Plan 2012*. These are:

- RU1 - Primary Production.
- R5 - Large Lot Residential.
- SP2 - Infrastructure.

No residential subdivision development has occurred; only one residence is located onsite. The dominant land use onsite and in the local area is agriculture. The steeper landforms onsite and in the area support mainly grazing activities and the flatter landforms are mostly cropped. Sheep (western lots) and cattle (eastern lots) currently graze the site. Native vegetation remnants are present across some areas of the site.

There are a number of existing transmission lines within the area, which connect to the existing substation south of Goolma Road. An overhead transmission line passes through the main proposal site, in a northwest – southeast direction (Figure 3-3). The proposal would require an additional transmission line to connect to the substation, which would be overhead.

The dwelling within the proposal site is located on Lot 90/DP2987. The property is listed as an item of local heritage significance under Schedule 5 of the *Wellington Local Environmental Plan 2012.* To preserve the heritage value of the property, this dwelling would be preserved by the proposal and used as the Operations and Maintenance (O&M) Building for the site. The proposal site also contains dilapidated

buildings (potential abattoir and office buildings), which have sometimes been used for storage of grains (Figure 3-5). These buildings were constructed by a previous landowner and were never completed. An old single room building is located onsite that may have once been used by shearers or as a milk separating shed. Above ground tanks for bore water used for stock are also located within the proposal site.

Three dams occur within the proposal site, one along the eastern boundary, one in the middle of the site and one in the middle of the western portion of the site. One watercourse, Wuuluman Creek and one ephemeral overland flow, occur within the proposal site (Figure 3-1 and Figure 3-2). Wuuluman Creek traverses east to west along the southern portion of the site. The ephemeral overland flow traverses east to west in the northern and central areas of the site, as well on the far western boundary. Wuuluman Creek is a tributary of the Macquarie River, which is located 1.3km west of the proposal site. Wuuluman Creek would be avoided by the proposed works, with the establishment of a 40m buffer zone.

Figure 3-1 Wuuluman Creek, facing east

Figure 3-2 Wuuluman Creek, facing west

Figure 3-3 Transmission line across the north western corner of the site, facing south east

Figure 3-4 View south across the proposal site towards the Wellington substation

Figure 3-5 Dilapidated building on the proposal site (abattoir).

3.1.2 Surrounding locality

The proposed solar farm is located approximately 2km north east of the town of Wellington, NSW. The population of Wellington was 4,540 at 2011 Census (ABS, 2017). Wellington provides support to the villages of Geurie, Elong Elong, Mumbil, Stuart Town and Euchareena.

The land surrounding the proposal site, 2km from the town of Wellington, includes irrigated crops and grazing land. Agriculture is the key industry in Wellington, with the steeper land to the east supporting mainly grazing activities and the gentle undulating land to the west supporting mainly cereal production. Mining exploration activity is of continuing interest, with a number of mineral deposits within the area (Regional Development Australia – Orana, 2016). The Wellington Correctional Centre is east of the proposal site and has currently expanded.

Several houses occur within 2km of the proposal site. Aside from the dwelling that is located within the proposal site, the closest receiver is located approximately 30 metres west of the proposal site.

Services and features of Wellington include:

- Tourism attractions including the Wellington Caves Complex, Phosphate Mine and Japanese Gardens, Lake Burrendong, Burrendong Botanic Garden and Arboretum, Mt Arthur Reserve, several wineries and boutique galleries (Dubbo Regional Council)
- Events include: the annual Wellington Boot race meeting, Agricultural Show and various markets, (Destinations NSW, 2017).
- Recreational and sporting facilities include: Burrendong Dam, basketball and netball courts, soccer, rugby union and rugby league fields, cricket pitches, touch football fields, tennis courts, athletics track, tennis courts, Olympic and children's swimming pools, parks and gardens (Destinations NSW, 2017b).
- Community facilities and clubs include: Soldiers Memorial Club, Race Club a memorial hall, branch library, cemetery, (Destinations NSW, 2017).
- Health services include: Wellington Hospital, Wellington Aboriginal Corporation Health Service, Bellhaven Aged Care Facility and Maranatha House care facility (Service NSW, 2017).
- Services include: banks, supermarkets, post office, real estate, trades people, machinery and farming services, hotels, accommodation, cafes and restaurants, fire station (Destinations NSW, 2017).
- Education facilities include: pre-school, primary schools, high school (Dubbo Regional Council, 2017).
- Churches – Uniting Church, Baptist Church, Anglican Church, Christian Community Church, Baha'i Faith, Catholic Church, Jehovah's Witnesses, International Network of Churches, Jachin Boaz Ministries (Dubbo Regional Council, 2017).
- The Wellington Airport, also known as Bondangora Airport, is owned and operated by Dubbo Regional Council.

3.2 SOLAR FARM INFRASTRUCTURE AND DEVELOPMENT REQUIREMENTS

3.2.1 Infrastructure components

The proposed Wellington SF would comprise of the installation of a solar plant with an upper capacity of 174MW that would supply electricity to the national electricity grid. An indicative proposed infrastructure layout is included in Figure 1-2.

The key infrastructure for proposal would include:

- PV modules (solar panels).
- Single Axis horizontal tracking (likely) or fixed mounting frames.
- 30-50 inverter stations with associated transformer.
- An onsite substation or substation within the existing Transgrid substation containing one transformer and associated switchgear.
- A 33kV or 132kV or 330kV transmission line to the adjacent existing Wellington Substation (100m).
- Underground or aboveground electrical conduits and cabling to connect the inverters to the onsite substation or substation within the existing Transgrid substation.
- 22-33kV underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access track off Goolma Road, approximately 4.6km north east of Mitchell Highway junction.
- Permanent site office and maintenance building with associated vehicle parking.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing up to 2.3m high.
- Energy Storage Facility (ESF; Lithium-ion cells).
- Native vegetation screening, where required to break up views of infrastructure to specific receivers, will be planted prior to commencement of operation.

During the construction period some additional temporary facilities would be located within the site boundary and may include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction worker's transportation. Once the plant has been commissioned, a small car park would remain for the minimal staff required and occasional visitors during operation.

Further details have been provided below for indicative key infrastructure components however the final supplier for all components would be confirmed during the construction contract Request for Proposal (RFP).

Prior to commencement of construction the following site works might be undertaken on site:

- Site clearing, if required.
- Site access road.
- Establishment of construction compound and laydown area.
- Establishment of construction electrical supply, if required.

Solar arrays

The solar arrays would be comprised of approximately 440,000 First Solar thin film solar modules installed on a single-axis tracker in rows aligned in north south arrangement. The tracker would have an estimated tracking range of 120 degrees, or +/- 60 degrees from the horizontal.

Approximately 66,600 piles would be driven or screwed into the ground in order to support the solar array's mounting system and solar modules. During the piling installation, work would be undertaken to avoid disturbing the existing ground cover to minimise ground disturbance and limit the potential for erosion.

The panel structures would have a height of approximately 4.5m high when tracked to the extent of their range and allowing for undulating topography. The final mounting system to be installed is yet to be determined but the below images provide an indication of the look of the infrastructure proposed.

Figure 3-6 First Solar Series 6 420-455W thin film modules

Figure 3-7 First Solar modules and a single axis tracker installed at the Gatton Research Facility in Queensland.

Figure 3-8 Piling installation for a single axis tracker

Inverters

Depending on the final inverter selected for the proposal approximately 30 to 50 inverter stations would be installed across the site with each inverter station containing the following equipment:

- Inverter – up to fifty inverters
- Transformer to step the AC voltage up to high voltage for transmission to the substation
- HV switchgear
- Communication and ancillary equipment

The current arrangement has been produced using three inverters per station, but this may change during detailed design. The inverter stations are usually delivered as either a fully containerised solution or a skid mounted solution. Both the containerised and skid solutions are sized to suit international shipping standards and have the same dimensions as either a 20' or 40' shipping container. The standard dimensions for the both options are detailed below. Figure 3-9 and Figure 3-10 provide examples of both options.

Table 3-1 Standard dimension of shipping containers to be used inverters

Dimensions	40 foot	20 foot
Length	12.2m	6.10m
Width	2.5m	2.5m
Height	2.6m – 2.9m	2.6 - 2.9m

Figure 3-9 Example 20' skid solution.

Figure 3-10 Example 40' containerised solution.

The inverter stations are generally installed on piles or a concrete foundation and are slightly elevated above the ground to enable the installation of the AC and DC cabling.

Energy Storage

Unlike markets for storable commodities, the electricity market is reliant upon the real-time balance of supply and demand. Electric Energy Storage is the capability of storing electricity or energy to produce electricity and releasing it for use during other periods when the use or cost is more beneficial.

Energy storage would be included within the project boundaries to compliment the large scale renewable energy generation and to prepare the network for more renewables in the future. Battery storage would involve the construction of an Energy Storage Facility (ESF) with an approximately 25MW/100MWH storage capacity by banks of Lithium-ion batteries. The batteries will be in approximately 670 power packs that include 16 battery pods and 1000 lithium ion cells per pod. The power packs will be in 5MW blocks of approximately 12.5m long, 12.5m wide and 3m high. The power packs would be set on concrete slabs and would include an inverter and transformer (refer to Figure 3-11). They don't require containerisation. Approximately 70 power conversion blocks would be required. Due the ESF using thermal cooling, the power packs will be placed together, with approximate spacing of one metre to allow for service access.

The location of the ESF is shown on Figure 1-2. The ESF would occupy approximately 950m^2, enclosed by a two metre security fence. All cabling would be underground or on cable trays. The ESF would be surrounded by an Asset Protection Zone (APZ) including gravel surfacing to minimise the risk of fire escaping from the facility and the risk of external fire affecting the facility.

The proposed ESF would use a thermal management system that uses liquid cooling at the power pack level and touches each cell within the pack, rather than air cooling at the container or building level. This enables even temperature distribution across all cells within the power pack system. The proposed ESF would contain a temperature control monitoring system and the automated control system would stop their operation if the temperature exceeds pre-set levels. The facility would include an integrated fire suppression system involving the storage and release of an 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.

Figure 3-11 Example of power pack System

Underground cables

All underground cabling would be installed across the site at a depth of at least 500mm with the electrical reticulation buried to either 600mm (low voltage) or 800mm (high voltage) depth, depending on the cables voltage and relevant Australian Standard.

Prior to excavating the cable trench, the topsoil would be stripped and stockpiled for use in the rehabilitation of the trench following the cable installation.

As the majority of the cabling would be direct buried, depending on the quality of the excavated material, a sand bed may be placed in the trench to create a cable bed. Once the cables are installed another layer of sand may be installed above the cable prior to the trench being backfilled with excavated material. Cables would be mechanically protected in accordance with AS 3000.

Figure 3-12 Examples of the underground trenches with the installation of sand bed.

Figure 3-12 Examples of underground cable trenches with bedding sand installed.

Transmission line

A new overhead transmission line would be required to transmit energy generated at the solar plant to the electricity grid. The transmission line would be constructed over a length of approximately 100m from the site substation across Goolma Road to the existing TransGrid Wellington Substation. The height of the transmission line would be between 15m and 30m, depending on the final design. The transmission line easement would be 20m wide. The new line would be constructed in a similar manner to the existing TransGrid transmission lines utilising either timber or concrete poles, cross member, insulators and strung conductor (Figure 3-13).

Consultation between First Solar and TransGrid is ongoing with regards to the detailed planning and construction of the transmission line. The impacts associated with construction of the transmission line have been assessed within this EIS.

Figure 3-13 Example TransGrid transmission line.

Substation

Two possible locations are being considered for the onsite substation. The first immediately north of Goolma Road and the second immediately south of the existing Wellington substation (refer to Figure 1-2). This will be used to transform electricity generated by the solar farm to 132kV or 330kV, the voltage of the connection point at the TransGrid Wellington Substation. A 132kV or 330kV transmission line would then connect the substation to the existing TransGrid Wellington Substation (refer to Figure 1-2), south of Goolma Road.

The final onsite substation design is yet to be finalised, but it is anticipated the substation would feature an elevated busbar, switch room, a lightning protection system, circuit breakers, disconnectors, current transformers, voltage transformers, and a 132 or 330kV transformer.

The onsite substation would be constructed on a prepared bench of compacted material, approximately 30m x 30m, and would be surrounded by security fencing with gravel placed around the equipment and fence to restrict vegetation growth and provide a safe working environment in accordance with Australian Standards. The existing Wellington Substation is roughly 10 times larger than the proposed site substation.

Figure 3-14 Example of a typical substation.

Access track and internal tracks

The entrance to the site would be constructed off Goolma Road, approximately 4.6km east of the intersection with the Mitchell Highway (Figure 1-2). A siding lane would be constructed on Goolma Road to accommodate traffic turning left off Goolma Road and into the Wellington SF site.

Internal solar farm access roads would be required to access the modules and inverter stations onsite for maintenance. These would be around 6m wide and constructed of compacted but unsealed gravel. The access roads and all internal tracks would be maintained throughout the construction and operation of the solar farm.

If required, water trucks would be used to suppress dust on unsealed access tracks during construction. Stabilising techniques and or environmentally acceptable dust palliatives would be utilised if the wetting down of surfaces proves to be ineffective.

Ancillary facilities and construction compound

Ancillary facilities would be located within the site boundary and would include:

- Material laydown areas.
- Temporary construction site offices.

- Temporary car and bus parking areas for construction worker's transportation. Once the plant has been commissioned a small car park would remain for the minimal operational/maintenance staff required and occasional visitors.
- Staff amenities. Once constructed, the solar farm would be monitored and operated remotely and would therefore require a minimum number of maintenance personnel (1-3 full time equivalent staff) to be onsite.
- CCTV installed to the operation and maintenance building and substation for security purposes.

Temporary staff amenities would be designed to accommodate the number of workers at the peak of the construction period (estimated at 200 workers) and would include:

- Car parking.
- Sanitary modules with septic tank.
- Water tanks.
- Changing rooms.
- Lunch rooms.
- Dining hall.
- Administrative offices.
- Covered walkways.
- Undercover storage area.
- Muster point in case of emergency.
- Generator, if required.
- Electrical, data and water reticulation.

A steel or concrete water storage tank would be installed adjoining the main internal access road for fire-fighting and other non-potable water uses. Rainwater tanks installed beside site buildings for staff amenities would also enable Rural Fire Service connectivity. Suitable fire extinguishers and PPE would also be maintained at site buildings.

Perimeter fencing

The perimeter of the site would be fenced with a 2.3m high security fence (refer to Figure 1-2). It is expected to be cyclone fencing with strands of barbed wire located within the top 450mm. The fence would be designed to ensure adequate access and egress points are provided during both the construction phase and ongoing operational life of the project. An example is provided in Figure 3-15.

Figure 3-15 Example of a typical 2.3m high perimeter fence.

Some sections of the fenced perimeter would be targeted for landscaping treatment. This would entail 1-2 rows of native species planted to break up views of the infrastructure from specific receivers. Species selection would consider the impact of shading on the array.

3.2.2 Construction and commissioning

Indicative timeline

An indicative timeline for the proposal is outlined in Table 3-2. The Energy Storage Facility may be constructed up to 5 years following the commissioning of the solar farm.

Table 3-2 Indicative timeline.

Phase	Approximate commencement	Approximate duration
Construction	3rd Quarter 2018	12 months
Operation	3rd Quarter 2019	30 years
Decommissioning	2049	12 months

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

Construction activities

The construction and commissioning phase is expected to last approximately 12 months for the solar farm and 6 months for the ESF. The main construction activities for the solar farm and ESF would include:

- Site establishment and preparation for construction (fencing, ground preparation, preliminary civil works and drainage).
- Installation of steel post and rail foundation system for the solar panels.
- Installation of underground cabling (trenching) and installation of inverter stations.
- Construction of the 132kV or 330kV overhead transmission line, onsite substation or substation within the existing Transgrid substation and equipment, and interconnection to the existing Wellington substation.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Should the ESF be constructed after the construction of the solar farm, approximately 45 heavy vehicle movements would be required over approximately three month period, followed by up to three months commissioning required around six workers in 4x4 vehicles to attend site per day. Additional traffic and noise management as well as community notifications would be undertaken if the ESF is constructed outside of the main construction program.

Earthworks

Figure 1-2 indicates the development footprint which covers approximately 316ha (includes all transmission line options and excludes substation option within the existing Transgrid substation). A majority of the area is already disturbed due to farming activities. Ground disturbance, resulting from earthworks would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of approximately 1.5m.
- Construction of internal access tracks and associated drainage.
- Substation bench preparation.

- Concrete or steel pile foundations for the inverter stations, onsite substation and maintenance building.
- Trenches up to 800mm deep for the installation of cables.
- Construction of footings for the transmission line to the existing Wellington substation.
- Concrete slab for ESF.
- Establishment of temporary staff amenities and offices for construction.
- Construction of security fencing around separate array areas.

The ground disturbance from pile foundations would be less than 1% (approximately 4ha) of the total site area. Panels within the solar array area would sit above the ground and existing ground cover would be maintained underneath the panels. Approximately 64% of the total site area groundcover would be affected by shading to varying degrees depending of time of year and time of day.

Additional ground disturbance would result from construction of the internal access tracks and any associated drainage, trenches for cabling and footings for other infrastructure.

Apart from the permanent infrastructure footprint (316ha), any disturbed areas would be restored to grassed ground cover immediately after construction.

Hours of operation during construction

Construction activities would be undertaken during standard daytime construction hours (7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays). Exceptions would occur as staff arrive and leave the site, before and after shifts; some of this traffic may occur outside the standard construction hours. Additionally, the delivery of large components may take place outside normal working hours.

Any construction outside of these normal working hours, if required, would only be undertaken in accordance with approvals from relevant authorities.

Resourcing requirements

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

Labour, machinery and equipment

It is anticipated that approximately 200 construction personnel would be required on site during the peak construction period. Construction supervisors and the construction labour force, made up of construction labourers and technicians are intended to be hired locally, where possible.

It is anticipated that most workers would be accommodated at existing accommodation within the local area. It is proposed that bus transfers would be provided to minimise traffic volumes and transit risks during construction. Bus transfers would be to/from Wellington and Dubbo.

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

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

Traffic volumes and requirements

Traffic management would be undertaken during the construction phase to manage haulage traffic. Preliminary plans for the site propose parking for approximately 60 vehicles. The proposed timeline for the proposal indicates that approximately 40 employees would be required during the first month rising to 200

employees during the peak construction period. Table 8-1 within Section 8.1 provides an indication of the total overall one-way traffic movements anticipated throughout the construction period. During the peak construction period there would be the following maximum movements:

- 100 heavy vehicles.
- 300 light vehicles.

The final traffic haulage route and number would be further detailed in the traffic management plan that would be prepared by the appointed contractor as part of First Solar's pre-mobilisation works.

Materials

In total, approximately 6,900m^3 of gravel would be required to cap the access and internal network of service tracks.

Approximately 2,800m^3 of sand would be required for the bedding of cables that are to be direct buried throughout the proposal site.

Approximately 3,980m^3 of concrete would be required for the ESF, onsite buildings, inverter stations and substation.

Water use during construction would be approximately 9000ML per annum. Potable water would be trucked to the site on as needs basis and stored within temporary water tanks at the staff amenities area. Water for dust suppression would be sourced from on-site dams or from a local council standpipe or other appropriate sources.

Transport route

The proposed haulage route for the delivery of key components to the Wellington Solar Farm would be from Sydney via the Great Western Highway, Mitchell Highway and Goolma Road. This route would require transit of delivery vehicles through the town of Wellington. Great Western Highway, Mitchell Highway and Goolma Road are all Oversized Overmass Load Carrying Approved Roads.

3.2.3 Operation

The operational phase of the proposal is anticipated to commence in the first quarter of 2020. Once operational, activities would include daily operations and maintenance. This would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays, if required.
- Routine visual inspections, general maintenance and cleaning operations of the substation.
- Vegetation management (which may include controlled grazing, utilising sheep). Ground cover vegetation would be maintained beneath panels to reduce erosion and weed infestation. A monitoring program would address any bare areas that develop. Management may include the use of seeding or armouring (i.e. jute mesh) to avoid erosion.
- Site security response (24hr) if a security event occurs.
- Replacement of equipment and infrastructure, as required.
- Pest and vermin control.

Hours of operation during operation

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

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

Outside of emergencies or major asset inspection or maintenance programs, night works or work on Sundays or public holidays would be minimised.

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

There would be no permanent night lighting installed within the array, but lighting may be included in each inverter station for maintenance purposes. There would also be maintenance lighting installed at the substation that would only be used in case of emergency, and security lighting at the operation and maintenance building. All lighting would be designed to reduce disturbance to neighbouring properties and would be utilised only when there are staff on site or during emergency situations.

Resourcing requirements

During the operational phase of the proposal, it is anticipated there would be one to three full time staff located on site supported by First Solar's Asset management team of six people located in Sydney. Given the nature of the services conducted by the operation and maintenance team there is potential to employ and train apprentices on site.

Given the proposed size of the plant it is likely that two light vehicles (4x4) and an All-terrain vehicle would be required to transport the staff around the site.

The majority of the plant maintenance including inverter station, transformer and HV switchgear, PV arrays and the trackers would be conducted by the onsite team on a rolling basis with activities scheduled consistently throughout the year. There would some occasions, such as during a major substation shut down, that additional maintenance staff may be required on site. If required, the staff would be accommodated in the existing O&M building and additional traffic would be minimised through car-pooling.

During operation non potable water would be required for cleaning panels, onsite toilet and showers, landscaping and animal care. Potable water would be required for the workers. Rain water would be collected onsite. In terms of quantities required, the operational water use volumes during operation would minimal; water would be required for staff amenities is estimated to be approximately 130kL per annum. Panel cleaning may be required in dry conditions when cropping operations in the locality are generating dust, however First Solar modules are currently do not require cleaning anywhere along the east coast of Australia. Rain water will be gathered from the O&M building roof and stored within on site tanks, in cases of prolonged drought water would be trucked to site as required.

3.2.4 Decommissioning

During decommissioning, all above ground infrastructure would be removed to a depth of 500mm. Key elements of proposal decommissioning would include:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse. Much of the solar array panels would be recyclable.

- All site amenities and equipment would be removed, and materials recycled or reused, wherever possible.
- Posts and cabling installed within 500mm of the surface would be removed and recycled, equipment below this depth would be left in situ.
- Fencing would be removed including small concrete footings.

Above ground concrete slabs for the ESF, onsite buildings, inverter stations and substation would be left in place where there is limited impact to the use of the land for agriculture (i.e. cropping). All areas of soil disturbed during decommissioning would be rehabilitated with the aim of meeting the existing (pre-construction) land capability. Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase.

4 PLANNING CONTEXT

4.1 ASSESSMENT CONTEXT

4.1.1 Permissibility

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

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

4.1.2 State significant development (SDD)

Section 89C of the EP&A Act provides that development will be SSD if it is declared to be SSD by a State Environmental Planning Policy (SEPP).

The State Environmental Planning Policy (State and Regional Development) (SRD SEPP) declares the Wellington SF 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 78A (8A) of the EP&A Act requires a development application for SSD to be accompanied by an EIS prepared in accordance with the EP&A Regulation.

The proponent made a written application to the Secretary requesting SEARS for the proposed Wellington SF as required by clause 3 of Schedule 2 of the EP&A Regulations. The proponent's application was accompanied by a Scoping Report, which provided detailed information about the proposed Wellington SF including key environmental issues. The request for SEARs was registered as SSD 8573.

On 20 July 2017, the Secretary issued the SEARs for the Wellington SF (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 5.1.1 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.

4.2 EVALUATION OF THE DEVELOPMENT

Section 89H of the EP&A Act provides that Section 79C applies to the determination of development applications for SSD. Under Section 79C 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 4-1 and assessed in terms of their relevance to the proposal.

Table 4-1 Matters of consideration

Provision	Relevance to the proposal
Any environmental planning instrument;	Relevant environmental planning instruments (EPIs) are discussed in Section 4. 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 44 - Koala Habitat Protection* • *Wellington 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 93F, or any draft planning agreement that a developer has offered to enter into under section 93F;	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration);	Clause 92 of the EP&A Regulation requires consideration of: • the Government Coastal Policy, for development applications in certain local government areas; and • the provisions of AS 2601 for development applications involving the demolition of structures. • 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 Wellington SF does not involve any of these types of development and the LGA is not listed in the table under this clause. The additional provisions provided by the EP&A Regulation are not relevant to the proposal.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates;	Coastal zone management is not applicable to the proposal.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and	The likely impacts of the proposal, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in Sections of this EIS. This EIS demonstrates that the environmental impacts of the proposal have to the extent, reasonably and feasibly possible, been

Provision	Relevance to the proposal
social and economic impacts in the locality;	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 2.3, 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 electricity substation with good connection capacity. Other characteristics include: • Availability of suitably sized lots • Suitability of the land in terms environmental factors such as soil, site vegetation, flood risk, waterway locations, location of sensitive receivers and population density. Further, the Wellington SF is largely reversible; at the end of the life of the solar farm, all above ground infrastructure would be removed and agricultural land use activities could resume.
Any submissions made in accordance with this Act or the regulations; and	First Solar would consider and, as necessary, respond constructively to any submission made in relation to the Wellington SF. Consultation with stakeholders that has been undertaken during the planning stages including the preparation of this EIS is summarised in Section 5.
The public interest.	The Wellington SF is in the public interest for a number of reasons. The plant would produce up to 174MW. On an annual basis, the proposed Wellington SF would provide enough clean, renewable energy for about 46,000 average NSW homes while displacing approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road. The solar farm would also assist to: • Reduce greenhouse gas emissions required to meet Australia's energy demands • Assist in the transition towards cleaner electricity generation. • Directly contribute to helping Australia in meeting the RET. • Create economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. A Community Consultation Plan has been prepared and implemented to inform the community and stakeholders about the proposal and their opportunities to provide input into the assessment and development process. Further details on the consultation process is provided in Section 5.

4.3 LOCAL GOVERNMENT

4.3.1 Wellington Local Environmental Plan 2012

The site is located within the Dubbo LGA, which has two Local Environmental Plans. The proposal site is subject to the provisions of the *Wellington Local Environmental Plan 2012*. The solar farm site is located across three land zonings: RU1 – Primary Production, R5 – Large Lot Residential and SP2 – Infrastructure.

RU1 Primary Production

The majority of the proposal site is zoned 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:

- 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 provide for a range of tourism-related uses that support the agricultural industry or are compatible with agricultural uses.

For the life of the proposal, the proposal would harness a natural resource (solar energy). While the activity would impact on land available for primary production, the land would allow for diversity in land use and being reversible and involving limited ground disturbance, it would not remove the potential to use the land for cropping (or some alternative permissible rural land use) at the end of the solar farm's life (expected to be 30 years).

Mitigation measures contained within the EIS that would form a commitment of the proposal, address construction and operational soil and water impacts and would act to maintain the onsite land capability.

R5 Large Lot Residential

Parts of Lots 102, 103 and 104/DP2987 of the proposal site are located within land zoned R5 Large Lot Residential. Electricity generation is prohibited within this land zoning. Additionally, the ISEPP does not allow development for the purpose of a solar energy system in residential zoning. A State Significant Development is sought under the following provisions:

- Clause 8(2) of the SEPP *State and Regional Development 2011*, which states that if a single development application comprises development that is only partly State Significant Development, the remainder of the development is also declared to be State Significant Development. Consultation with the Department on similar projects has confirmed that the intent of this clause means if the subdivision is included in the development application with the solar farm, the subdivision is also declared to be state significant; and

- Section 89E(3) of the *Environmental Planning and Assessment Act 1979*, which states "development consent may be granted despite the development being partly prohibited by an environmental planning instrument".

First Solar has undertaken consultation with Dubbo Regional Council and Department of Planning and Environment, refer to Section 5.1. It is understood that Dubbo Regional Council would not object to the proposal being placed in R5 zoned land.

SP2 Infrastructure (classified road and electricity supply)

Electricity generation is permitted with consent within this zoning. The objectives for development in this zone are:

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

4.4 NSW LEGISLATION

4.4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulations and instruments set the framework for development assessment in NSW. The Wellington SF proposal would be assessed under Part 4 of the EP&A Act. The relevant objects of the Act are to encourage:

- the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment
- the promotion and co-ordination of the orderly and economic use and development of land
- the protection, provision and co-ordination of communication and utility services
- the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats
- ecologically sustainable development
- increased opportunity for public involvement and participation in environmental planning and assessment.

Development assessment provisions are contained in Part 4 and Part 5 of the Act. Developments requiring consent under a planning instrument (such as State Environmental Planning Policies and Local Environmental Plans) are assessed under Part 4.

Section 79C identifies matters to be considered in determining a development application. These matters are considered in relevant sections of this EIS and specifically in Section 4.2, Table 4-1.

Section 111(1) of the Act requires a determining authority, when considering an activity, to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment.

Section 89C of the EP&A Act provides that a development will be State Significant Development (SSD) if it is declared to be SSD by a State Environmental Planning Policy (SEPP); refer section 4.4.2. Section 78A (8A) of the Act requires an 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*.

Environmental Planning and Assessment Regulation 2000

Clause 228 of the Regulation lists 16 factors that must be taken into account concerning the impact of an activity on the environment. These factors are considered in relevant sections of this EIS.

Schedule 2 of the EP&A Regulation specifies the form and content of Environmental Impact Statements, which provide the basis for the Secretary's Environmental Assessment Requirements (SEARs) issued for proposals. The relevant sections in the EIS are referenced against each of the SEARs in Section 5.1.1.

Clauses 82 to 85B of the EP&A Regulation addresses public participation in SSD proposals. The Wellington SF Development Application and accompanying information (including this EIS) will be placed on public exhibition by DPE for a period not less than 30 days.

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

State Significant Developments (SSD) are major projects which require approval from the Minister for Planning and Environment or delegate (Planning Assessment Commission, Secretary or other public authority). An EIS must be prepared in accordance with environmental assessment requirements issued by the SEARs. The SSD assessment process and the SEARs issued for this proposal are summarised Section 5.1.1.

Under section 89J 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*.

Under section 89K of the EP&A Act, several other authorisations cannot be refused if they are necessary for and consistent with an approved SSD, including a consent under section 138 of the *Roads Act 1993* (refer section 4.4.7).

State Significant Development status

Clause 20 of Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* defines State Significant Development 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 Wellington SF would have an estimated capital investment cost greater than $30 million and is therefore considered State Significant Development under Part 4 of the EP&A Act.

The Application for SEARs and Scoping Report for the Wellington SF proposal were submitted to DPE on 20 June 2017. SEARs for the assessment were received from DPE on 20 July 2017 (refer Section 5.1.1). A summary of the SEARs and corresponding sections in the EIS are provided in Table 5-1.

4.4.3 State Environmental Planning Policy (Infrastructure) 2007

Clause 34(7) of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) provides 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. Part of the proposal site is zoned R5 Large Lot Residential.

However, as noted in Section 4.3.1, a State Significant Development may however seek approval under the following provisions:

- Clause 8(2) of the SEPP State and Regional Development 2011, which states that if a single development application comprises development that is only partly State Significant Development, the remainder of the development is also declared to be State Significant Development. Consultation with the Department on similar projects has confirmed that the intent of this clause means if the subdivision is included in the development application with the solar farm, the subdivision is also declared to be state significant; and
- Section 89E (3) of the *Environmental Planning and Assessment Act 1979*, which states "development consent may be granted despite the development being partly prohibited by an environmental planning instrument".

4.4.4 State Environmental Planning Policy (Rural Lands) 2008

The aims of this SEPP include:

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

The objects of the State significant agricultural land provisions in the SEPP are:

a) to identify State significant agricultural land and to provide for the carrying out of development on that land,
b) to provide for the protection of agricultural land:
   (i) that is of State or regional agricultural significance, and
   (ii) that may be subject to demand for uses that are not compatible with agriculture, and
   (iii) if the protection will result in a public benefit.

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 as State significant agricultural land. The proposal site is however mapped as Biophysical Strategic Agricultural Land (BSAL). This is land which is assumed to feature

the best quality soil and water resources and be capable of sustaining high levels of productivity. It is not extensively ground truthed and the onsite inspection suggests that sustained high productivity (such as annual cropping) would not be supported at the site. Section 8.2 outlines the potential impact of the proposal to land use. Soil survey is being undertaken to provide an accurate land capability assessment.

4.4.5 State Environmental Planning Policy No 33—Hazardous and Offensive Development

This SEPP defines and regulates the assessment and approval of potentially hazardous or offensive development. 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.*

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 list 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 8.9.

4.4.6 Other State Environmental Planning Policies

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.

There are no contaminated sites for the Wellington LGA in the EPA contaminated land register (NSW Government, 2017). There is a risk that contamination associated with agricultural activities (e.g., pesticides) could be present on the site, however, given no contaminated sites are recorded on or adjacent to the proposal site and no evidence of contamination was observed during the site assessment, this risk is considered very low. In terms of the proposed solar farm, the risk from contamination and the need for remediation prior to the works is considered to be low (refer to Section 8.3).

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) encourages the conservation and management of natural vegetation that provides habitat for Koalas. Koalas are listed under the TSC Act as a vulnerable species. The SEPP applies to each local government area listed in Schedule 1. The Dubbo Regional LGA is not listed in Schedule 1 of SEPP 44. As such, this SEPP does not apply to the proposal site.

4.4.7 Roads Act 1993

The *Roads Act 1993* (Roads Act) establishes a system of 'classified roads', comprising the following categories; main road, highway, freeway, controlled access road, secondary road, tourist road, tollway, transitway and a State work.

Freeways, State Highways and Main Roads ('State Roads') are generally the responsibility of RMS. For State Roads other than Freeways, the local council generally has responsibility for footpaths and road reserves. Councils are roads authorities for less important classified roads and for roads not classified under the Act. Regional Roads may be classified or unclassified, and Local Roads are unclassified under the Act. The Lands Minister is the authority for Crown roads, including 'paper roads' (refer below).

The 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 would use one access point from Goolma Road, for its operation and construction. Goolma Road is a State Road which is managed by Roads and Maritime Services. The site access from Goolma Road would be designed and constructed in consultation with Roads and Maritime Services to the appropriate standard to accommodate the proposed traffic flows during construction and to avoid safety issues. The site access would include construction of a dedicated turning lane from Goolma Road into the site.

4.4.8 Water Management Act 2000

The aim of the *Water Management Act 2000* (WM Act) is to ensure that water resources are conserved and properly managed for sustainable use benefiting both present and future generations. It is also intended to provide formal means for the protection and enhancement of the environmental qualities of waterways and in-stream uses, as well as to provide for the protection of catchments.

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

Under the WM Act a controlled activity approval is required from the NSW Office of Water for certain types of developments and activities that are carried out on 'waterfront land' (i.e. in or within 40 metres of a river, lake or estuary). Under the WM Act a controlled activity means:

> *(a) The erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or*

(b) The removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or

(c) The deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or

(d) The carrying out of any other activity that affects the quantity or flow of water in a water source.

Under section 89J of the EP&A Act, SSD developments do not require a water use approval under section 89, a water management work approval under section 90 or a controlled activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Even though a Controlled Activity is not required for the works, a 40m buffer has been applied to waterways within the proposal site. Additionally waterway crossings and services crossing are required to be designed in accordance with '*Guidelines for Controlled Activities on Waterfront Land*' (DPI Water).

4.4.9 Heritage Act 1977

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

It should be noted that under Section 89J of the EP&A Act, an approval under Part 4 or a permit under Section 139 of the *Heritage Act 1977* would not be required for SSD. Potential impacts on heritage items has been undertaken in Section 7.5.

4.4.10 Mining Act 1992

The main objective of the *Mining Act 1992* (Mining Act) is to encourage and facilitate the discovery and development of mineral resources in New South Wales, having regard to the need to encourage ecologically sustainable development.

A search of Department of Industry's MinView database (DPE, 2017) found the site to have two current Mineral Titles:

- EL 6178 – held by Modelling Resources Pty Ltd
- EL 8505 – held by Drummond West Pty Ltd

First Solar have consulted with the mineral title holders and the details and outcomes of the consultation are provided in Section 5.

4.4.11 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.

- Section 148 of this Act requires notification of pollution incidents.
- Section 120 of this Act provides that it an offence to pollute waters.
- Schedule 1 of the POEO Act describes activities for which an Environment Protection Licence is required.

First Solar (Australia) Pty Ltd must ensure that all phases of the solar farm proposal are managed to prevent pollution, including pollution of waters.

First Solar Pty Ltd is obliged to notify the relevant authorities (e.g. Environment Protection Authority) should a 'pollution incident' occur that causes or threatens 'material harm' to the environment. This is included in Section 8.3.3.

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). The Wellington SF would not be a scheduled activity under this Act, an EPL is not required.

Legal requirements for the management of waste are also established under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Waste management should be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). The objectives of this Act are:

a) to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development,
b) to ensure that resource management options are considered against a hierarchy of the following order:
    i. avoidance of unnecessary resource consumption,
    ii. resource recovery (including reuse, reprocessing, recycling and energy recovery),
    iii. disposal,
c) to provide for the continual reduction in waste generation,
d) to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste,
e) to ensure that industry shares with the community the responsibility for reducing and dealing with waste,
f) to ensure the efficient funding of waste and resource management planning, programs and service delivery,
g) to achieve integrated waste and resource management planning, programs and service delivery on a State-wide basis,
h) to assist in the achievement of the objectives of the Protection of the Environment Operations Act 1997*.*

Waste minimisation and management is assessed and mitigation strategies in line with this are provided in Section 8.6 of this EIS.

4.4.12 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) regulates the clearing of native vegetation. Clearing is defined as cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation including native grasses and herbage. Under Section 89J of the EP&A Act, an authorisation referred to in section 12 of the NV Act to clear native vegetation would not be required for a SSD.

The requirements for offsetting impacts to native vegetation are detailed in Section 4.4.13 below.

4.4.13 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act* relates to the conservation of biodiversity. The Act repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*. The Act commenced on the 25th of August 2017.

The assessment of biodiversity impacts has been undertaken under the provisions of this Act. Specifically, under the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* this proposal is to be assessed in accordance with the Framework for Biodiversity Assessment (FBA), given the SEARs have been issued and the field data has been collected under the FBA. Refer to Section 7.1.

4.4.14 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) is administered by NSW Department of Primary Industries. The Biosecurity Act repeals the *Noxious Weeds Act 1993*. It streamlines and modernises the way all biosecurity risks (feral animals, plant and animal diseases, and weeds) are managed in NSW. In relation to weeds, the Act:

- embeds the principle of shared responsibility for weed risk across government, community and industry;
- applies equally to all land and waterways in the state, regardless of whether ownership is public or private;
- is premised on the concept of risk, so that weed management investment and response is commensurate with the risk posed; and
- supports regional planning and management for weeds.

The Biosecurity Act includes a number of mechanisms (regulatory tools) that can be used to manage weed risks. The Act and Regulations provide specific legal requirements for high risk activities and state level priority weeds. The Biosecurity Act introduces a General Biosecurity Duty (GBD): that all plants are regulated with a GBD to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as reasonably practicable.

Whilst not a regulatory document, the Central West Regional Strategic Weed Management Plan 2017 - 2022 (RSWMP) (Central West Local Land Services, 2017), utilises the regulatory tools available in the Biosecurity Act to manage weed risks.

Appendix 1.1 of the RSWMP details the specific legal requirements for state level priority weeds and high risk activities. For each state level priority weed, the management objective, and specific requirements for its management (as stated in the Biosecurity Act and regulations) is included. The specific requirements include Prohibited Matter, Biosecurity Zones, Control Orders and Mandatory Measures. Appendix 1.2 identifies regionally prioritised weeds and outcomes to demonstrate compliance with the General Biosecurity Duty.

Refer to Section 7.1 and Appendix D for weed management.

4.4.15 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) sets out to conserve fish stocks and key fish habitats, threatened species, populations and ecological communities of fish and marine vegetation and biological

diversity. Further, it aims to promote viable commercial fishing, aquaculture industries and recreational fishing opportunities. Threatened species, populations and ecological communities and key threatening process are listed in the FM Act's Schedules.

The Wellington SF is within the Macquarie-Bogan catchment. The Wellington Key Fish Habitat Map (NSW DPI, 2016) maps Wuuluman Creek as Key Fish Habitat. Key Fish Habitat are those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species (DPI 2016).

A permit under Section 201, 205 or 219 of the Act is not required by virtue of Section 89J of the EP&A Act. Impacts on waterways and fish habitat are addressed and mitigated in Sections 7.1 and 8.4.

4.4.16 National Parks and Wildlife Act 1974

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

Under Section 89J of the EP&A Act, an Aboriginal Heritage Impact Permit under Section 90 of the *National Parks and Wildlife Act 1974* would not be required for a State Significant Development.

The potential impact to Aboriginal heritage is discussed in Section 7.2 of this report.

4.4.17 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 New South Wales. The Catchments and Lands Division, DPI is responsible for the sustainable and commercial management of Crown land.

One Crown Road is located in the proposal site. An application to close this Crown road has been made in August 2017 – Application No. W589205. Consultation with DPI (Lands) is summarised in Section 5.

4.5 COMMONWEALTH LEGISLATION

4.5.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Environment (DoE). Under the EPBC Act, if the Minister determines that an action is a 'controlled action' which would have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or Commonwealth land, then the action may not be undertaken without prior approval of the Minster.

The EPBC Act identifies nine MNES:

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

- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development

If significant impacts are anticipated on these entities, the activity must be referred to the Department for a decision as to whether the proposed action is a 'controlled action'.

A search for MNES and other matters protected by the EPBC Act was carried out for the proposal site using the Commonwealth Online Environmental Reporting Tool (report created 16 May 2017). A summary of the findings is provided in the tables below.

The EPBC protected matters report identified the following MNES to have potential to occur within the search area:

- Wetlands of international importance (4)
- Threatened ecological communities (2)
- Threatened species (28)
- Migratory species (11)
- Commonwealth land (2)
- Commonwealth heritage places (1)
- Listed marine species (17)
- Invasive species (29)

Considering the locations of the site and the potential for impacts as a consequence of the development

- Four wetlands of international importance were returned from the protected matters report, the nearest of these is the Macquarie Marshes, which occurs over 200 km north west of the proposal site. All other wetlands returned form the searches are over 700 km away. No impact on this matter is anticipated.
- Two threatened ecological communities were returned from the protected matters report. One is verified to occur onsite: White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland (which is listed under both the NSW BC Act and the Commonwealth EPBC Act). The majority of the site is derived from this community. It is present across the site in varying levels of condition. This matter is investigated in Section 7.1.
- Twenty-eight threatened species and Eleven listed migratory species were returned from the protected matters report. This matter is investigated in Section 7.1.
- The proposal would not impact on Commonwealth Land.
- Fourteen listed Marine species were returned from the protected matters report. None of these species would occur at the proposal site due to the distance from marine environments. Migratory species would not occupy the proposal site on a regular basis or rely on the habitats present. No impact on this matter is anticipated.
- Twenty nine invasive species returned from the protected matters report. This matter is investigated in Section 7.1.

It is anticipated that the proposal would not impact on any MNES and a referral under the EPBC Act is not considered to be required.

4.5.2 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.

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral lease.
- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the Native Title Register on 27 April 2017 for the Dubbo Regional LGA found no registered native titles relevant to the proposal site.

4.5.3 Renewable Energy (Electricity) Act 2000

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

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

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth Government's 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 Wellington SF would need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

4.6 OTHER RELEVANT POLICIES AND MATTERS

4.6.1 Ecologically Sustainable Development (ESD)

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

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

a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ii. an assessment of the risk-weighted consequences of various options.
The precautionary principle has been adopted in the assessment of 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 Wellington SF 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 Wellington SF 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 Wellington SF would 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 Wellington SF on biodiversity, including EPBC listed species, have been assessed in detail in the Biodiversity Assessment in Appendix D 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, ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.
Attributes of the proposal 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 requirement for biodiversity offsets has been considered in accordance with the FBA for Major Proposals.

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in Section 9.2 provide an auditable set of environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the Wellington SF 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.

4.7 SUMMARY OF LICENSES AND APPROVALS

The following approvals are considered to be required for the Wellington SF:

Table 4-2 Licences and approvals required for Wellington SF.

Legal Instrument	Licence or Approval
EP&A Act – Part 4	SSD consent required
Roads Act	Section 138 approval for work within a public road reserve, Goolma Road.

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

5 STAKEHOLDER CONSULTATION

5.1 AGENCY CONSULTATION

5.1.1 Secretary's environmental assessment requirements (SEARs)

SEARs were provided by NSW DPE on 20 July 2017. The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

The following sections paraphrase the SEARS and cross reference where specific issues are addressed within this EIS (Table 5-1) and guidelines that are required to be considered (Table 5-2). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the proposal.

Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or to seek further advice. This additional consultation with agencies is also summarised below in Section 5.1.3.

Table 5-1 SEARS issue summary

Issue summary	Addressed in this EIS
The 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 full description of the development, including:**	
o **details of construction, operation and decommissioning;** o **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);** o **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 3. • A site plan is provided in Figure 1-2. No required infrastructure is part of a separate approvals process • An updated constraints map developed during the assessment and used to inform the design is included in Figure 1-3.
• **a strategic justification of the development focusing on site selection and the suitability of the proposed site;**	• The proposal justification is provided in Sections 2.3 and 2.4.
• **an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:**	
o **a description of the existing environment likely to be affected by the development;** o **an assessment of the likely impacts of all stages of the development (which is commensurate**	• Site context is provided in Section 1.2.1. Existing environment of the site is described in Section 7 and 8.

Issue summary	Addressed in this EIS
with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; o **a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and** o **a description of the measures that would be implemented to monitor and report on the environmental performance of the development;**	• Detailed information regarding environmental legislation relevant to the proposal is outlined in Section 4. • A risk scoping table included in Section 6 identifies the key environmental issues for this proposal. Commensurate with the level of impact, detailed impact assessment, mitigation and monitoring are included in Sections 7 and 8. Draft management plans or management outlines have been included for: o Proposed visual screening (Appendix F) o Draft Noise Management Plan (Appendix H)
• **a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and**	• A summary of all environmental management measures is included in Section 9.2.
• **the reasons why the development should be approved having regard to:** o **relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act and how the principles of ESD have been incorporated into the design, construction and operation of the development;** o **suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and** o **feasible alternatives to the development and its key components, including the consequences if the development does not proceed.**	• Key matters under the EP&A Act and ESD principles are addressed in Section 4.6.1. • Section 2 and Section 10 includes a summary of the key benefits, reasons why the proposal should be approved and feasible alternatives to the development and its components if the development does not proceed.
The development application must be accompanied by:	
• **a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation 2000*); and**	• The capital investment report has been provided separately. • Landowners consent has been provided separately.

Issue summary	Addressed in this EIS
• **the consent in writing of the owner of the land (as required in clause 49(1)(b) of the *Environmental Planning and Assessment Regulation 2000*).**	
The EIS must address the following specific issues:	
• **Biodiversity – including an assessment of the likely biodiversity impacts of the development, having regard to the *NSW Biodiversity Offsets Policy for Major Projects*, and in accordance with the *Framework for Biodiversity Assessment (FBA)*, unless otherwise agreed by the Department;**	• An FBA assessment has been completed and is summarised in Section 7.1 and provided in full in Appendix D.
• **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 Assessment Report (ACHAR) has been completed and is summarised in Section 7.2 and provided in full Appendix E. • This includes consultation, summarised in Section 5.2. • Historic heritage is addressed in Section 7.5.
• **Land – including an assessment of the impact of the development on agricultural land and flood prone land, a soil survey to consider the potential for erosion to occur, and paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land, in particular with the prohibition in the R5 – Large Lot Residential Zone;**	• An assessment of land use impacts is detailed in Section 8.2. • A soil survey is currently being undertaken and is a commitment of the proposal to inform ground cover management in operation and restoration of land capability after decommissioning. • An assessment of the compatibility of existing and surrounding land use on the site and adjacent land is detailed in Section 8.2. • The development of R5 land is discussed in Section 4.3.1.
• **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, having regard to the *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring,* and including a draft landscaping plan for on-site perimeter planting, with**	• A Visual Impact Assessment has been completed (Appendix F) and is summarised in Section 7.3. • The *Dark Sky Planning Guideline* is addressed by the visual assessment. • Proposed perimeter planting is detailed as a recommendation

Issue summary	Addressed in this EIS
evidence it has been developed in consultation with affected landowners;	of the visual assessment. It includes a requirement to consult with the most affected land owners in finalising the treatments. • First Solar have held meetings with the most affected landowners and have provided them information regarding the proposal. Screening is proposed to address views for specific landowners, if requested based on the as built view of the site.
• **Water – including:** o **an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including any nearby water courses), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;** o **details of water supply arrangements; and** o **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);**	• An assessment of water impacts is detailed in Section 8.4 and 8.5. • A description of erosion and sediment measures are detailed in Sections 8.3.3.
• **Noise – including an assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and operational noise impacts in accordance with the NSW *Industrial Noise Policy* (INP), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;**	• A noise assessment has been completed and is summarised in Section 7.4. • A draft noise management plan is included in Appendix H.
• **Transport – including an assessment of the site access route, site access point, and likely transport impacts of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);**	• An assessment of transport impacts is detailed in Section 8.1. • Consultation will be undertaken with RMS regarding access to the site. • Crown land is addressed in Section 4.4.17
• **Hazards and electromagnetic Interference – an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and**	• An assessment of hazards and electromagnetic interference

Issue summary	Addressed in this EIS
substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields*.	impacts is detailed in Section 8.9.
• **Socio-Economic – including an assessment of the likely impacts on the local community and consideration of the construction workforce accommodation.**	• An assessment of potential impacts on the local community are addressed in Section 8.7.
The EIS consultation process includes:	
• **In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders.**	• Consultation is summarised in Section 5.2.
• **In particular, you must undertake detailed consultation with affected landowners surrounding the development and Dubbo Regional Council.**	
• **The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.**	• Consultation is summarised in Section 5.2.
• **If you do not lodge a development application and EIS for the development within two years of the issue date of these Environmental Assessment Requirements, you must consult further with the Secretary in relation to the preparation of the EIS.**	• NA

5.1.2 Relevant guidelines

The following guidelines, nominated in the SEARs, have been consulted in the preparation of this EIS:

Table 5-2 Guidelines relevant to this EIS

	Guideline	How guideline has been addressed?
Biodiversity	Framework for Biodiversity Assessment (OEH)	Biodiversity Assessment format, Section 7.1.
	NSW Biodiversity Offsets Policy for Major Projects (OEH)	
	Threatened Species Assessment Guidelines – Assessment of Significance (OEH)	Biodiversity survey methods, Section 7.1.
	Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (2003)	Water assessment and measures, Section 8.4 and 8.5.
	Policy and Guidelines for Fish Habitat Conservation and Management (DPI)	
Heritage	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)	Consultation approach Section 5.2.

	Guideline	How guideline has been addressed?
	Code of Practice for Archaeological Investigations of Objects in NSW (OEH)	Heritage survey methods Section 7.2.
	Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW (OEH).	Heritage assessment format Section 7.2.
	NSW Heritage Manual (OEH)	Heritage assessment format Section 7.5.
Land	Primefact 1063: Infrastructure proposals on rural land (DPI)	Section 8.2.
	Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA)	Community consultation, Section 5.2. Visual assessment method, Section 7.3.
	Australian Soil and Land Survey Handbook (CSIRO)	Section 8.3.
	Guidelines for Surveying Soil and Land Resources (CSIRO)	
	The land and soil capability assessment scheme: second approximation (OEH)	Section 8.2 and 8.3.
Visual	Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring (DPE)	Section 7.3 and Appendix F.
Water	Managing Urban Stormwater: Soils & Construction (Landcom)	Section 8.3 and 8.4.
	Floodplain Development Manual (OEH)	Section 8.4 and 8.5.
	Guidelines for Controlled Activities on Waterfront Land (DPI Water)	
	Water Sharing Plans (DPI Water)	
	Floodplain Management Plan (DPI Water)	
	Guidelines for Watercourse Crossings on Waterfront Land (DPI Water)	
Noise	NSW Industrial Noise Policy (EPA)	Section 7.4.
	Interim Construction Noise Guideline (EPA)	
	NSW Road Noise Policy (EPA)	
Transport	Guide to Traffic Generating Developments (RTA)	Section 8.1.
	Road design Guide (RMS) & Relevant Austroads Standards	
	Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development	
Waste	Waste Classification Guidelines (EPA)	Section 8.6.
Electromagnetic Interference	ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields	Section 8.9.
	State Environmental Planning Policy (State and Regional Development) 2011	Section 4.4.

	Guideline	How guideline has been addressed?
Environmental Planning Instruments	State Environmental Planning Policy (Infrastructure) 2007	
	State Environmental Planning Policy (Rural Lands) 2008	
	State Environmental Planning Policy No.44 – Koala Habitat Protection	
	State Environmental Planning Policy No.55 – Remediation of Land	
	Wellington Local Environmental Plan 2012	

5.1.3 Agencies additional comments and consultation

The SEARs require that, in preparing the EIS for the development, relevant State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders.

Relevant local, State or Commonwealth Government authorities, infrastructure and service providers and consultation and assessment to address matters raised by these entities are provided below.

Table 5-3 Agency consultation summary

Agency	Issue raised	How issue has been addressed
Roads and Maritime Services	Matters raised in RMS's addendum to the SEARs included the requirement for: • A Traffic Impact Study prepared in accordance with Section 2 of *RTA's Guide to traffic Generating Developments 2002.* • Traffic volumes. • Travel routes for traffic. • Description of over size and over mass vehicles and materials to be transported. • Details of access requirements to Goolma Road and an analysis of haulage routes including: o Intersection of Goolma Road and the Mitchell Highway (HW7). • Assessment of the impact of generated traffic and measures to ensure efficiency and safety on the public roads. • The need for; and proposed road improvements, to mitigate the impact of project-related traffic. • Consideration of local climate conditions in regard to road safety for vehicles. • Proposed road facilities, access and intersection treatments are to be identified and be in accordance with Austroads Guide to Road Design and, on classified roads, Roads and Maritime supplements, including safe intersection sight distance. • Layout of internal road network, parking facilities and infrastructure within project boundary. • Development of a Traffic Management Plan (TMP) in consultation with the Dubbo Regional Council and RMS prior to the commencement of haulage and/or construction operations. The TMP is to identify and provide management strategies to manage the impacts of project related traffic.	The traffic assessment was completed from desktop assessment and site inspection. It has been peer reviewed by a traffic consultant and is included at Section 8.1. Required information, including hours of construction, traffic volumes and overmass vehicles etc., is included in this section. Consideration has been given to the effect of local climate in the development of mitigation measures. The appointed construction contractor would prepare a Traffic Management Plan (TMP), including this information, in consultation with the RMS and Dubbo Regional Council.
Office of Environment	Matters raised in Department's addendum to the SEARs included impacts on biodiversity, Aboriginal Cultural Heritage, water, soils and flooding.	

Agency	Issue raised	How issue has been addressed
and Heritage (OEH)	• Biodiversity and offsetting: o Biodiversity impacts to be assessed and documented in accordance with the Framework for Biodiversity Assessment.	The biodiversity assessment and offsetting has used the FBA for major projects, as required, summarised in Section 7.1.
	• Aboriginal Cultural Heritage: o Identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development. o Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken. o Impacts on Aboriginal cultural heritage values are to be assessed. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to a OEH regional officer.	The Aboriginal heritage assessment has used the Guide to Investigating, assessment and reporting on Aboriginal Cultural Heritage in NSW and consultation guidelines Aboriginal cultural heritage consultation requirements for proponents 2010 as required, summarised in Section 7.2.
	• Historic Heritage: o 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 generally consistent with the *NSW Heritage manual* (1996); o Be undertaken by a suitably qualified heritage consultant(s); o Include a statement of heritage impact for all heritage items (including significance assessment); o Consider impacts including, but not limited to, vibration, demolition,	The heritage assessment was desktop, informed by a site inspection. Consultation was undertaken with Dubbo Regional Council's Heritage officer and additional information was provided by the Homestead onsite. No listed heritage items would be directly impacted by the proposal. Refer to Section 7.5.

Agency	Issue raised	How issue has been addressed
	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.	
	• Water and soils: o The EIS must map the following features relevant to water and soils including: ▪ Acid sulfate soils ▪ Rivers, streams, wetlands, estuaries ▪ Groundwater. ▪ Groundwater dependent ecosystems. ▪ Proposed intake and discharge locations. o Must describe background conditions for any water resource likely to be affected by the development. o Must assess the impacts of the development on water quality. o Must assess the impact of the development on hydrology.	The soil and water assessments were desktop, informed by a site inspection. Surface and ground water resources are detailed in Section 8.3 and 8.4. Acid sulphate soils are not relevant to the site. Water quantities are detailed. No direct impacts are proposed on waterways. Operational impacts, such as creation of additional impervious surfaces, would be adequately mitigated through a commitment to prepare a Ground Cover Management Plan, to retain ground cover beneath the panels, arresting soil erosion impacts. No landform reshaping or other effects that would alter onsite hydrology are proposed.
	• Flooding: o Must map the following features relevant to flooding including: ▪ Flood prone land. ▪ Flood planning area, the area below the flood planning level. ▪ Hydraulic categorisation (flood ways and flood storage areas). o Must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the	The flooding assessment was undertaken by a specialist and included a desktop assessment, informed by a site inspection. Flooding risks are assessed in Section 8.5. Maps of relevant flooding features are provided.

Agency	Issue raised	How issue has been addressed
	probable maximum flood, or an equivalent extreme event. o Must model the effect of the proposed development (including fill) on the flood behaviour. o Must assess the impacts on the proposed development on flood behaviour.	
Department of Primary Industries (DPI)	Matters raised in Department's addendum to the SEARs included impacts on land and water.	
	• A soil survey to confirm the agricultural value of the land. The area is mapped as biophysical strategic agricultural land. DPI advised: o To continue to use the land for agricultural purpose during the operation of the solar farm; o The land should be returned back to agricultural production at final rehabilitation on closure.	A soil survey is currently being undertaken and has been recommended to be undertaken prior to construction. The soil survey will inform any soil treatments and provide baseline information for the decommissioning rehabilitation. Refer to Section 8.3.
	• Details of the rehabilitation objectives and strategies including: o The design criteria of final land use and form; o Baseline indicators to guide rehabilitation; and o Monitoring and mitigation measures to be adopted.	Soil properties and key risks of construction are well understood and documented in Section 8.3. Excepting the perimeter track and small footings onsite for inverters and the substation, the majority of the soil surface would not be impacted by the development; no large areas of landform reshaping or excavation are proposed. A Groundcover Management Plan is a commitment of the proposal. The objective is to ensure a stable ground cover during operation of the solar farm, minimising erosion and adverse water quality impacts. Agronomist input is a requirement of the plan, to ensure persistence of groundcover. Highly managed grazing may be used to maintain the height of groundcover. A Rehabilitation Plan is a commitment of the proposal, relevant to post construction and

Agency	Issue raised	How issue has been addressed
		decommissioning. The objective is to ensure land uses post-construction and operation are not adversely affected. Below ground infrastructure that impedes cropping (less than 500mm depth) may be removed, in consultation with the land owner. The Ground Cover Management Plan and Rehabilitation Plan would both be informed by soil testing to ensure any limitations are addressed specific to the soils onsite.
	• Aquatic Ecology Assessment should include: o A recent aerial photograph of the locality identifying the area which may be affected by the development or activity on an appropriately scaled map; o Waterways within the area of development; o Extent of aquatic habitat and riparian vegetation removal or modification resulting from the development; o Details of the location of waterways crossings; o Details of methodology for any underground grid connection or transmission lines passing through the waterways. o Impacts on the aquatic ecology of Wuuluman Creek should be addressed specifically and controls should be established for: ▪ Access track; ▪ Underground grid connection or transmission lines.	Aquatic Ecology has addressed has been in the Biodiversity Assessment which is summarised in Section 7.1.
	• Waterway crossings: o Construction of waterway crossings or underground cables through waterways should be in accordance with DPI *Fisheries Policy & Guideline document: Policy and Guidelines for Fish Habitat Conservation and Management* (Update 2013)	This is addressed in Section 8.4.

Agency	Issue raised	How issue has been addressed
	• Riparian vegetation: o There is likelihood of riparian vegetation loss at Wuuluman Creek. This is listed as a Key threatening process under the provisions of the *Fisheries Management Act 1994.* o DPI fisheries policy advocates the use of terrestrial buffer zones in order to maintain the riparian buffer zone and limit disturbance and susceptibility to bed or bank erosion.	Riparian vegetation is assessed in the Biodiversity Assessment which is summarised in Section 7.1.
Division of Resources and Geoscience	Matters raised in Department's addendum to the SEARs included impacts on mineral titles.	
	• Recommends an assessment of the developments compatibility with existing land uses on the site and adjacent land. • The proposed site is partially subject to Exploration License 6178 (Act 1992) (EL 6178) held by Modeling Resources Pty Ltd and partially subject to Exploration Licence 8505 (Act 1992) (EL 8505) held by Drummond West Pty Ltd. • Acknowledge and identify the current in force mineral titles on the project's map, including the proposal area and associated electrical transmission infrastructure. • Make contact with the title holders (Modeling Resources Pty Ltd and Drummond West) to determine their level of interest in the project area. Including evidence of: o Notification of the proposal to the title holder; o Project map (noted above); and o Any response from the title holder to the proponent. • Consultation, during the preparation of the EIS, with mineral resource stakeholders including exploration licence holders, quarry operators and mineral title holders. • Review and update 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.	Consultation undertaken is outlined in Section 5.3 and provided within Appendix K. Potential impact on mineral resources and map of features is provided in Section 8.2. Mitigation measures include ongoing consultation with the Stakeholders.

Agency	Issue raised	How issue has been addressed
Fire & Rescue NSW	Matters raised in Department's addendum to the SEARs included impacts associated with fire events and hazardous materials.	
	• The proposed location is within the NSW Rural Fire Services (RFS) Fire District. • A comprehensive Emergency Response Plan (ERP) is developed for the site that specifically addresses the following: o Foreseeable on-site and off-site fore events and other emergency incidents; o Details appropriate risk control measures that would need to be implemented in order to safely mitigate potential risks to first responders i.e. level of personal protective clothing, minimum respiratory protection required etc. o Other risk control measures that need to be implemented in a fire emergency due to any unique hazard specific to the site. o Once constructed, but prior to operation, that the operator contacts the local emergency management committee (LEMC). The LEMC will develop a comprehensive inter agency local emergency procedures for significant hazardous sites. • FRNSW and NSW Rural Fire Service must be able to implement effective and appropriate risk control measures when managing an emergency incident at the site.	Bushfire Risk is addressed in Section 8.9. The measures outline the preparation of an ERP.
NSW Rural Fire Service	• The EIS should include a bush fire assessment prepared by a suitably qualified person that addresses the aim and objectives of *Planning for Bush Fire Protection 2006*. • The report should also recommend measures to prevent a fire occurring within the site from developing into a bush/grass fire risk to the surrounding area.	Bushfire Risk is addressed in Section 8.9. The measures include prevention of fires occurring on site.
Heritage Council	Matters raised in Department's addendum to the SEARs included impacts on heritage items and consultation with local Aboriginal Land Council (LALC).	
	• Where impacts to State or locally significant heritage items are identified, the EIS must:	The heritage assessment was desktop, informed by a site

Agency	Issue raised	How issue has been addressed
	o Include assessments of any impacts, including cumulative, to the heritage significance of listed heritage items. o Provide a discussion of alternative locations and design options that have been considered to avoid any negative heritage impacts. o In areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment in accordance with Heritage Council of NSW guidelines. Including methodology and research design to assess the impacts of the works to guide physical archaeological test excavations, including results of these excavations. o Consultation with the LALC should begin at the planning stage of any assessment of impacts of the proposal on Aboriginal heritage values.	inspection. No listed heritage items would be directly impacted by the proposal. Refer to Section 7.5. The Aboriginal heritage assessment has used the *Guide to Investigating, assessment and reporting on Aboriginal Cultural Heritage in NSW* and consultation guidelines *Aboriginal cultural heritage consultation requirements for proponents 2010* as required, summarised in Section 7.2.
	Matters raised in Department's addendum to the SEARs included impacts on transport and community consultation.	
	• Transport: o Details be provided on the proposed road upgrades that the applicant intends on undertaking. o Address the impact on local roads during the construction and operational phases and shall include a Road Dilapidation Report and a complete audit of the road formation and/or pavement condition.	Proposed upgrades are outlined in the proposal description (Section 3.2.1) and further in Section 8.1 A Road Dilapidation Report and audit have been included as mitigation measures.
	• Community Consultation	Consultation undertaken is addressed in Section 5.2.

5.1.4 Dubbo Regional Council

Consultation with Dubbo Regional Council has included the following:

- On 22 June 2017, First Solar's Project Manager contacted Dubbo Regional Council to arrange a meeting to introduce the project.
- On 28 June, the Project Manager met with Liz Rich at the Wellington Council Offices to introduce the project.
- On 28 June the Project Manager also met with Darryl Quigley (Planning Services Supervisor) at the Dubbo Regional Council to consult with Council prior to the request for SEARs to the NSW DPE.
- On the 27 July Dubbo regional Council administrator commented his enthusiasm for the project in the Daily Liberal.
- On 28 September the Project Manager met with Steven Jennings (Senior Planner) at the Dubbo Regional Council to consult with Council regarding the R5 land zoning within the proposal site.
- On 28 September the Project Manager met with Josie Howard (Manager Economic Development and Marketing) to discuss community benefits to the project.

Subsequent, to the meeting with Council on 28 September 2017, First Solar met with DPE on 9 October 2017 regarding the R5 land zoning within the proposal site. Prior to this meeting DPE and Council had a direct conversation regarding the R5 land and it is understood that the R5 land zoning was spot rezoned in relation to the Wellington Correctional Centre across the road from the proposal site. Council stated to First Solar and DPE that the R5 land zoning at the proposal site has no strategic value to Council and they would not object to the proposal being located within the R5 land.

5.2 ABORIGINAL COMMUNITY CONSULTATION

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 2010* (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 E. A summary of actions carried out in following these stages are as follows.

Stage 1. Letters outlining the development proposal and the need to carry out an ACHA were sent to the Wellington LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspaper, Daily Liberal Advertiser on the 26th of April 2017 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, five groups contacted the consultant to register their interest in the proposal. The groups who registered interest were Wellington Local Aboriginal Land Council, Wellington Valley Wiradjuri Aboriginal Corporation, Gallangabang Aboriginal Corporation, Binjang Wellington Wiradjuri Heritage Survey and the Wiradjuri Central West Republic.

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

Stage 2. On the 28 of June 2017, an Assessment Methodology document for the Wellington 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.

Billy Stanley (Heritage Officer for Wellington LALC) replied for the Wellington LALC that he was satisfied with the methodology.

The Wiradjuri Central West Republic informed NGH that Jamie Gray with the Binjang Wellington Wiradjuri Heritage Survey would respond for both these registered Aboriginal parties. Jamie Gray responded that he was satisfied with the methodology.

The Gallangabang Aboriginal Corporation informed NGH that Bradley Bliss with the Wellington Valley Wiradjuri Aboriginal Corporation would respond for both these registered Aboriginal parties. The main points raised in the comments received from the Bradley Bliss on the methodology were in relation to:

- Survey spacing; and
- Recording techniques for sites, specifically photography and GPS co-ordinates.

These comments were addressed by NGH in reply letters sent to the Wellington Valley Wiradjuri Aboriginal Corporation on the 3rd of August 2017. No further correspondence was received regarding the letters from NGH Environmental that addressed the comments on the methodology.

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

At this stage, the fieldwork was organised, and all of the registered parties were asked to participate in fieldwork. Wiradjuri Central West Republic informed NGH that Binjang Wellington Wiradjuri Heritage Survey would represent them during the fieldwork. Therefore, two representatives from Binjang Wellington Wiradjuri Heritage Survey participated in the survey with a single representative from each of the other three Registered Aboriginal Parties (RAPs) also participating in the fieldwork. The fieldwork was carried out in August 2017 with five representatives from the registered parties participating in the survey.

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

- Jamie Gray- Binjang Wellington Wiradjuri Heritage Survey;
- Fonua Havili- Binjang Wellington Wiradjuri Heritage Survey;
- William (Billy) Stanley- Wellington LALC;
- Bradley Bliss- Wellington Valley Wiradjuri Aboriginal Corporation; and
- Stephan Lamb- Gallangabang Aboriginal Corporation.

Stage 4 In October 2017 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal 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. To date no comments have been received.

5.3 MINERAL TITLES CONSULTATION

On the 20 July 2017 NSW DPE provided First Solar mailing addresses of mineral license exploration holders. Two license holders were identified. A letter was sent to the License Holders on the 2 August 2017 advising of the development and options to provide input.

Phone calls were made to the license holder representatives on the 9 and 11 of August introducing the project and associated timelines. One of the licence holders indicated the exploration in the proposal area is low priority and unlikely to yield ore bores. The other indicated that the project would not affect their exploration other than bringing forward non-invasive exploration activities. The project manager committed to providing project updates. Follow up emails summarising the discussions was sent to the licence holders on the 14 and 15 August. Response emails were received from the license holders on the 15 and 23 of August acknowledging consultation and confirming interest in working collaboratively and being informed on project milestones. Further consultation will be necessary with one of the license holders during exhibition of the EIS as they reserved their right to make an objection regarding concerns the construction of the solar farm could preclude the licence holder from exploration on the proposal site.

5.4 QUARRY CONSULTATION

Three quarries have been identified within 5km around the site. Consultation has been initiated, although only the operator of one quarry was able to be located.

- Maryvale Sand & Gravel Pit is operated by Boral Property Group and consultation in September and October 2017 concluded in Boral stating they have no objection to the proposed Wellington Solar Farm.
- Montefoires Pit (Nanima Quarry) was stated to be related to Exploration Licence EL 6178. Consultation with EL 6178 resulted in the quarry not being related to exploration licence. It is understood to be operated by Dubbo Regional Council. Dubbo Regional Council has been contacted but no response has been received in relation to this matter.
- Brookfield Pit is understood to be operated by Dubbo Regional Council. Dubbo Regional Council has been contacted but no response has been received in relation to this matter.

5.5 COMMUNITY CONSULTATION

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

5.5.1 Community Consultation Plan

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

A Community Consultation Plan (CCP) was developed for the proposal. It is provided in Appendix C. The aim of the CCP is to identify methods to inform the community about the Wellington SF and facilitate engagement with the community.

The CCP identifies:

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

5.5.2 Visual impact assessment requirements

Community consultation specific to the 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 the proposed development.

As part of the Community Consultation Plan, feedback forms were distributed, and respondents were surveyed on their views regarding solar farm development and local visual amenity values. The results are included within the Visual Impact Assessment, Section 7.3.

5.5.3 Community consultation activities to date

Dubbo Regional Council provided First Solar with mailing addresses for all ratepayers within 2km of the solar farm site. Letters were sent out to this group at the following proposal development milestones:

- 18 April 2017: Planning notification (first notification).
- 3 July 2017: Request for SEARs notification.
- 7 August 2017: Planning update – SEARs issued.
- 13 September 2017: Notification about Community Open Day – (27 September 2017; a feedback form was included in this mail out).

On 10 May, all adjacent and close neighbours, including local businesses and agencies, were visited. If at home, a Project Manager and Project Support Officer provided introduction to the project and provided a notification letter with the project contact information and a feedback form. If a resident was not at home, the letter and form were left in either the letter box or a prominent location (e.g. at a doormat or screen door). During this period one close neighbour was met with in person and was not concerned about the impact of the solar farm as their views do not face the solar farm.

On 9 May 2017, a Project Manager met with Kathy Webb, Business Manager of the Wellington Correctional Centre. On 15 May 2017 Kathy Webb requested information about the interaction between solar panels and security cameras. An email was sent to Kathy Webb on the 15 May detailing responses to the questions raised.

Neighbours with potential for extensive views of the solar farm (identified via the visual impact assessment) were met with in person on the 27 June, and 8 August 2017. A visual assessment consultant prepared montages in consultation with neighbours, where requested. On 30 August further meetings were scheduled with the Project Manager to discuss the photomontages, discuss impacts and mitigation options, where appropriate.

5.5.4 Results of community consultation

The Community Open Day took place on the 27 September 2017 at the Wellington Civic Centre. In total, 28 people participated in the open day. Feedback from the participants included:

- Positive feedback regarding the creation of jobs. Local contractors and local labour will be utilized when possible.
- Two neighbouring landowners raised concerns regarding visual impact of the site. Photomontages were prepared for these landowners.
- Two participants raised concerns regarding water supply for their property from watermills that are in close proximity to the development. First Solar staff agreed to complete a site visit to ensure no watermills would be impacted by the proposal.
- Land value concerns were raised by one community member with regard to another solar farm adjacent to her property.

First Solar Australia Pty Ltd received six completed community feedback forms. Five residents lived five kilometres or less from the proposal site and one resident lived greater than five kilometres. This resident was not a member of the local community. Important local values identified by the respondents included:

- To be living in an area where soils are ideal for agriculture use/farming activities.
- Modern enhancements through the creation of wind farms.
- Historic significance values.
- Scenic views of the existing landscape; river valleys, hills and greenery.

Residents were generally very positive and supportive of the proposal with responses highlighting the need for innovation in the area, less reliance on coal and welcoming the addition of a practical and economical energy source.

Key concerns raised by members of the community were the impact to land value, impacts to agricultural businesses, landscape impacts, glare from the panels, noise emissions during construction and possibility of increased temperature to the immediate surroundings residents. All these matters have been discussed directly with the local community and included in this environmental assessment. The issues identified through the consultation process have also been addressed in the proposal design and mitigation measures included in this EIS.

5.5.5 Continued engagement

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

The CCP would be reviewed regularly, as well as at key transition phases between different 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.

First Solar will be undertaking a presentation on the proposal to Dubbo Regional Council on 20 November 2017.

6 SCOPING

6.1 FATAL FLAWS ANALYSIS AND CONSTRAINTS MAPPING

Early in the investigation of the Wellington site, NGH Environmental prepared a 'fatal flaws' analysis. The analysis was undertaken based on desktop review and site surveys, to identify high level constraints to the development of the site. It assisted to guide more detailed investigations, as well as inform the development of a site layout that reflects the site's constraints.

The constraints map was further refined during the preparation of the Scoping Report and following the detailed field investigations. This allowed further refinements of the concept design. The final constraints map is provided in Figure 1-3. It shows:

- Conservation significant vegetation and threatened species habitats (potential rocky outcrops)
- Waterways
- Nearby sensitive receivers
- Historic Heritage site

The indicative 'worst case' infrastructure layout shown in Figure 1-3 can be seen to reflect these constraints.

6.2 RISK ASSESSMENT

Additionally, a risk assessment exercise was undertaken to rank the degree of environmental risk associated with the construction, operation, and decommissioning of the solar farm. The aim of the risk assessment was to ensure that all relevant risks were identified, investigated and mitigated as part of the EIS, commensurate to the degree of environmental risk they present.

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

Table 6-1 Risk assessment rating matrix.

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

The risk assessment below considers all impacts likely to be attributed to the proposal (including the solar arrays and ancillary infrastructure, fencing, access roads, substation and transmission line). This includes consideration of:

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

Table 6-2 summarises the results of the 'unmitigated' risk assessment. The following five key risks were investigated in detail by way of specialist assessments (refer Section 7):

- Biodiversity.
- Aboriginal heritage.
- Visual amenity.
- Noise.
- Historic Heritage.

Lower risk issues were investigated, primarily using desktop assessment. These are included in Section 8 of this EIS.

It is noted that, on the basis of the investigations now documented in this EIS for key and lower risk issues, all risks are considered manageable and would have a revised 'mitigated' risk rating of 'low'.

Table 6-2 Risk analysis of environmental issues

Relevant EIS section	Environmental risk	Consequence	Likelihood	Unmitigated risk rating
7.1	Biodiversity	Moderate	Likely	Very high
7.2	Aboriginal heritage	Moderate	Likely	Very high
7.3	Visual amenity	Moderate	Likely	Very high
7.4	Noise and vibration	Moderate	Likely	Very high
7.5	Historic heritage	Moderate	Possible	High
8.1	Traffic, transport and road safety	Moderate	Possible	High
8.2	Soils	Minor	Possible	Medium
8.3	Water use and water quality (surface and ground water)	Minor	Possible	Medium
8.4	Flooding	Minor	Possible	Medium
8.5	Land use (including mineral resources)	Minor	Possible	Medium
8.6	Resource use and waste generation	Minor	Possible	Medium
8.7	Socio-economic and community	Minor	Possible	Medium
8.8	Climate and air quality	Minor	Possible	Medium
8.9	Hazards (including bushfire and EMF)	Minor	Possible	Medium
8.10	Cumulative impacts	Minor	Possible	Medium

7 ENVIRONMENTAL IMPACT ASSESSMENT: KEY ISSUES

7.1 BIODIVERSITY (FLORA AND FAUNA)

7.1.1 Approach

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

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

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

Comprehensive mapping and field surveys were completed in accordance with the requirements in the FBA and BioBanking Credit Calculator (BCC). The assessment approach involved literature reviews, database searches, and field surveys conducted in accordance with relevant survey guidelines. The report followed the BAR format required by the FBA. Specifically, this assessment uses the site-based landscape assessment methodology, in accordance with Appendix 4 of the FBA for major proposals.

BCC plot data were collected in May 2017 for six homogenous vegetation zones that were mapped for the site. Targeted flora and fauna field surveys were undertaken in May and October (Spring) 2017 to ensure that the majority of species likely to be occurring within the development site could be detected, and in accordance with the threatened species survey timing matrix produced by the BCC.

Survey effort included:

- Fauna habitat
    - Approximately 20 person hours were spent assessing fauna habitat within the proposal site. This included:
        - An assessment of habitat types available and their quality and suitability as threatened species habitat was conducted across the development site.
        - Factors such as arboreal resources, ground-layer resources, vegetation structure, connectivity and disturbance were noted.
        - An assessment was undertaken of all accessible trees within the development site to record the species, presence of hollows, tree height, diameter and number, and size and location of hollows. Photographs were taken of each tree surveyed.

  - Waterbodies and ephemeral waterways were assessed for their fauna habitat potential and their likely utilisation by species within the locality.
  - Incidental sightings of fauna and their traces (e.g. scats, tracks, scratches) made while present on the site were also recorded.
  - An opportunistic record of fauna species observed during the fauna assessments was taken.
- Diurnal birds including Regent Honeyeater
  - Six bird monitoring plots were undertaken within the development site using the area search method. These consisted of 20 minute searches within a 2ha area in the early morning over two days.
  - One full day of opportunistic searches also occurred in areas of suitable habitat.
- Nocturnal birds
  - Two nights of nocturnal spotlighting surveys and call playback were undertaken within woodland areas and areas containing hollow-bearing trees.
- Koala
  - Surveys of the woodland areas were undertaken for the Koala by actively searching each of the trees for scratching and scats.
  - Nocturnal spotlighting surveys were also undertaken within the woodland area containing hollow bearing trees.
- Threatened bats
  - Two ANABAT recorders were placed in the woodland areas.
- Threatened flora (Blue Grass, Ausfeld's Wattle, Scant Pomaderris, Silky Swainson-Pea, Small Purple Pea, *Tylophora linearis, Euphrasia arguta*, *Prasophyllum* sp. Wybong)
  - Ausfeld's Wattle and Scant Pomaderris- Surveys were undertaken in the woodland areas within the appropriate detection period for these species between the 8th and 10th of May 2017.
  - Blue grass- Surveys were undertaken for these species within areas of native grassland, roadsides and woodland areas. Surveys for this species was undertaken within an appropriate detection period between the 8th and 10th of May 2017.
  - Silky Swainson-Pea, Small Purple Pea, *Tylophora linearis*, *Euphrasia arguta*, *Prasophyllum* sp. Wybong- On the 4th October areas of suitable habitat were surveyed using the parallel field traverse survey technique in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH, 2016).
- Squirrel Glider, Brush-tailed Phascogale and Eastern Pygmy Possum
  - Two nights of nocturnal spotlighting surveys and call playback were undertaken within the woodland areas.

Results of the surveys were entered into the BCC to determine the landscape values, ecosystem and species credits generated by the proposed development, in accordance with the FBA. The proposal ID for the assessment is BioBanking Credit Calculator Major Project 144/2017/4350MP Version 2.

7.1.2 Previous surveys conducted in the local area

It is unclear whether dedicated biodiversity surveys have been undertaken within the locality, however evidence from the NSW Bionet Search and Atlas of Living Australia indicated that previous occasional opportunistic surveys have been undertaken.

One threatened bird, the Little Eagle (*Hieraaetus morphnoides*) listed as vulnerable, has been recorded opposite the TransGrid substation on Goolma Road in 2003. This species is predicted to occur in this assessment as an ecosystem credit species.

7.1.3 Landscape attributes

The proposal is located within NSW South Western Slopes Bioregion and the Inland Slopes Subregion (IBRA v.7 2012). The dominant IBRA subregion affected by the proposal is the Inland Slopes Subregion.

Two Mitchell Landscapes occur within the proposal site; Mullion Slopes and Macquarie Alluvial Plains. The dominant Mitchell Landscape affected by the proposal is Mullion Slopes and this was entered into the BCC for the proposal.

A site based assessment was completed in the BCC, in accordance with Appendix 4 of the FBA as the proposal site is non-linear. The total area of native vegetation mapped within the outer assessment circle of 2000ha is 401.38 ha. This reflects the high amount of land cultivation and surrounding the site.

Two watercourses run through the proposal site. Wuuluman Creek, a 3rd order stream, runs though the centre of the development site (Figure 1-3). In the east of the development site Wuuluman Creek is a slow flowing shallow creek with steep banks. An Overland Flow Path traverses east to west in the northern and central areas of the site and joins up with Wuuluman Creek on the western edge of the site. This overland flow path has been man made for stock water supply. These watercourses flow into the Macquarie River, approximately 2.5km downstream.

Under the DPI's Policy and Guidelines for Fish Habitat Conservation and Management, Wuuluman Creek comprises both Class 2 and Class 3 Key Fish Habitat. In the east of the development site, Wuuluman Creek would be classed as Type 3, Minimal Sensitive Key Fish Habitat, with no native aquatic vegetation present. Towards the west of the site, with native aquatic vegetation becoming established the Creek would be classed as Type 2, Moderately Sensitive Key Fish Habitat. The waterway class is defined as Class 3 Minimal Key Fish Habitat, having intermittent flow and semi-permanent pools within the waterway.

The closest Nationally Important Wetland to the development site is the Macquarie Marshes, located over 150km downstream of the development site.

No state or regionally significant biodiversity links occur within the development site or within the inner and outer assessment circles.

The BCC returned a landscape value score of 12.80 based on the above data.

7.1.4 Field survey results

Flora

Two Plant Community Types (PCT) were identified in the development site;

- White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes (PCT 266).
- Blakely's Red Gum – Yellow Box grassy tall woodland (PCT 277).

Both these PCTs are listed as Endangered Ecological Communities.

Within the development site, PCT 266 occurred as:

- 1.81ha of woodland vegetation in moderate to good condition.
- 0.90ha of woodland vegetation in moderate to good condition comprised from a previous tree planting.
- 1.75ha of woodland vegetation in low condition.
- 5.86ha of derived grassland in moderate to good condition.
- 133.59ha of derived grassland in low condition.

Within the development site, PCT 277 occurred as two small patches (totalling 0.32ha) of low condition woodland vegetation.

Refer to Figure 7-1 to Figure 7-6.

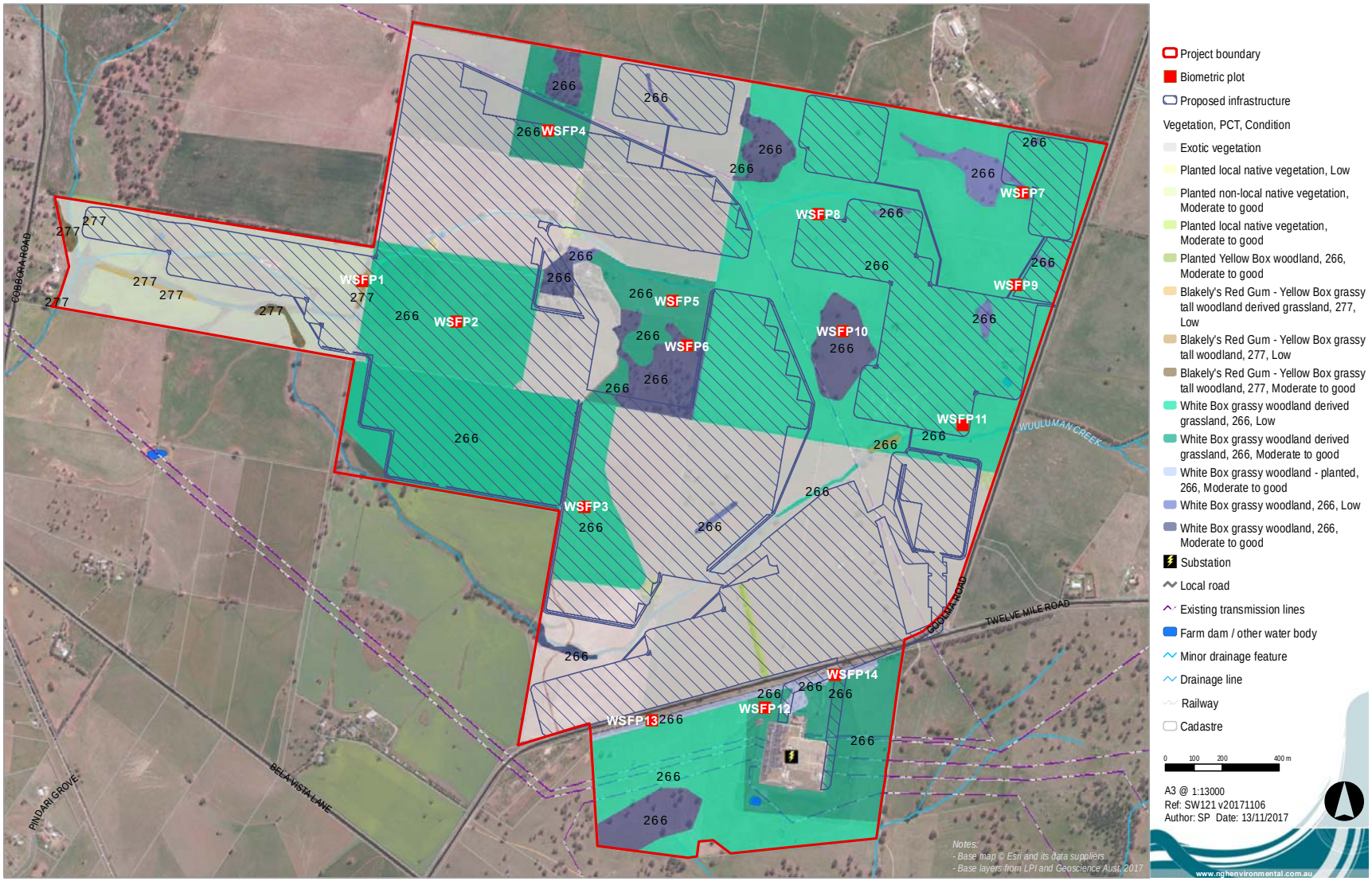


Figure 7-1 PCT and survey locations within the development site.

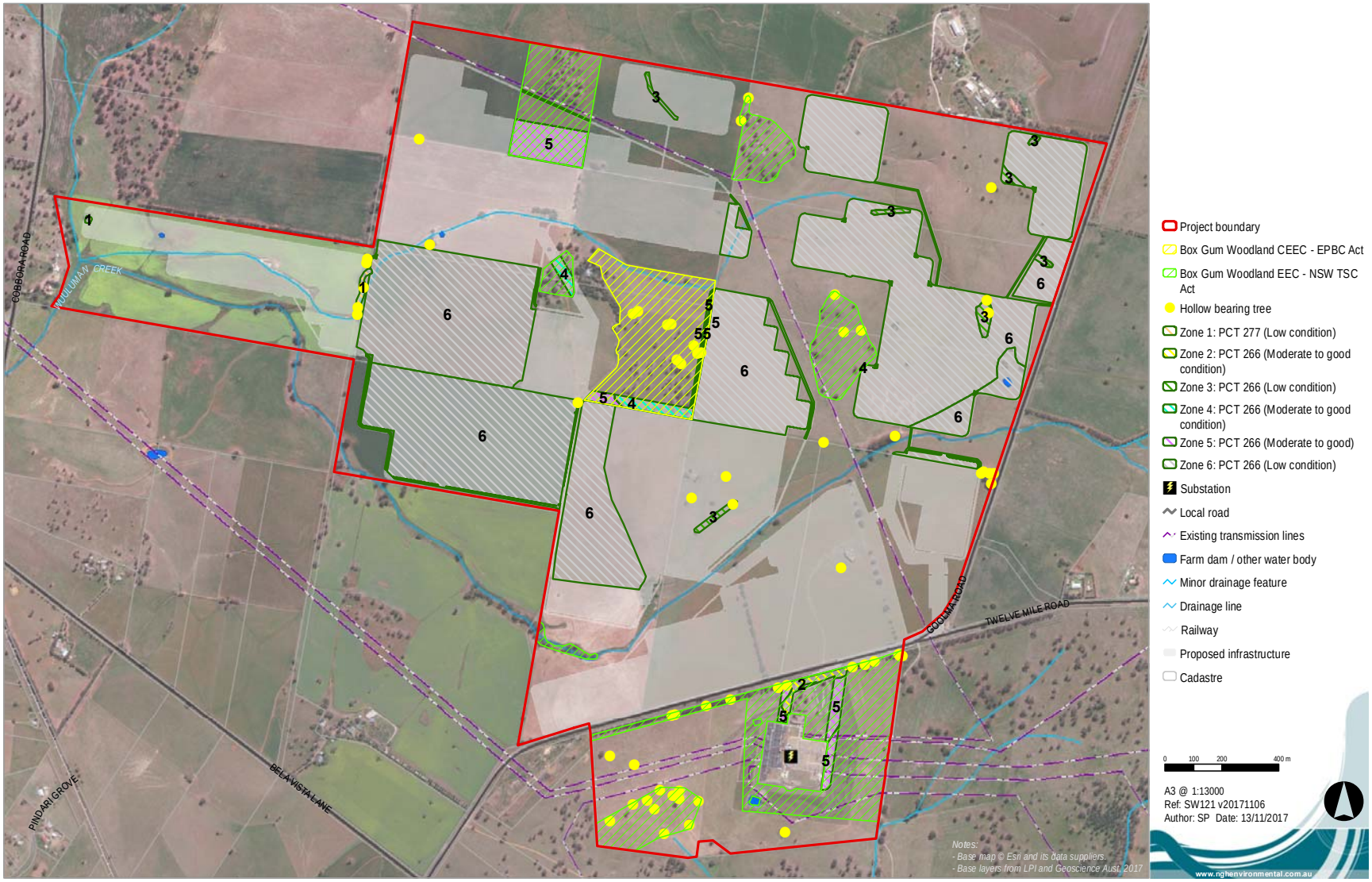


Figure 7-2 Hollow-bearing trees

Figure 7-3 Example of moderate to good condition White Box Grassy woodland in the development site.

Figure 7-4 Example of White Box grassy woodland planted vegetation within the development site.

Figure 7-5 Example of moderate to good condition White Box grassy woodland derived grassland in the development site.

Figure 7-6 Example of low condition Blakely's Red Gum – Yellow Box grassy tall woodland in the development site.

Fauna

The field surveys identified one threatened species, a Masked Owl (*Tyto novaehollandiae*) was observed during spotlighting surveys on a branch of a large Yellow Box (*E. melliodora*) tree. This tree contained two large hollows (greater than 20cm) in the trunk of the tree. The Masked Owl is listed as vulnerable in NSW.

The Masked Owl is a dual credit species being an ecosystem credit species predicted to occur in this assessment and also a species credit species where breeding habitat is impacted. Breeding habitat is defined in the OEH BioNet Threatened Biodiversity Database (BTBD) as; Living or dead trees with hollows greater than 20cm diameter. As such this species has been included as a candidate species.

The assessment determined that the habitat within the proposal site is unlikely to be preferred habitat of the Masked Owl. The development site is highly cleared and fragmented with the nearest densely forested area over two kilometres to the south-west. Further, breeding usually occurs in close proximity to foraging areas. Common Ringtail Possum, Greater Glider and the Sugar Glider are important prey species for large forest owls (Kavanagh and Stanton, 2002), none of which were recorded at the development site during nocturnal surveys. The development site is therefore unlikely to provide foraging habitat for the Masked Owl. The NSW Recovery Plan for large forest owls (DEC 2006) states that the Masked Owl requires old hollow eucalypts with hollows greater than 40cm wide and greater than 100cm deep for nesting. None of the hollows within the development site are greater than 40cm wide and none are likely to be 100cm deep. Based on the above it is considered unlikely that the Masked Owl would utilise the hollows within the development site for nesting. It is likely that the individual observed was resting within the development site while travelling through. As such, no breeding resources would be impacted by the proposal and species credits are not considered to be generated for this species.

7.1.5 Biobanking credit calculator results

Applying the above information to the BCC assessment, the following data were entered into the BCC and returned the final site value scores and areas of impact on threatened species habitat.

Table 7-1 Vegetation zones for the development site.

Zone ID	Vegetation zones	Condition class	Area (ha) within development site	Survey effort (number of plots)	Site value score (current)
1.	PCT #277 BVT CW112 Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Low	0.32	1	14.00
2.	PCT #266 BVT CW216 White Box Grassy Woodland in the Upper Slopes sub-region of the NSW South Western Slopes Bioregion	Moderate/Good Other (Planted Vegetation)	0.90	2	34.67
3.	PCT #266 BVT CW216 White Box Grassy Woodland in the Upper Slopes	Low	1.75	1	8.67

Zone ID	Vegetation zones	Condition class	Area (ha) within development site	Survey effort (number of plots)	Site value score (current)
	sub-region of the NSW South Western Slopes Bioregion				
4.	PCT #266 BVT CW216 White Box Grassy Woodland in the Upper Slopes sub-region of the NSW South Western Slopes Bioregion	Moderate – good	1.81	3	36.67
5.	PCT #266 BVT CW216 White Box Grassy Woodland in the Upper Slopes sub-region of the NSW South Western Slopes Bioregion	Derived Grassland – Moderate to Good	5.86	3	23.33
6.	PCT #266 BVT CW216 White Box Grassy Woodland in the Upper Slopes sub-region of the NSW South Western Slopes Bioregion	1Derived Grassland - Low	133.59	5	10.67
Total			**144.22**	**15**	

[1] As the BCC cannot have two zones of the same PCT in the same condition, this zone had to be entered into the calculator as 'moderate to good – poor'. Being moderate to good, the area of this zone required 6 plots where only 5 should have been required for a low condition zone. An additional plot was entered into the BCC which was the average of the 5 actual plots to overcome this limitation.

Table 7-2 Threatened species requiring surveys

Common name	Scientific name	Surveys	Present/presumed present	Affected by the proposal
Ausfeld's Wattle	*Acacia ausfeldii*	Conspicuous species targeted during all flora surveys	Absent	Unlikely – Not detected during targeted surveys
Bluegrass	*Dichanthium setosum*	Targeted transect surveys in suitable habitat	Absent	Unlikely - Not detected during targeted surveys
Booroolong frog	*Litoria booroolongensis*	No	Absent	Unlikely – No suitable habitat present
Brush-tailed Phascogale	*Phascogale tapoatafa*	2 Nights of Nocturnal Surveys	Absent	Unlikely – No suitable habitat present
Eastern Pygmy Possum	*Cercartetus nanus*	2 Nights of Nocturnal Surveys	Absent	Unlikely – No suitable habitat present and not detected during surveys
Euphrasia arguta	*Euphrasia arguta*	Targeted transect surveys in suitable habitat	Absent	Unlikely – No suitable habitat present
Koala	*Phascolarctos cinereus*	2 Nights nocturnal Surveys + Searches around trees for scratches or scats	Absent	Unlikely - Not detected during targeted surveys
Narrow Goodenia	*Goodenia macbarronii*	No longer a threatened species	Absent	Unlikely – Not detected during surveys
Prasophyllum sp Wybong	*Prasophyllum sp. Wybong*	No – Survey timing not appropriate	Absent	Unlikely – No suitable habitat present
Regent Honeyeater	*Anthochaera phrygia*	Six 20minute bird surveys conducted over 2 days	Presumed present	Yes – Not detected during surveys but presumed to occur from time to time, impacts to foraging habitat only
Scant Pomaderris	*Pomaderris queenslandica*	Conspicuous species targeted during all flora surveys	Absent	Unlikely – No suitable moist woodland habitat present and not detected during surveys
Silky Swainson pea	*Swainsona sericea*	Targeted transect surveys in suitable habitat	Absent	Unlikely – Not detected during targeted surveys
Small Purple-pea	*Swainsona recta*	Targeted transect surveys in suitable habitat	Absent	Unlikely – Not detected during targeted surveys
Squirrel Glider	*Petaurus norfolcensis*	2 nights nocturnal surveys	Absent	Unlikely – Not detected during targeted surveys

Common name	Scientific name	Surveys	Present/presumed present	Affected by the proposal
Tylophora linearis	*Tylophora linearis*	Targeted transect surveys in suitable habitat	Absent	Unlikely – No suitable habitat and not detected during targeted surveys

The outcome of the FBA BCC assessment is a total of 203 ecosystem credits and no species credits have been generated for the development site (BCC Major Project 144/2017/4350MP Version 2). The BCC full credit report is provided in the BAR (Appendix D).

Ecosystem credits

Ecosystem credits are required for the following PCTs:

- PCT 266 - White Box Grassy Woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion – 203 ecosystem credits

Species credits

No species credits are required for the project.

To offset the impacts of the development, these credits must be retired, either through the establishment of an offset onsite, retirement at another offset site, or purchase of credits on the Public BioBanking Register.

Commonwealth Matters of National Environmental Significance (MNES)

An EPBC protected matters report was undertaken on the 6th April 2017 (10km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site (refer to Appendix D). Relevant to Biodiversity these include:

- Wetlands of International Importance
- Threatened Ecological Communities
- Threatened species
- Migratory species

The potential for these MNES to occur at the site are discussed below.

Wetlands of International Importance

Four wetlands of international importance were returned from the protected matters report. The nearest of these (within 200km of the development site) is the Macquarie Marshes. All other wetlands returned from the search are over 500km away. The Macquarie Marshes occurs approximately 150km north west of the development site. It is fed by the Macquarie River. There is no apparent connectivity between the development site and the Macquarie River.

Threatened Ecological Communities

Two threatened ecological communities were returned from the protected matters report. One of these, the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland occurs on the development site. One 9ha patch of this community occurs on the hill slope in the centre of the development site where more than 12 native forb species and important species are present in the

understory. This patch meets the condition threshold for listing under the EPBC Act. The majority of this patch has been avoided by the proposal.

Threatened species

Nine threatened birds, six mammals, two reptiles and four fish were returned from the protected matters report. Of these, six species were considered to have the potential to utilise the habitats within the development site:

- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered EPBC Act
- Swift Parrot (*Lathamus discolor) – Critically Endangered EPBC Act*
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable EPBC Act
- Koala (*Phascolarctos cinereus*) – Vulnerable EPBC Act
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable EPBC Act
- Small Purple-pea (*Swainsona recta*) – Endangered EPBC Act.

Surveys have demonstrated that the Koala and Small Purple-pea are unlikely to occur at the development site. The remaining species are assessed further in Section 10.4 of the BAR, Appendix D.

Migratory species

Twelve listed migratory species were returned from the protected matters report. A habitat assessment was conducted for these species. Two of these species could occur on the site on occasion. – the Fork-tailed Swift, White-throated Needletail. However, as these species are almost exclusively aerial (DoE, 2015) impacts to these species are considered unlikely.

7.1.6 Potential impacts

Avoidance of impacts

A preliminary constraints analysis was conducted by NGH Environmental (2017) which informed the site layout design. Vegetation constituting the highest ecological constraints such as forming components of EECs and providing threatened flora and fauna habitat were avoided as far as practical. Key changes to the proposal design included the avoidance of areas of White Box grassy woodland in moderate to good condition, streams and rocky outcrops.

Impacts on native vegetation

The proposal would have a direct impact on three vegetation zones that are identified as an EEC with a site value >17. These vegetation zones area summarised is Table 7-3.

Table 7-3 Extent of vegetation communities within the development site and their impact areas

PCT	Threatened Ecological Community (BC Act or EPBC Act)?	PCT Id	Biometric vegetation condition	Site value score	Extent of vegetation (ha) impacted in development site
PCT #266 BVT CW216 White Box Grassy Woodland in the upper slopes sub-region of the	Yes	266	Moderate – good (other)	34.67	0.85

PCT	Threatened Ecological Community (BC Act or EPBC Act)?	PCT Id	Biometric vegetation condition	Site value score	Extent of vegetation (ha) impacted in development site
NSW South Western Slopes Bioregion					
PCT #266 BVT CW216 White Box Grassy Woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Yes	266	Moderate - good	36.67	1.81
PCT #266 BVT CW216 White Box Grassy Woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Yes	266	Moderate - good (Derived Grassland)	23.33	4.46
Total native vegetation	**-**	**-**	**-**		**7.12**

Direct and indirect impacts unable to be avoided

The construction and operational phases of the proposal has the potential to impact biodiversity values at the site that cannot be avoided.

Construction and decommissioning

In addition to the offset requirement, direct impacts that must be managed during construction and decommissioning include:

- Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, transmission lines, compound sites, stockpile sites, access tracks). The consequences of this impact may include:
    - Direct loss of native flora and fauna habitat from clearing, including removal of hollow bearing trees for Superb Parrot and Corben's Long-eared Bat.
    - Injury and mortality to fauna during clearing of fauna habitat
    - Introduction and spread of noxious weeds and pathogens
    - Disturbance to fallen timber, dead wood, bush rock and riparian vegetation.

A commitment to a Flora and Fauna Management Plan to address the risks during construction and decommissioning forms part of the proposal.

Indirect impacts identified in the BAR included:

- Risks for soil and water contamination
- Creation of barriers to fauna movement
- Generation of excessive dust, light or noise

Operation

Potential impacts during operation of the proposal include:

- Shading by solar array infrastructure. The consequences of this impact may include:
  - Ongoing prevention of flora regeneration
  - Unstable ground surfaces and sedimentation of downstream habitats
  - Collision risk to fauna (fencing, array infrastructure, and driving)

Indirect impacts identified in the BAR included risks for light spill, weed encroachment, increased vehicle traffic, solar array microclimate, fences, pest animals, and mobilisation of sediments. Where not already included as soil and water mitigation commitments of the proposal, these issues are addressed in the mitigation measures below.

7.1.7 Safeguards and mitigation measures

With the effective implementation of the mitigation measures below, biodiversity impacts can be managed to an acceptable level. Residual impacts will be offset using the FBA. A biodiversity offset strategy will be prepared to detail the management of offsets.

Table 7-4 Safeguards and mitigation measures for biodiversity impacts.

Safeguards and mitigation measures	C	O	D
• Hollow-bearing trees within the development site would not be cleared between June and January, to avoid the breeding season of Superb Parrot and Corben's Long-eared Bat and the core hibernation period for Corben's Long-eared Bat. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure these species do not occur.	C		
• Preparation of a Flora and Fauna Management Plan (FFMP) that would incorporate protocols for: o Protection of native vegetation to be retained o Best practice removal and disposal of vegetation o Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist o Weed management o Unexpected threatened species finds o Rehabilitation of disturbed areas The FFMP would form part of the Wellington Solar Farm Construction Environmental Management Plan (CEMP).	C		
• Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree. • Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be clearly demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	C		

Safeguards and mitigation measures	C	O	D
• A riparian buffer zone of 10-50m along Wuuluman Creek should be clearly delineated prior to works commencing. Works should be avoided within the riparian buffer zone. • Existing native riparian vegetation is retained to the greatest extent possible in an undamaged and unaltered condition. • Works occurring around the Wuuluman Creek should be in accordance with the DPI Fisheries Policy and Guideline document: *Policies and Guidelines for Fish Habitat Conservation and Management*.	C		
• A groundcover management plan would be developed and implemented to ensure an appropriate perennial ground cover is established and maintained beneath the arrays during operation of the solar farm. This will require consideration of existing groundcover and may require expert input and trials to achieve the objective.	C	O	
• Where possible, landscape plantings will be comprised of local indigenous species with the objective of increasing the diversity of the existing vegetation. Planting locations would be designed to improve the connectivity between patches in the landscape where consistent with landscaping outcomes.	C		
• Carry out refuelling of plant and equipment, chemical storage and decanting off site or at least 50m away from farm dams in impervious bunds. • Ensure that dry and wet spill kits are readily available.	C	O	
• The Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		
• Avoid night works. • Direct Lights away from vegetation.	C	O	
• Weed, hygiene and pest management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal.	C	O	
• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced.	C	O	

7.2 ABORIGINAL HERITAGE

7.2.1 Approach

A specialist Aboriginal Cultural Heritage Assessment Report (ACHAR) 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 E 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 National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the (ACHCRP) guide provided by OEH.

As a result of this process, five groups contacted the consultant to register their interest in the proposal. The groups who registered interest were:

- Wellington Local Aboriginal Land Council;
- Wellington Valley Wiradjuri Aboriginal Corporation;
- Gallangabang Aboriginal Corporation;
- Binjang Wellington Wiradjuri Heritage Survey; and
- Wiradjuri Central West Republic.

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

The fieldwork was organised, and all registered parties were asked to participate in the fieldwork. The fieldwork was carried out in August 2017.

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 area. Included in this was a search of the OEH AHIMS database. No Aboriginal sites had previously been recorded within or adjacent to the proposal area. Three sites were located within 2kms of the proposal area, a modified tree to the south west (AHIMS #36-4-0081), an isolated find to the north east (AHIMS #36-4-0099) and two stone artefacts located to the south east (AHIMS #36-4-0108).

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 area. This would most likely be in the form of stone artefacts and scarred trees.

7.2.3 Survey results

The survey strategy was to cover as much of the ground surface as possible within the proposal area. Although the actual ground impact from the construction method for the proposed solar farm was likely to below, 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 area to achieve maximum coverage. All mature native trees within the proposal area were also inspected for evidence of Aboriginal scarring. Visibility within the proposal area was variable with visibility ranging from 90% in exposures and recently ploughed areas to less than 5% in areas of dense grass. The average visibility was 30% but overall was quite good

Between the survey participants, over the course of the field survey, approximately, 280 km of transects were walked across the proposal area. Allowing for an effective view width of 5m for each person and given the variability in the ground visibility across the proposal area overall the survey effectively examined 7.7% of the proposal area. It is considered that the survey of Wellington Solar Farm proposal area had sufficient and effective survey coverage.

Despite the variable visibility encountered during the survey, there were 61 stone artefacts found across the proposal area that were recorded as 25 site occurrences. These archaeological features have been recorded as ten artefact scatters and 15 isolated finds. A single scarred tree and a possible hearth were also recorded (refer to Figure 7-7).

In terms of the current proposal therefore, extrapolating from the results of this survey, it is possible that additional stone artefacts could occur within the proposed development footprint. Based on the land use history, visibility, an appraisal of the results from the field survey and the archaeological background of the area it was concluded that two areas, Potential Archaeological Deposits (PAD) 1 and PAD 2, within the proposal area have potential for subsurface finds. Both of these PAD areas have a higher density of surface artefacts compared to the rest of the proposal area and appear to have a good depth of deposit.

The results of previous archaeological surveys in the Wellington region show that there are sites and artefacts present across the landscape. The predictions based on the modelling for the proposal area 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 area. The sites were all identified on low slopes and flats within proximity of a creek line or water source, even in areas highly disturbed by farming activities.

The cultural significance of the sites is only determined by the local Aboriginal community.

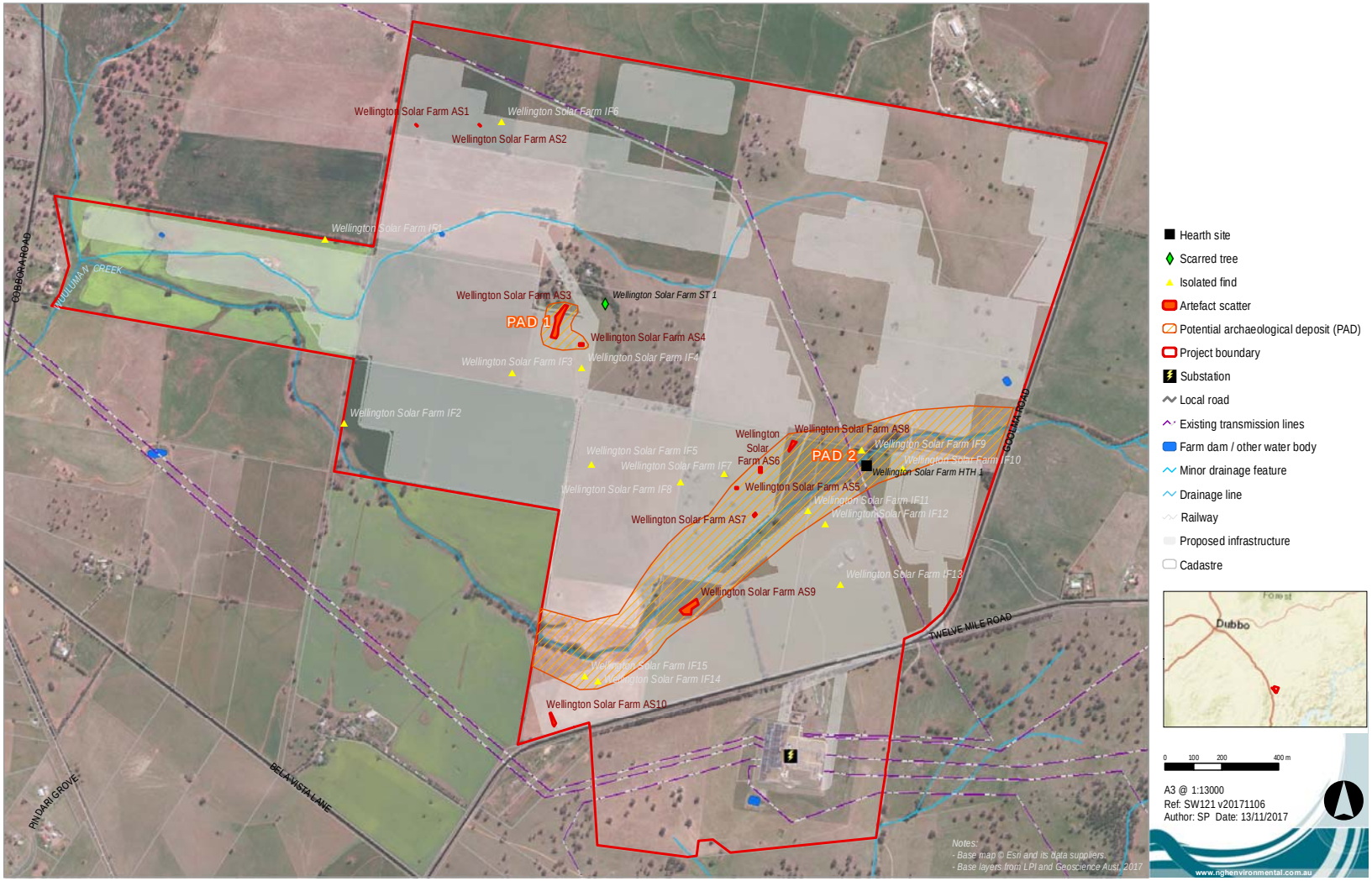


Figure 7-7 Heritage Assessment survey results

7.2.4 Potential impacts

The proposal involves the construction of a solar farm and includes connection to the nearby substation with an above or underground powerline that will extend across to the existing substation on Lot 1/DP1226751. The development will result in disturbance of almost 316ha of the 493-hectare property within of Lots 99, 102, 103 and 104/DP2987; Lots 89, 90, 91 and 92/DP2987; Lot 1/DP34690, Lot 1/DP520396 and Lot 2/DP807187. 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 impact to the scientific values if the sites Wellington Solar Farm Isolated Find (IF) 3, Wellington Solar Farm IF 4, Wellington Solar Farm IF 5, Wellington Solar Farm IF 6, Wellington Solar Farm IF 7, Wellington Solar Farm IF 8, Wellington Solar Farm IF 10, Wellington Solar Farm IF 11 Wellington Solar Farm IF 12, Wellington Solar Farm IF 13, Wellington Solar Farm IF 14, Wellington Solar Farm IF 15, Wellington Solar Farm artefact scatter (AS) 1, Wellington Solar Farm AS 2, Wellington Solar Farm AS 3, Wellington Solar Farm AS 4, Wellington Solar Farm AS 5, Wellington Solar Farm AS 6, Wellington Solar Farm AS 7, Wellington Solar Farm AS 8 and Wellington Solar Farm AS 10 were to be impacted by the current proposal is considered 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.

In the context of an Aboriginal heritage assessment, Social or Cultural Value refers to the significance placed on a site or place by the local Aboriginal community. While the true cultural and social value of Aboriginal sites can only be determined by local Aboriginal people, as a general concept, all sites hold cultural value to the local Aboriginal community. An opportunity to identify cultural and social value was provided to the Aboriginal representatives for this proposal through the fieldwork and draft reporting process. As part of this process, stakeholders identified that all sites hold cultural value to the local Aboriginal community but differentiated AS1, AS2 and the scarred tree (ST) as having higher value.

The Wellington 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 7-5 Identified risk to known sites

Site name	Site integrity	Scientific significance	Cultural significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wellington Solar Farm IF 1	Poor – 100+ year history of agricultural and pastoral use	Low	Higher	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Ensure minimum 5m buffer to avoid inadvertent disturbance to site.
Wellington Solar Farm IF 2	Poor – 100+ year history of agricultural and pastoral use	Low	Higher	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Ensure minimum 5m buffer to avoid inadvertent disturbance to site.
Wellington Solar Farm IF 3	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 4	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 5	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage objects prior to development of proposal area.
Wellington Solar Farm IF 6	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 7	Poor – 100+ year history of agricultural and pastoral use	Low to moderate	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 8	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.

Site name	Site integrity	Scientific significance	Cultural significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wellington Solar Farm IF 9	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Ensure minimum 5m buffer to avoid inadvertent disturbance to site.
Wellington Solar Farm IF 10	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 11	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 12	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 13	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 14	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm IF 15	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.

Site name	Site integrity	Scientific significance	Cultural significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
Wellington Solar Farm AS 1	Poor – 100+ year history of agricultural and pastoral use	Low to moderate	All sites hold value	Direct	Complete	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 2	Poor – 100+ year history of agricultural and pastoral use	Low to moderate	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 3	Poor – 100+ year history of agricultural and pastoral use	Low to moderate	All sites hold value	Direct	Partial	Minimal loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 4	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 5	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 6	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 7	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 8	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm AS 9	Poor – 100+ year history of agricultural and pastoral use	Low to moderate	All sites hold value	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Ensure minimum 5m

Site name	Site integrity	Scientific significance	Cultural significance	Type of harm	Degree of harm	Consequence of harm	Recommendation
							buffer to avoid inadvertent disturbance to site.
Wellington Solar Farm AS 10	Poor – 100+ year history of agricultural and pastoral use	Low	All sites hold value	Direct	Total	Total loss of value	Salvage object prior to development of proposal area.
Wellington Solar Farm Scar Tree (ST) 1	Poor- *in situ* dead tree	Low	Higher	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Avoid with a minimum 10m buffer placed around site.
Wellington Solar Farm Hearth (HTH) 1	Moderate – some disturbance from 100+ year history of agricultural and pastoral use	Low	All sites hold value	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	Nil- outside of development area or access tracks	N/A- outside of development area. Ensure minimum 5m buffer to avoid inadvertent disturbance to site.
PAD 1	0-20cm below ground surface - Poor/Moderate Below 20cm from surface- High	Yet to be determined - high potential for additional artefact.	All sites hold value	Direct	Partial	Unknown loss of value	Further archaeological research should be undertaken in the form of excavations in order to establish the presence or absence sub surface deposits
PAD 2	-20cm below ground surface - Poor/Moderate Below 20cm from surface- High	Yet to be determined - high potential for additional artefact.	All sites hold value	Direct	Partial	Unknown loss of value	Further archaeological research should be undertaken in the form of excavations in order to establish the presence or absence sub surface deposits

7.2.5 Safeguards and mitigation measures

The ACHAR identifies that the proposal can proceed with no additional archaeological investigations. The report identifies a number of safeguards, these are identified below, tabulated by finds in Table 7-4 and stipulated as proposal commitments in the Safeguards and mitigation measures provided in Table 7-6.

Table 7-6 Safeguards and mitigation measures for Aboriginal heritage

C: Construction; O: Operation; D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
• The development must avoid the site Wellington Scarred Tree 1, as per the current development design plans detailed in this report. A minimum 10m buffer around the tree should be in place to protect the tree given its current condition.	Design		
• If complete avoidance of the ten artefacts scatters and 15 isolated find sites recorded within the proposal area 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		
• The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties. A new site card/s will need to be completed once the artefacts are moved to record their new location on the AHIMS database.	C		
• A minimum 5m buffer should be observed around all sites including those outside the development footprint.	C	O	D
• As the complete avoidance of PAD1 and PAD2 is not possible, First Solar have agreed that further archaeological research should be undertaken in the form of excavations in order to establish the presence or absence and significance of any sub surface deposits. The excavations would be conducted prior to any development and would be undertaken in consultation with the Registered Aboriginal Parties in compliance with the OEH Code of Practice. A technical report on the results of the testing would be provided and management strategies recommended depending on the outcome. The testing would be conducted by a qualified archaeologist and members of the registered Aboriginal parties.	C		
• First Solar 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		

Safeguards and Mitigation Measures	C	O	D
• 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		
• Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the registered Aboriginal party and may include further field survey.	C	O	D

7.3 VISUAL IMPACT

NGH Environmental completed a Visual Impact Assessment (VIA) of the proposed Wellington Solar Farm (provided in full, Appendix F and summarised below). It provides a full assessment of the visual impacts associated with the proposal, including:

- Landscape character and scenic vistas in the locality.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints, including residences and road corridors.

This report includes consideration of reflectivity and glare, an evaluation of potential visual impacts significant vistas in the locality, consideration of the *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring,* and a draft landscaping plan.

Air traffic is not considered in this report. It is noted that glare and reflectivity are not considered an impact for aircrafts.

7.3.1 Approach

The Visual Impact Assessment has been completed in the following stages:

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

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 project.

Mitigation measures are considered 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 unlikely to be perceived or acceptable.

7.3.2 Results

Existing environment

The proposed solar farm is located approximately 2km north east of the town of Wellington, NSW. The land surrounding the proposal site includes irrigated crops and grazing land. Agriculture is the key industry in Wellington, with the steeper land to the east supporting mainly grazing activities and the gentle undulating land to the west supporting mainly cereal production. The population of Wellington was 4,540 at 2011 Census (ABS, 2017). There are approximately 19 residences within one kilometre of the Wellington SF proposal site, and approximately 169 residences within 2 kilometres. Aside from the dwelling that is located within the proposal site, the closest receiver is located 30 metres west of the proposal site.

Mount Arthur Reserve is situated outside the town of Wellington and approximately 5km from the proposed Wellington Solar Farm. Rising to 563 m above sea-level (ASL), this 2,123 ha reserve lies within the northern most section of the Catombal Range and takes in three main peaks - Mounts Arthur, Wellesley and Duke. Of the three peaks, Mount Artur summit Ningana lookout is located directly west of the town of Wellington and is the closest peak to the proposed solar farm; approximately 5.5km distant. Mt. Wellesley Summit and Mt. Duke Summit are located to the south west of Wellington. They are 6.8km and 6.4km from the proposed site, respectively. Scenic vantage points from the three main peaks provide visual characteristics over Wellington, the valley and the Bell and Macquarie Rivers.

Approximately 130km south of the proposed Wellington 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.

Values of the local community

Community consultation undertaken to inform the assessment and design of the proposal is summarised in Section 5.5 of this EIS. Comments relevant the community's perception about solar farms and visual values have been included below.

- Positive feedback regarding the creation of jobs. Local contractors and local labour will be utilized when possible.
- Two neighbouring landowners raised concerns regarding visual impact of the site. Photomontages were prepared for these landowners.
- Two participants raised concerns regarding water supply for their property from watermills that are in close proximity to the development. First Solar staff agreed to complete a site visit to ensure no watermills would be impacted by the proposal.
- Land value concerns were raised by one community member with regard to another solar farm adjacent to her property.

Important local values of respondents of the feedback forms included:

- To be living in an area where soils are ideal for agriculture use/farming activities.
- Modern enhancements through the creation of wind farms.
- Historic significance values.
- Scenic views of the existing landscape; river valleys, hills and greenery.

Landscape character units (LCU) and representative viewpoints

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a device that can be used to group areas that may be similarly affected by a development. Four key LCUs were identified within 15km of the proposed solar farm site:

1. Agricultural (grazing lands and cropping lands, with low density dwellings and sheds).
2. Rural residential and commercial facilities.
3. Urban (Wellington town centre and residential areas).
4. Forest (surrounding ranges and recreational areas).

These four LCUs are characterised below in terms of their visual features and scenic quality.

Landscape Character Unit - Agriculture

Visual features

The pastures with scattered trees are of low relief to undulating. Pastures are generally not irrigated and so are dull green through to beige and brown with the season. Some cropping occurs in the locality. Scattered trees are either at low density, remnants of an open woodland, or planted as wind breaks or amenity planting along roadsides or near dwellings. Cropped paddocks and more intensively cleared area have less variety.

The ranges to the west and south-west of the site are a dominant feature in higher locations, contrasting with low open expanses of the lower landscape. The colour would change from dusky green-blue to purple hues with season and time of day. Less continuous ranges and ridges occur to the east and south-east.

Unsealed roads and bare paddocks are light beige. Most local roads are however, sealed. Local roads are generally straight within minor curves that reflect the gently undulating terrain. Such curves and minor dips limit short sight lines such that extensive views are limited to minor rises.

Residences within this landscape are sparsely distributed and commonly associated with additional landscape plantings and out buildings (sheds, yards). Low paddock fencing, electricity lines and roads reinforce a linear pattern of production over the more organic pattern of the terrain.

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 production related. Cropped areas are considered to have low scenic quality, due to lesser variety and visual interest.

This LCU is common in the study area, but has features and variety. The proposed solar farm site is located within this LCU.

Landscape Character Unit – Rural residential and commercial facilities

Visual features

Smaller residential allotments occur to the east of the site, off Twelve Mile Road. A correctional facility and its expansion occur to the north-east of the site. An agricultural research centre occurs to the immediate north of the site. Commercial chicken farms occur just over 1km north-east of the site. Higher residential density development occurs south of the site, off the Mitchell Highway. Density of development increases with proximity to Wellington, see Urban LCU below.

In these areas, which are surrounded by agricultural LCU in most cases, dominant elements are dwellings, car ports, gardens and in the case of commercial facilities, large structures and access roads (often tree lined).

Built forms are varied. Roofs, cladding, water tanks and sheds are not consistent. Vehicles, yards and gardens produce a residential character. These areas are often separated from the surrounding expansive agricultural areas with rectilinear fencing, creating small boxed in allotments within the broader landscape. Electrical infrastructure includes overhead transmission lines and substation.

Streets and access roads are usually sealed and feature vegetation, either native remnants or planted feature trees or avenues.

Scenic quality

Scenic quality is considered moderate in residential locations. These areas have variety in colour and form, including some historic features. Built elements and landscaping contribute to the character type. Scenic quality is considered low in commercial areas, these being commercially focused and having less variety and visual interest.

This LCU is not common in the study area.

Landscape Character Unit – Urban

Visual features

Wellington is situated mainly south of the Macquarie River. Its tributary, Bell River, also borders the main residential area. These waterways retain connected riparian zones and the deep greens of the shady recreational and public spaces provide the town with a unique character and public amenity.

Wellington's main streets have a consistent historic character. In retail and residential building colours, materials and design, historic character and red brick are elements are dominant. There are several large public buildings of exceptional character. There are large agricultural silos that reinforce the history of agricultural production in the area.

Frontages feature street trees and formal fencing. Views to the surrounding ranges are sometimes visible. A large recreational area is located on the river and features tree lined avenues. Streets are sealed and often incorporate curbing and footpaths and landscaping. The street layout is generally rectilinear.

Scenic quality

Scenic quality is considered high. These areas have variety in colour and form. They contribute to a unique historic character type, in residential and commercial built form. Elements include recreational facilities, parks and gardens. 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 - Forested ranges and waterways

Visual features

The vegetated ranges to the west of Wellington, Mt Arthur Reserve, provide a dominant visual element to the town and to surrounding areas. Lookouts and walking tracks are present that allow for views of the town to the east and likely to other areas including the north-east, in the direction of the proposed solar farm site. Limited public roads traverse these ranges.

Less continuous vegetated ridges and ranges occur to the east, near Wuuluman. As above, the connected riparian zones of Macquarie River and Bell River, add to the unique character provided by dense, mature vegetation.

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 urban LCUs. Recreational infrastructure provides a scenic recreational space where groups may congregate.

This LCU is not common in the study area.

The BLM methodology requires identification of representative viewpoints in the study area. These may be travel routes such as roads, waterways and recreational tracks, residential areas, tourist facilities, houses and farmland. Representative viewpoints within each LCU were identified using Zone of Visual Influence (ZVI) modelling. This was to ensure all viewpoints are located in the 'view shed' of the solar farm.

The ZVI modelling (provided as Figure 7-8) assumes the proposal could be modelled as a 4.5m high rectangular block. A height of 4.5m was used to model onsite infrastructure. This is realistic approximation of the height of panels, PV containers, onsite substation and ESF, which may actually be between 2.3m and 4.5m. 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. It is noted that the topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours and that the ZVI does not take into account existing screening from vegetation or infrastructure and, on this basis, is considered a 'worst case' model.

Viewpoints were not selected in areas predicted to be shielded from views of the solar farm. Fourteen representative viewpoints were identified using the ZVI mapping (refer to Table 7-7 and Figure 7-9).

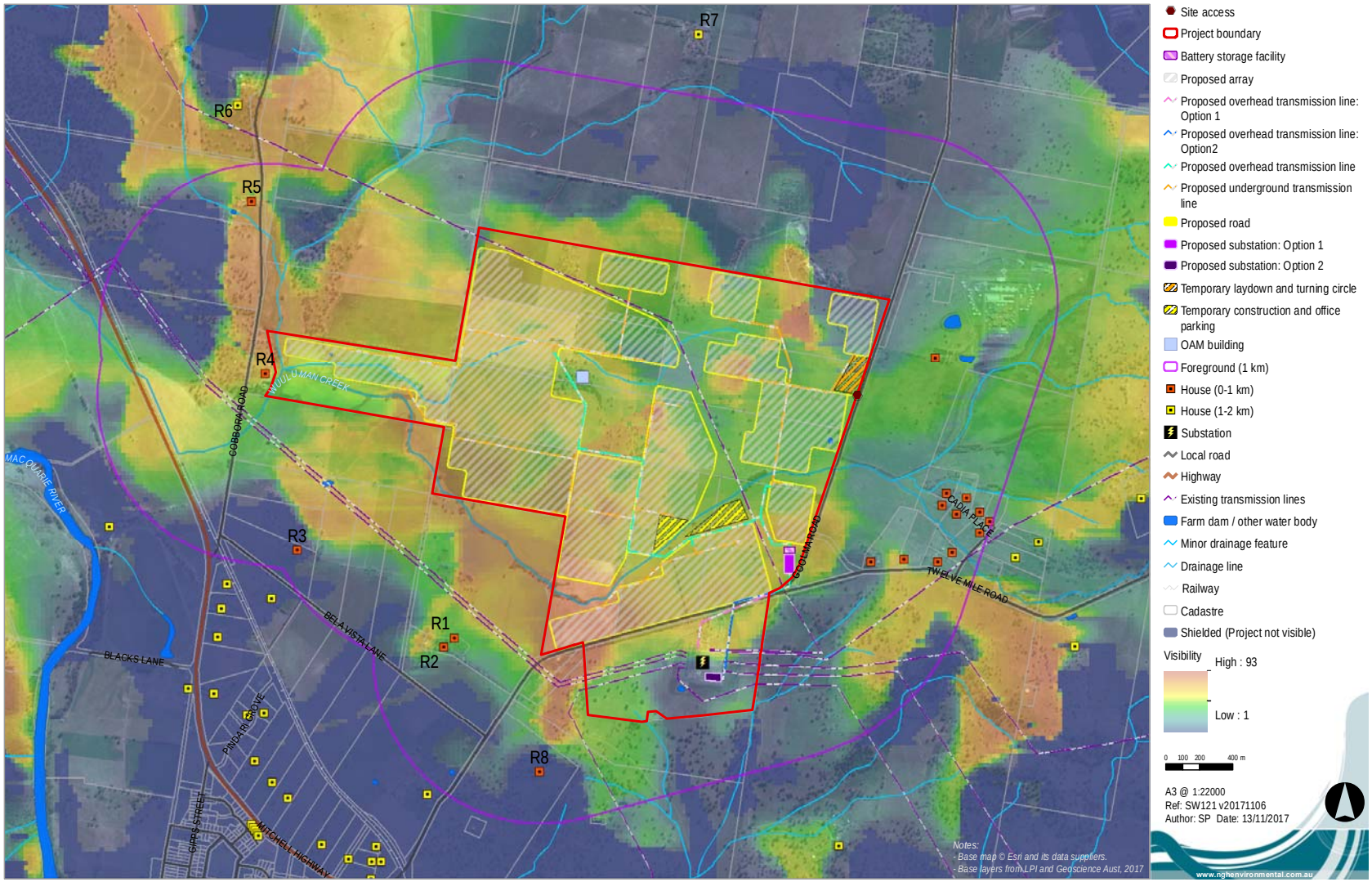


Figure 7-8 Foreground Zone of Visual Influence (ZVI; 1 km)

The predicted sensitivity of each viewpoint can be determined, considering its proximity to the proposed solar farm 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 and moderate sensitivity on higher use road that retained some remnant vegetation. These areas are production related but offer vistas of farming land broken up by native vegetation. Goolma and Cobbora Roads are used to access Wellington.
- Within the Rural residential / commercial LCU, viewpoints were assessed as low sensitivity in commercial locations (the existing substation on Goolma Road, but also including the agricultural research station and correctional facility to the north and north west of the proposal site on Goolma Road) and moderate sensitivity in residential areas (noting the residential areas on Bella Vista Lane and Cadonia Drive are located on low use roads but that views to the ranges and of farming land broken up by native vegetation are assumed to be valued).
- Within the Urban LCU, viewpoints were assessed to have high sensitivity, having high usage, historic character and having recreational, retail and residential land uses.
- Within the Forest LCU (which was a recreational lookout area), the view point was assessed to have high sensitivity, being established specifically to take in views of the local area; including farm land, the town of Wellington and natural areas.

The sensitivity of each viewpoint is tabulated below.

Table 7-7 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID new	LCU	View location	Proximity	Scenic quality	Sensitivity
1	Agricultural	Road	<1km	Moderate	Moderate
2	Agricultural	Road	<1km	Moderate	Moderate
3	Commercial	Substation	<1km	Moderate	Low
4	Agricultural and rural residence	Road / residence	<1km	Moderate	Moderate
5	Rural residential	Residence	<1km	Moderate	Moderate
6	Rural residential	Residence	<1km	Moderate	Moderate
7	Agricultural	Road	<1km	Moderate	Moderate
8	Rural residential	Road and residence	<1km	Moderate	Moderate
9	Agricultural	Road and residence	1-5km	Moderate	Moderate
10	Agricultural	Road and residence	1-5km	Moderate	Moderate
11	Agricultural	Road	1-5km	Moderate	Moderate
12	Agricultural	Road	1-5km	Moderate	Low
13	Urban	Recreational area	5-15km	High	High
14	Forest	Recreational area	5-15km	High	High

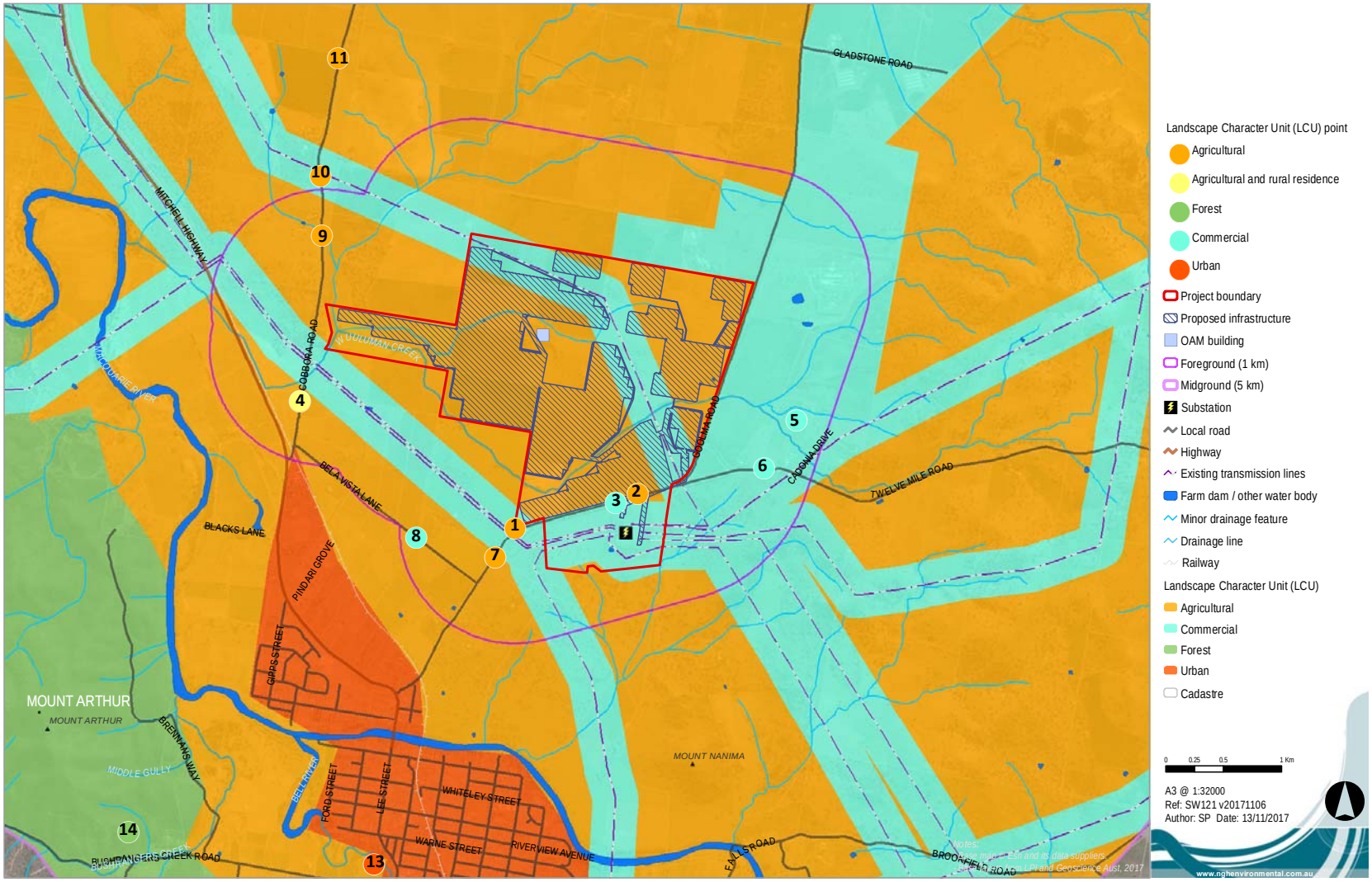


Figure 7-9 Representative landscape character units and viewpoints (viewpoint 12 is north of screen capture, on Campbells Lane).

7.3.3 Potential impacts

The visual impact assessment was undertaken considering:

- The infrastructure components [2].
- Their potential to be viewed from representative viewpoints.
- The degree of contrast they would have within identified Visual Land Management Zone (LMZs).

Evaluation criteria

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 little or not perceived and is acceptable.

For high impact viewpoints, mitigation must be considered.

Table 7-8 below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating. Viewpoints assessed to have a low impact (negligible or not perceived and considered acceptable) are excluded below but provided in full in the Visual Assessment, Appendix F of this EIS.

Representative photos (including panoramas for selected locations) of the existing views are provided below. In the panoramas below, the horizontal extent of the infrastructure layout is shown as a red line. This indicates where views of the infrastructure are possible. The location of panorama and montages is provided in Figure 7-10.

[2] It is noted that battery storage was an addition to the project in the later stages of the assessment; the ZVI modelling has been updated to reflect this infrastructure component. Its height has no bearing on the ZVI, being less than the modelled height of 4.5m. The do not present a substantially different visual element (considering both scale and materials) than the inverters, as illustrated in Section 3.2.1 of this EIS. Screening to mitigate visual impacts was already proposed in this location due to the location of the substation option 1 in this area. No changes to the assessment conclusions or mitigation strategies resulted from the inclusion of battery storage.

Table 7-8 Visual impact at representative viewpoints with reference to the Wellington Solar Farm, in order of highest impact

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
1	Agricultural	Road	<1km	B	Protect dominant visual features	High	Medium	The array infrastructure would be located immediately adjacent to Goolma Road for approximately 1.3 km. While a vegetation screen is located on the south of Goolma Road, little overstorey vegetation is present on the northern solar farm boundary. The solar infrastructure would be a new type of structure and contrast with the existing agricultural landscape character while adding some cumulative industrial visual impacts to the locality. **Mitigation is recommended.** Additional vegetation planting on the site's boundary to Goolma Road is recommended to soften / break up views of infrastructure. Investigation of residence specific views at R1 and R2 should be undertaken to investigate further screening at these locations, if warranted.

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
2	Agricultural	Road	<1km	B	Protect dominant visual features	High	Medium	This location further north along Goolma Road would view array infrastructure for an unbroken stretch of approximately 1.3 km. Little overstorey vegetation is present on the northern solar farm boundary. The solar infrastructure would be a new type of structure and contrast with the existing agricultural landscape character while adding some cumulative industrial visual impacts to the locality. **Mitigation is recommended.** Additional vegetation planting on the site's boundary to Goolma Road is recommended to soften / break up views of infrastructure.

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
3	Commercial	Substation	<1km	C	Less importance for retaining existing visual amenity.	High	Medium	This location occurs along Goolma Road with a view of array infrastructure for an unbroken stretch of approximately 1.3 km. Little overstorey vegetation is present on the northern solar farm boundary. The solar infrastructure would be a new type of structure and contrast with the existing agricultural landscape character while adding some cumulative industrial visual impacts to the locality. **Mitigation is recommended.** Additional vegetation planting on the site's boundary to Goolma Road is recommended to soften / break up views of infrastructure.

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
4	Agricultural and rural residence	Road and residence	<1km	B	Protect dominant visual features	Medium	Medium	Located on Cobbora Road, this is the first location travelling north that the site would be visible from the road. This view is considered indicative of two closest receivers to it, R3 and R4. Existing riparian screening will soften views from the road. Given the low lying infrastructure proposed and distance from the road (in excess of 400m), the contrast and impact would not be high for road corridor views. These views should be investigated further. **Mitigation is recommended.** Investigation of residence-specific views at R3 and R4 should be undertaken to investigate further screening at these locations, if warranted.

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
5	Rural residential	Residence	<1km	B	Protect dominant visual features	Medium	Medium	Approximately 13 residences are located in this area, off either 12 Mile Road or Cadonia Drive. The closest residence is 300m from the solar site boundary. None are likely to be afforded more than glimpse views to the solar farm, given the existing screening of structures and vegetation around the residences and the gradient of the land falling to the west, diminishing western views in the context of foreground screening. Where solar farm infrastructure is located at higher elevation to the north west, existing vegetation screening in this direction would screen views. The contrast is not expected to be high. **Mitigation is recommended.** Additional vegetation planting on the site's boundary near the site access way may soften the entry to the site.

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment

Existing screening provided by structures and plantings, to the east of Goolma Road (showing representative viewpoints 6 and 5).

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
6	Rural residential	Residence	<1km	B	Protect dominant visual features	Medium	Medium	Approximately 4 of the above residences are located off 12 Mile Road; the closest residence is 300m from the solar site boundary. The panorama below shows the glimpse views to the solar farm, noting the array will avoid One Tree Hill; the highest rise on the solar farm site, visible in the background view below. Given the existing screening of structures and vegetation around the residence, the contrast is not expected to be high. **Mitigation is recommended.** Additional vegetation planting on the site's boundary near the site access way may soften the entry to the site.

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
7	Agricultural	Residence and road	<1km	B	Protect dominant visual features	Medium	Medium	Located on Goolma Road, the low lying solar infrastructure is not expected to represent a high contrast in this undulating agricultural landscape. Existing vegetation remnants, particularly those along Wuuluman Creek, and the irregular extent of the array are expected to soften views of the infrastructure further. A large historical style house is located at R8. It appears to face away from site (no windows visible), however the house is elevated. Given the elevation of R8, these views should be investigated further. **Mitigation recommended.** Investigation of residence-specific views at R8 should be undertaken to investigate further screening at these locations, if warranted.

Visual impact assessment at representative viewpoints

HIGH VISUAL IMPACT

In high visual impact locations, mitigation is required. No high impact view locations were identified for the project. The infrastructure is generally low lying with limited view durations available to receivers and would be located in an area with existing infrastructure components.

MEDIUM VISUAL IMPACT

In medium visual impact locations, mitigation may be recommended to further soften views of infrastructure, either on the solar farm site or at specific offsite locations. Medium impact was identified for seven locations (Viewpoints 1-7). Of these, mitigation is recommended in four cases. The resulting recommendations are that:

1. A sparse vegetation screen be included in specific sections of Goolma Road, to mitigate cumulative impacts and lessen the contrast of the infrastructure given the close proximity of the proposed infrastructure in this location. Additionally, two areas where small groves could be established have been identified. These will provide a more natural structure to the vegetation; akin to small remnants. Refer to Appendix C for the proposed locations of the screen. The screen would be of varying native species and of varying height to soften not block the view of the site. Breaks in the screen, reflecting natural breaks in existing remnants would be appropriate. A hedge or formal row of trees is not proposed.
2. Investigation of specific residential receivers; R1, R2, R3, R4, R8; see below. Assessment from public vantages was not sufficient to understand the acceptability of views from these locations.

LOW VISUAL IMPACT

The remaining five viewpoints were assessed to have a low visual impact. No mitigation is considered for these locations.

In summary, while the visual *contrast* produced by the development would be high along Goolma Road, the sensitivity of the receiving environment in this area, which includes commercial and industrial developments, reduced the overall visual impact at these locations. Perimeter planting could assist to break up the views of the infrastructure and would also address cumulative impacts of this infrastructure to maintain the landscape character and avoid a more industrial character becoming dominant.

In all other locations surrounding the site, view durations would be less for passing motorists, due to undulating terrain, additional distance of infrastructure from the road, less linear edge of infrastructure boundary and existing vegetation between the site and receivers.

Residential views – additional investigation

In most locations, the road side representative viewpoints were considered sufficient to assess and consider mitigation for the residences and other receivers in these locations. However, five residences were identified that this road-side assessment could not adequately investigate. First Solar consulted with the land owners of each residence, discussed the proposal and discussed impact mitigation measures. Where requested, photo montages to illustrate the look of the solar farm from specific locations were undertaken; two residences had montages prepared. The before and after montages are presented in the table below, noting that the infrastructure is difficult to discern due to the distance from the site. Additional mitigation was proposed for these two residences. The outcomes of this additional investigation are provided in Table 7-9.

Table 7-9 Additional assessment of specific residential locations (refer to Appendix A.3 for location of residential receivers)

ID	Street address	Reason for further investigation	Outcome
R1	Off Bella Vista Lane	Elevated site approximately 800m from site boundary. Public road access could not ascertain extent of views from residence and outdoor recreational spaces.	First Solar undertook a site visit to investigate potential impacts and discuss the project with the resident. A montage was not requested. Additional mitigation was not agreed.
R2	Off Bella Vista Lane	Elevated site approximately 850m from site boundary. Public road access could not ascertain extent of views from residence and outdoor recreational spaces.	First Solar undertook a site visit to investigate potential impacts and discuss the project with the resident. Montages were requested. **Additional mitigation was agreed and included in the project mitigation strategy.**

Before (refer to Figure 7-10 for location of WSF06)

After

Before (refer to Figure 7-10 for location of WSF07)

After

R3	Off Bella Vista Lane	Elevated site approximately 1000m from site boundary. Public road access could not ascertain extent of views from residence and outdoor recreational spaces.	First Solar undertook a site visit to investigate potential impacts and discuss the project with the resident. A montage was not requested. Additional mitigation was not agreed.
R4	Off Cobbora Road	Close proximity (30m) to site boundary. Public road access could not ascertain extent of views from residence and outdoor recreational spaces.	First Solar undertook a site visit to investigate potential impacts and discuss the project with the resident. A montage was not requested. Additional mitigation was not agreed.
R8	Off Goolma Road	Elevated site approximately 650m from site boundary. Public road access could not ascertain extent of views from residence and outdoor recreational spaces.	First Solar undertook a site visit to investigate potential impacts and discuss the project with the resident. Montages were requested. **Additional mitigation was agreed and included in the project mitigation strategy.**

Before (refer to Figure 7-10 for location of WSF 04)

After

Before (refer to Figure 7-10 for location of WSF 03)

After

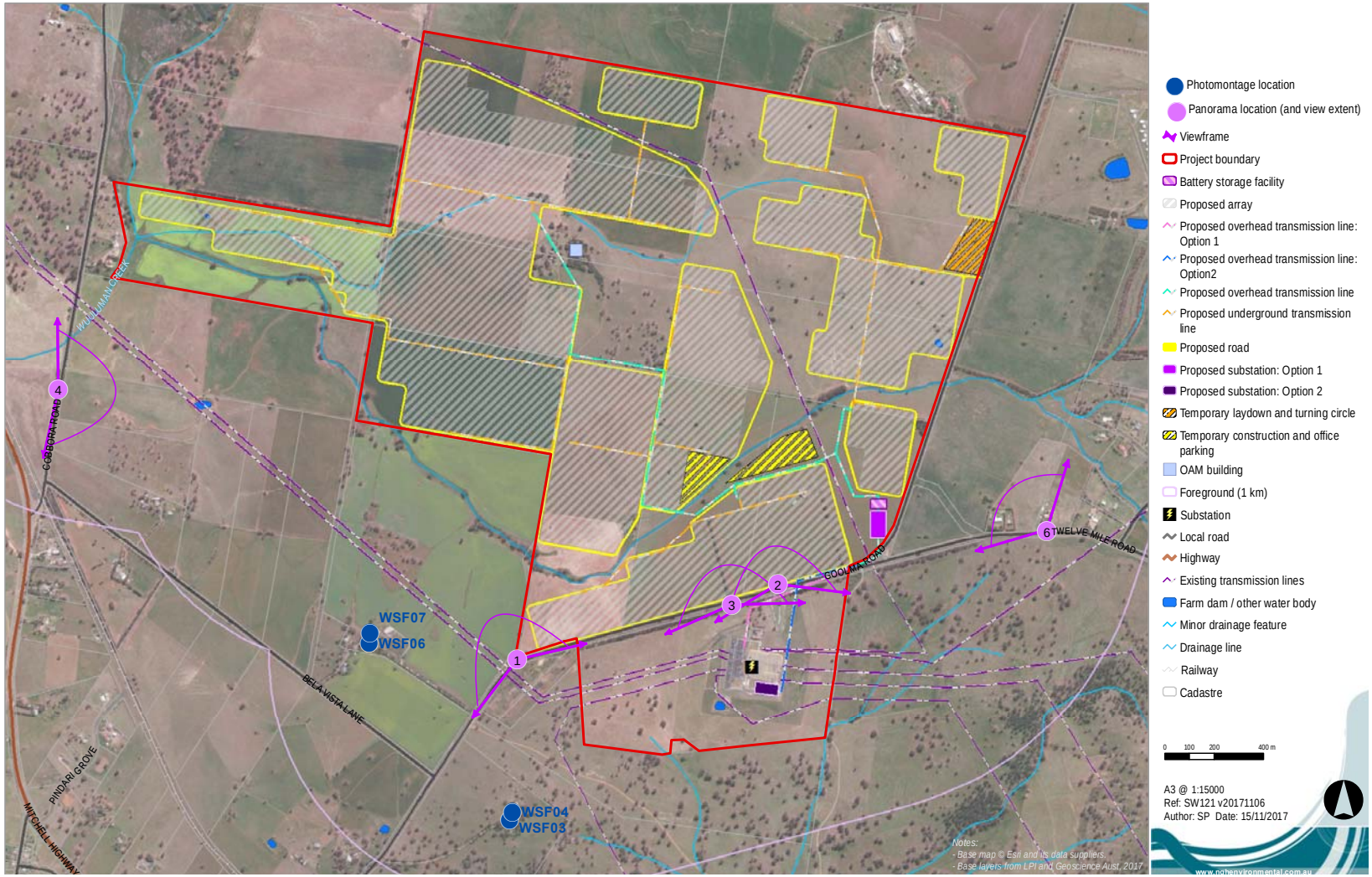


Figure 7-10 Panorama and photomontage viewpoints

Dark Sky region mitigation

Additional impacts are relevant to the proposal, given its location within the *Dark sky region*.

Construction has potential to increase the levels of dust in the locality temporarily. Excavation would be minimal however the traffic on unsealed internal access 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.

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 will limit dust generation and movement. The unsealed perimeter access track would have low traffic levels during operation and is unlikely to generate substantially more dust that existing farm access tracks onsite. Limited security lighting is anticipated.

General measures to minimise light pollution including reducing dust are however, recommended.

7.3.4 Safeguard and mitigation measures

A Visual Impact Management Plan and general measures to address the visual impacts of the proposed solar farm are commitments of the proposed Wellington Solar Farm. They are considered feasible, in that the proponent has agreed the measures can be implemented as part of the project. They are considered effective, as the measures include a 'post construction' verification process and would be undertaken in consultation with affected landholders (where relevant).

Table 7-10 Safeguards and mitigation measures for visual impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• Solar farm vegetation screening: o A sparse vegetation screen, 1 -2 rows deep, would be established with reference to Appendix C Proposed onsite screening. o The screen would be comprised of varying native species appropriate to the area and of varying height to soften not block the view of the site. o Breaks in the screen, reflecting natural breaks in existing remnants would be appropriate. o Planting should be undertaken as soon as practical in the construction process depending on the season, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered. o The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views. • Residential receiver screening o Establish plantings for receivers R2 and R8, in consultation with landowners, based on the as-built views of the solar farm.	Pre-construction		

Safeguards and mitigation measures	C	O	D
• Where feasible, underground rather than overhead power lines would be considered. • Where feasible, co-location of powerlines would be undertaken to minimise the look of additional power poles. If additional poles are required, these would match existing pole design as much as possible. • The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical: o Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown. o Pole mounts will be non-reflective. o Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.	Design stage		
• During construction, dust would be controlled in response to visual cues. • Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil. • Ground cover would be maintained beneath the panels and within the site boundary, to break up views of the infrastructure from the side and back views. • Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).	C		
• Maintenance of ground cover beneath panels, to reduce dust. • Minimise traffic movements on unsealed tracks, to reduce dust. • Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).		O	

7.4 NOISE IMPACTS

7.4.1 Approach

A Construction and Operational Noise and Vibration Assessment for the proposed Wellington Solar Farm was undertaken by Renzo Tonin and Associates. The full report is provided in Appendix G and is summarised below. It includes consideration of noise and vibration impacts from the construction and operation phases of the proposal in accordance with relevant Council and EPA requirements and guidelines.

7.4.2 Existing environment

The proposal is located in a regional setting, approximately 2km north east of Wellington. The surrounding land uses to the proposed solar farm are generally agriculture, including cropping and cattle and sheep grazing. Wellington Correctional Centre is located east of the proposal site. Noise sources in the locality include traffic along Goolma Road and agricultural activities such as the operation of large harvesters, tractors, haulage trucks, irrigation pumps, quad bikes and 4WD vehicles.

Figure 7-11 illustrates the locations of the nearest receivers to the proposal site, with the nearest non-involved residential dwelling being approximately 560m west of the proposal site (R1).

7.4.3 Noise monitoring

Criteria for the assessment of construction and operation noise are usually derived from the existing noise environment of an area. The NSW EPA Industrial Noise Policy (INP) 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 at the closest residence (R1, monitored at L1 on Figure 7-11). Long term (unattended) noise monitoring was carried out at M1 between Friday 23 June and Monday 3 July 2017. The existing background and ambient noise levels determined from the monitoring are presented in Table 7-11.

Table 7-11 Measured existing background (L90) & Ambient (Leq) Noise Levels, dB(A)

Monitoring location	L_{A90} Background Noise Levels			L_{A90} Ambient noise level		
	Day	Evening	Night	Day	Evening	Night
L1 104 Cobbora Road, Maryvale	25	29	13	41	42	37

Based on the relevant section of the INP Guidelines, where background noise levels are less than 30dB(A), the minimum applicable background noise level is recommended to be set at **30dB(A)**. Therefore, this minimum background noise level has been adopted for all receiver locations nominated during the night time assessment period.

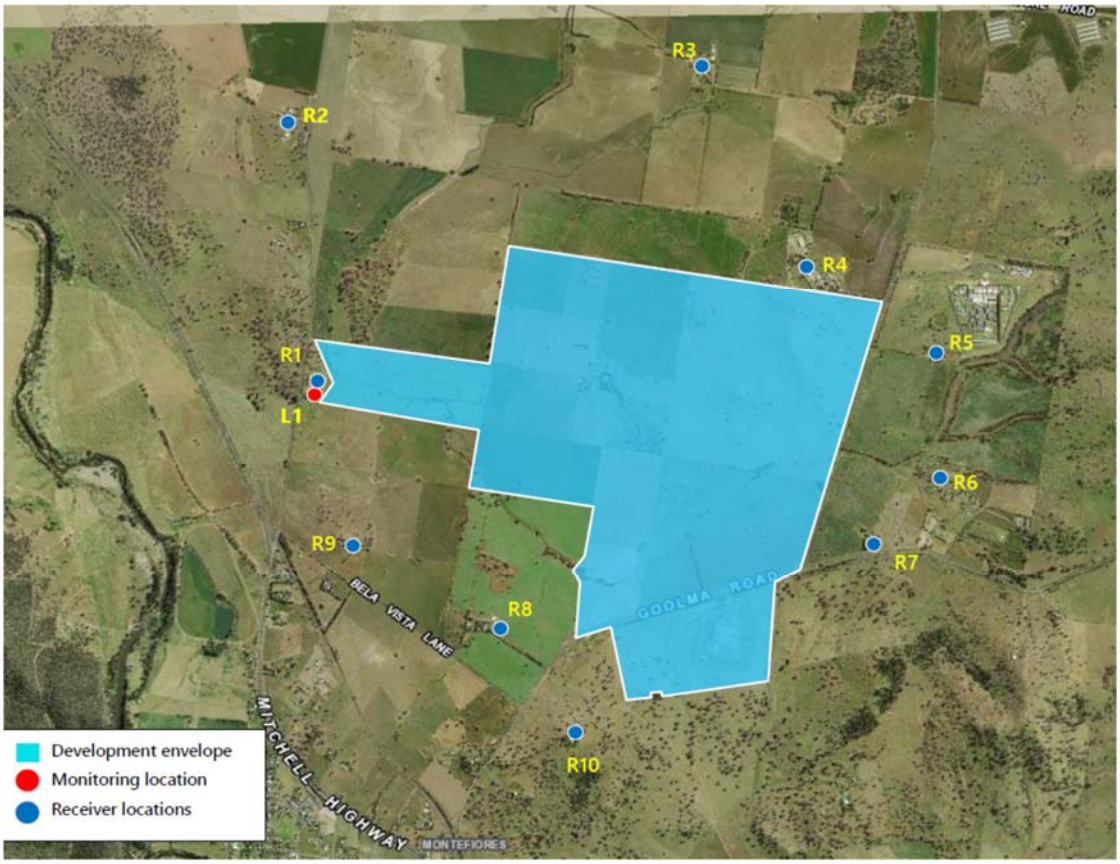


Figure 7-11 Residential receivers and noise monitoring locations adjacent to the proposal site.

7.4.4 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.

Residential receivers

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers (Table 7-12). 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 7-12 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 7-13 identifies the adopted construction Noise Management Levels (NMLs) for the nearest noise sensitive residential receivers (refer to Figure 7-11). The NMLs for the receiver locations are derived from the RBLs represented by the background noise levels measured at the monitoring location (Table 7-11) and NSW ICNG (DECC' 2009) criteria (Table 7-12). Furthermore, during standard construction hours, a highly affected noise objective of 75 dB(A) applies at all receivers.

Table 7-13 Construction Noise Management Levels at Residential Receivers

Location description	Day LA90 Background Noise Level (RBL)	Day Noise Management LA90 (15min)
All residential receivers (R1-R3 and R6-R10)-	301	40

Notes: 1. Construction works occur during the daytime period only, hence only the day period is assessed.

Sensitive land uses

Table 7-14 sets out ICNG noise management levels for other types of noise sensitive receiver locations applicable for this proposal.

Table 7-14 Construction Noise Management Levels at other Noise Sensitive Land Uses

Land use	Receiver type	Where objective applies	Management level LAeq (15min)
Receiver R4 – NSW Soil Conservation Commission Offices	Commercial	External noise level	70dB(A)
Receiver R5 – Wellington Correctional Centre	Commercial	External noise level	70dB(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 are in Table 7-15.

Table 7-15 Construction equipment sound power levels

Equipment used	LAeq Sound power levels (dBA) per single item	No. Items required
Small Pile Driving Rig	114	6
Crane	110	2
Drum roller	109	2
Padfoot roller	109	2
Wheeled loader	109	2
Dump Truck	108	4
30T Excavator	107	8
Grader	107	4
Chain trencher	104	2
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.

Table 7-16 presents the noise levels likely to be experienced at the nearby affected receiver locations during the construction works. The present levels are considered a worst-case scenario with up to three nosiest plants operating concurrently.

Table 7-16 Predicted $L_{Aeq\ 15\ min}$ construction noise levels at receiver locations

Receiver location (refer to Figure 7-11)	Noise management level1	Predicted Construction Noise Level, LAeq (15 min) 2	Comply? (Yes/No)
Residential receivers			
R1	**40**	**20-49**	**No**
R2		20-36	Yes
R3		20-31	Yes
R6		20-39	Yes
R7		**20-44**	**No**
R8		20-40	Yes
R9		20-33	Yes
R10		20-39	Yes
Commercial receivers			
R4	70	20-47	Yes
R5		20-44	Yes

Notes: 1. Noise management for standard day time construction works (i.e. Monday to Friday 7am to 6pm and Saturday 8am to 1pm)

2. Based on up to three nosiest construction plant and equipment operating concurrently.

Based on the construction noise levels presented in the table above, the construction management levels at receivers R1 and R7 will be exceeded when the construction works are conducted at closest proximity to the receivers. Based on the description of the proposal, there would be minimal construction occurring near R1. It is noted that construction noise levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A).

In light of the predicted noise levels above, it is recommended that a feasible and reasonable approach towards noise management measures be applied to reduce noise levels as much as possible to manage the impact from construction noise and assist in meeting compliance for R1 and R7. Table 7-17 outlines possible noise reductions from using some recommended control methods (refer to Appendix G).

Table 7-17 Relative Effectiveness of Various Forms of Noise Control, dB(A)

Noise control method	Practical examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS2436	Renzo Tonin and Associates	AS2436	Renzo Tonin and Associates
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustics barriers such as earth mounds, temporary or permanent noise barriers	5 to 10	5 to 10	15	15
Acoustic enclosures	Engine casing lagged with insulation and plywood	15 to 25	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25	-	40

7.4.5 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 Industrial Noise Policy* (INP) (EPA, 2000) specifies noise criteria relating to intrusive noise impacts and noise level amenity. The assessment criteria under the INP for the Wellington Solar Farm is outlined in Table 7-18.

Table 7-18 NSW Industrial Noise Policy Proposal Specific criteria

Assessment Criteria	Proposal Specific Criteria
Intrusive	Rating background level + 5dBA
Amenity	INP based on recommended LAeq noise levels for rural residential properties.

The operational proposal-specific noise criteria for the solar farm based on the INP criteria and guidelines (Table 7-18) is shown in Table 7-19 and Table 7-20.

Table 7-19 Intrusiveness noise criteria

Receiver	Period	LAeq (15 minute) (dBA)
All residential receivers[1]	Day	30 + 5 = 35
	Evening	30 + 5 = 35
	Night	30 + 5 = 35

Notes: Intrusiveness criteria only applicable for residential receivers.

Table 7-20 Applicable Amenity noise criteria

Receiver	Indicative Noise Amenity Area	Time of day	Recommended L_{Aeq} Amenity Noise level	
			Acceptable	Maximum
Residence	Rural	Day[1]	50	55
		Evening[2]	45	50
		Night[3]	40	45
Commercial premises	All	When in use	65	70

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.

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

As the proposal will potentially operate for part of the night time period (prior to 7.00am) during summer months, EPA sleep disturbance criteria apply. Criteria specific to the proposal are outlined in Table 7-21.

Table 7-21 Sleep Disturbance Criteria dB(A)

Receiver	Sleep Disturbance Criteria	Sleep Disturbance Criteria specific to proposal, Lamax
All residential receivers	Night Rating background level + 15dBA	30 +15 = 45dBA

Operational noise sources

The potential sources of noise during operation of the solar farm considered for the assessment included:

- Mechanical noise from the tracking system of the solar panels, from up to 6,950 tracking motors to drive solar panels.
- Operation of 44 inverter stations that each contain 3 inverters.
- An energy storage facility comprising of 6 transformers, up to 70 power conversion units and up to 70 air-conditioning units.
- Three staff members onsite daily with the use of a light vehicle.

The predicted power levels of these operation activities are outlined in Table 7-22.

Table 7-22 Typical operational plant and equipment and sound power levels for the proposal

Plant description	LAeq Sound power levels (dBA)
Tracker Motor (up to 6,950 in total)	78 (each)
Ingeteam 1640TL B630 Inverters (up to 44 stations of three (3) inverters in total)	88 (each)
Energy Storage Facility PCUs (up to 70 in total)	88 (each)
Energy Storage Facility Air-conditioning Units (up to 70 in total)	75 (each)
Energy Storage Facility Transformers (up to 6 in total)	83 (each)
Light vehicle (3 in total)	88 (each)

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 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.

Additionally, in accordance with INP 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 7-23 and Table 7-24 present the predicted noise levels for the 'worst case scenario' based on concurrent operation all plant and equipment shown in Table 7-22. The tracker motors were time corrected based on their operation of one (1) minute out of a 15 minute period.

Table 7-23 Predicted $L_{Aeq\ 15min}$ Operational Noise Levels at Residential Receiver Locations, dB(A)

Receiver location (refer to Figure 7-11)	Intrusiveness criteria1	Predicted Operational Noise Levels, LAeq (15 min)			Comply? (Yes/No)
		Calm and isothermal conditions	Slight to gentle breeze	Moderate temperature inversion[2]	
R1	35	25	30	30	Yes
R2		<20	25	25	Yes
R3		<20	24	24	Yes
R6		27	31	31	Yes
R7		31	35	35	Yes
R8		25	31	31	Yes
R9		22	28	28	Yes
R10		22	28	28	Yes

Notes: 1. Criteria for Day, Evening and night periods

2. Applicable for the night time period only.

Table 7-24 Predicted $L_{Aeq\ 15min}$ Operational Noise Levels at other sensitive Receiver locations, dB(A)

Receiver location (refer to Figure 7-11)	Intrusiveness criteria[1]	Predicted Operational Noise Levels, L_{Aeq} (15 min)			Comply? (Yes/No)
		Calm and isothermal conditions	Slight to gentle breeze	Moderate temperature inversion[2]	
R4	65	28	33	33	Yes
R5		26	32	32	Yes

Notes: 1. When in use

2. Applicable for the night time period only.

Based on the predicted operational noise levels presented in Table 7-23 and Table 7-24, predicted noise levels at all nearby receivers comply with the nominated criteria under all scenarios and meteorological conditions.

The predicted operational noise levels will additionally be well below the sleep disturbance criteria of 45 dB(A). No specific mitigation measures are required.

7.4.6 Vibration assessment

Vibration generating activities would occur only during the construction phase. There are no vibration generating activities expected during the operational phase. The nearest identified non-involved receiver is in excess of 100m from the proposal site, structural damage due to vibration is not expected. Assessment for vibration impact on human comfort is assessed during the construction phase.

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with EPA's *Assessing Vibration: A Technical Guideline* (DECC, 2006). Based on the proposed

plant items to be used during construction (Table 7-15), vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 7-25.

Table 7-25 Potential vibration Impacts for Identified receivers.

Receiver location (refer to Figure 6-5)	Approx. distance to nearest buildings from works	Type of nearest sensitive buildings	Assessment on potential vibration impacts	Vibration monitoring
R1	560m	Residential	Very low risk of adverse comment	Not required
R2	1,350m	Residential	Very low risk of adverse comment	Not required
R3	1,250m	Residential	Very low risk of adverse comment	Not required
R4	300m	Commercial	Very low risk of adverse comment	Not required
R5	420m	Commercial	Very low risk of adverse comment	Not required
R6	670m	Residential	Very low risk of adverse comment	Not required
R7	400m	Residential	Very low risk of adverse comment	Not required
R8	600m	Residential	Very low risk of adverse comment	Not required
R9	1,040m	Residential	Very low risk of adverse comment	Not required
R10	665m	Residential	Very low risk of adverse comment	Not required

The potential for adverse comment to vibration impacts was determined to be very low. No vibration mitigation measures are required.

7.4.7 Road traffic noise assessment

As the proposed vehicle access to the subject site is much greater during the construction stage than the operational stage, road traffic noise assessment is only considered for the construction stage to provide a 'worst case' assessment. Vehicle movements during operation of the solar farm would be minimal. Refer to Section 3.2.2 for detailed traffic volumes.

Noise impact from the potential increase in traffic on the surrounding road network due to construction is assessed against the NSW '*Road Noise Policy*' (RNP) (DECCW, 2011). The RNP sets out criteria to be applied to particular types of road and land uses. The Goolma Road is categorised as a sub-arterial road. Criteria for these roads are outlined in Table 7-27.

Vehicle access to the subject site will be via Goolma Road on the eastern side of the site. The proponent has advised that peak vehicle movements during the construction stage are presented in the following table.

Table 7-26 Summary of estimated construction traffic volumes during peak.

Vehicle type	Trips per day
Cars/light vehicles	300
Trucks/heavy vehicles	Up to 100

During the operational stage, vehicle access to the site will be primarily limited to maintenance vans and delivery trucks (3 x site staff light vehicles and 5 x miscellaneous courier delivers per week) which would occur on an irregular basis.

Table 7-27 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)
Residences on Goolma Road	Sub-arterial	$L_{Aeq(15\ hour)}$ 60 dB(A)	refer to Table 7-26	100	20m	55 dB(A)	Yes

From Table 7-27 it can be seen that road traffic noise level contributions from the truck movements associated with the construction works are at least 5dB(A) below the applicable noise criteria based on dwellings being 20m from the road. Therefore, traffic noise levels as a result of the construction works for the solar farm would not adversely contribute to the existing traffic noise levels at the most affected residences along the surrounding roads and require no specific mitigation.

7.4.8 Safeguards and mitigation measures

Table 7-28 Safeguards and mitigation measures for noise impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• Implement noise control measures such as those suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", to reduce predicted construction noise levels.	C		
• A Noise Management Plan would be developed as part of the CEMP and will specifically target R1 and R7 in order to achieve compliance. The plan would include, but not be limited to: o Use less noisy plant and equipment where feasible and reasonable o Plant and equipment to be properly maintained. o Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. o Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.	C		

Safeguards and mitigation measures	C	O	D
o Avoid any unnecessary noise when carrying out manual operations and when operating plant. o Any equipment not in use for extended periods during construction work should be switched off. o 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. o Establish good relations with people living in the vicinity of the site at the beginning of proposal and maintain. Keep people informed, take complaints seriously, deal with complaints expeditiously. The community liaison member of staff should be adequately experienced.			
• If the ESF is constructed outside the main construction period, a specific construction noise management plan would be undertaken to manage any additional impacts.	C		

7.5 HISTORIC HERITAGE

7.5.1 Approach

A desktop study and site inspection 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. The following resources were used as part of this assessment:

- 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.
- 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.
- Heritage schedule of Wellington Local Environmental Plan (LEP) 2012, for locally listed heritage items, that are within or adjacent to the proposal site.
- The Dubbo Regional Council was consulted regarding the potential for heritage within proximity of the proposal area.

7.5.2 Results

The results of the heritage investigations listed above indicate that one (1) heritage site is located within the proposal site: Narrawa Homestead. The Narrawa Homestead is a site of local significance listed on the Wellington LEP (2012). This site was inspected separately by the Dubbo Regional Council Heritage Advisor and NGH consultants. Further details regarding the property and its significance are provided in Section

7.5.3. The closest heritage items identified in proximity to the solar farm proposal area are two locally listed homesteads between 400-700 metres away.

A summary of the results of the heritage searches are illustrated in Table 7-29.

Table 7-29 Summary of heritage listed items in the Wellington LGA.

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
NSW State Heritage Register	6
NSW State Agency Heritage Register (section 170)	8
Wellington Local Environmental Plan (LEP) 2012	54

Australian Heritage Database

The Australian Heritage Database search was undertaken on the 11 October 2017 using a search of the Wellington local government area. The search resulted in 43 listings, none of which are within proximity of the proposal site.

No known items listed under the World Heritage List were identified in relation to the proposal site.

NSW State Heritage Inventory

The SHI database search was undertaken on the 11 October 2017. For the Wellington LGA, there were 6 items listed under the NSW State Heritage Register, 8 items listed under the NSW State Agency Heritage Register (Section 170), and 54 listed as items listed under local government. None of these items were identified onsite, with the closest item being a homestead located approximately 700 metres from the southernmost extent of the proposal site: *Nanima* (database ID: 2640104). Nanima Homestead is also listed on the Wellington LEP and further details are provided below.

Wellington Local Environmental Plan 2012

The Wellington LEP database search was conducted on the 11 October 2017. One item of local heritage has been identified onsite, *Narrawa Homestead*. Two additional sites were identified between 400-700 metres from the solar farm proposal area (Table 7-30).

Table 7-30 Locally listed heritage items in proximity of the proposal area

Name	Address	LEP listing ID	Approximate distance from the proposal area
Narrawa Homestead	6916 Goolma Road Lot 90, DP 588075	I49	Surrounded by the proposal area.
Keston homestead	6938 Goolma Road Lots 1 and 2, DP 588075	I50	400m to the west of the southernmost boundary of the proposal area.
Nanima homestead	7009 Goolma Road Lot 2, DP 806578	I51	700m to the south of the southernmost boundary of the proposal area.

Nanima	Nanima is a locally listed property consisting of a large, single storey verandaed Bungalow homestead in the Queen Anne style; prominently sited on a hill overlooking the town of Wellington.
Keston	Keston is a locally listed property consisting of a Victorian Italianate style house. Historically it was built by Nancarrow, prominent in the development of the town & district of Wellington.

7.5.3 Heritage Significance

Narrawa Homestead is a locally listed heritage item located within the solar farm proposal area. The local listing for the property has identified that it has historical and aesthetic heritage significance at a local level.

The OEH guidelines for *Assessing Heritage Significance (Heritage Office* (former), 2001) states that an item will be considered to be of state and/or local heritage significance if it meets one or more of the NSW Heritage Assessment Criteria, below:

Table 7-31 NSW Heritage Assessment Criteria

Criteria	Description
Criterion (a)	An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);
Criterion (b)	An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);
Criterion (c)	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
Criterion (d)	An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;
Criterion (e)	An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
Criterion (f)	An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);
Criterion (g)	An item is important in demonstrating the principal characteristics of a class of NSW's • cultural or natural places; or • cultural or natural environments. (or a class of the local area's • cultural or natural places; or • cultural or natural environments.)

In order to undertake an assessment of an item against the NSW heritage assessment criteria, the OEH guidelines recommend that the following steps be undertaken:

- Investigate the historical context of the item or study area;
- Investigate the community's understanding of the item;
- Establish local historical themes and relate them to the State themes;
- Investigate the history of the item; and

- Investigate the fabric of the item.

Narrawa Homestead LEP Listing

The Narrawa Homestead is listed as item I49 on the LEP, located as 6916 Goolma Road, Montefiores (Lot 90, Deposited Plan 2987).

Dubbo Regional Council manage a heritage inventory (State Heritage Inventory) database for heritage items listed on the LEP. The Narrawa Homestead State Heritage Inventory (SHI) listing number is 2640149. The SHI inventory sheet for the property includes the following information:

Physical Description	The homestead at Narrawa was built in 1908. It is a typical large country home with Federation features in its ceilings, joinery and detail. The owners have extended the original house, adding a bedroom wing to the north east of the building and a kitchen and family room on the eastern side. These extensions were carried out in keeping using sandstone bricks sourced from an old building in Dubbo to match the original. The fibro infill on the timber veranda was removed and the gardens were designed and extended with new plantings. A courtyard included in the design holds interesting examples of sculpture among the foliage and especially on the eastern wall. The bridge over the creek has recently been rebuilt using bricks from the original and aged timbers.
Historical Notes	Narrawa was once a part of a group of properties comprising of “Kelvin”, “Keston” and “Narrawa”. The Cameron family bought Narrawa, then called Kelvin, from the Egelabra Stud. Keston was owned by Mr Joe Quirk and his daughter, Lois Quirk, married to Colin Cameron with their children, Ron and Jennifer, growing up on the property. John and Margie White bought Kelvin from the Cameron’s in 1990 and changed the name back to Narrawa.
Assessment of significance	Criteria a): A large comfortable country house with strong elements of the Federation Queen Anne style. Historically important as an example of a type of residence erected on prosperous country properties prior to World War I. Criteria c): A large comfortable country house with strong elements of the Federation Queen Anne style and with sympathetic addition in keeping with the ambience of the house.
Statement of Significance	The brick homestead is a large house with strong elements of the Federation Queen Anne style and with a sympathetic addition and complementary garden setting in keeping with the ambience of the house. Historically important as an example of a type of residence erected on prosperous country properties prior to World War I.

7.5.4 Historical background relevant to the proposal site and Narrawa Homestead

Five years after the crossing of the Blue Mountains, explorers ventured down the lower reaches of the Macquarie River. Surveyor General John Oxley was the first European to describe the Dubbo region, with his first expedition to the Macquarie River Valley in 1817, and a second in 1818. Four years earlier George Evans had ventured along the river as far as present day Wellington, but it was Oxley who named the valley, Wellington Valley, after the Duke of Wellington who had defeated Napoleon at Waterloo in 1812.

A Colonial government outpost was established in Wellington in 1819. In 1823, Governor Brisbane sent Lieutenant Percy Simpson to establish a camp with convicts and soldiers. It was situated about 3 km south of the present town site of Wellington on the high ground above the Bell River (on the eastern side of the Mitchell Highway).

Although wheat was successfully grown, the settlement was abandoned in 1831, becoming a government stock station. The abandoned government buildings were given to the Church Missionary Society for the opening of a mission for the local Aborigines. When a town was later proposed, the society objected on the grounds that this would interfere with its work and its mission. It was not until after the mission closed in the 1842 that a township developed on the site and was proclaimed as the town of Wellington in 1846.

Towards the end of the 19th century, wheat farming was widespread in the Dubbo districts, fuelled by population growth and the opening up of export markets at the time of world-wide wheat shortages during 1896-7. The Central Western Slopes wheat area trebled from 1897-1906 with the greatest expansion occurring in the Wellington, Dubbo and Narromine areas. Narrawa Homestead was built in 1908 and is a reflection of the prosperity of this period.

Since its establishment, Narrawa Homestead has been used to farm wheat, sheep, cattle and more recently canola. Previous owners include the Katers, the Quirks and the Camerons who sold the property to the current owners, the Whites.

7.5.5 NSW historical themes

An historical theme is a way of describing a major force or process which has contributed to history. Historical themes provide a context within which the heritage significance of an item can be understood, assessed and compared. In using themes to assess individual items it is useful to identify both local or regional themes applying to the item and the broader state theme to which the local or regional theme relates.

Australian Theme	NSW Theme	Description	Relevance to Narrawa Homestead
4 Building settlements, towns and cities	Towns, suburbs and villages	Activities associated with creating, planning and managing urban functions, landscapes and lifestyles in towns, suburbs and villages	Narrawa Homestead is one of a number of surviving early 20th century homes that were built during a period of prosperity within the region.

7.5.6 Site inspection, 11 August 2017

A site inspection of the homestead property was undertaken on 11 August 2017 by NGH Heritage Consultants, Kirsten Bradley and Emily Dillon.

The inspection included the following elements:

- Main house;
- Driveway; and
- Shed.

The main house has been restored and altered significantly applying sympathetic design and building materials.

Main house and veranda

Decorative federation style finial

View of back of house extension

View of extension and courtyard

The hallway that runs the length of the house from the front door to the dining room was originally walled in with doors to each room visible based upon direction of floorboards compared to rooms.

The door between the extension and dining room was originally an outside door- brick exterior still visible.

Kitchen has 1950s lino, Metters wood stove in original fireplace, and different pressed tin ceiling pattern to the rest of the house.

Hardwood flooring

Living room and fireplace

Pressed tin ceilings

Kitchen linoleum

Metters woodstove in kitchen

Pressed tin ceilings in kitchen

The property includes a driveway, lawns and cultural plantings.

Pepper corn lined driveway

Lawns between house and driveway with cultural plantings

View south west towards stock yards

Shed

Additional potential heritage

A small structure was investigated on the neighbouring property (Lot 99, DP 2987) to Narrawa Homestead. It is not listed on any statutory heritage register. The current owner of Narrawa Homestead suggested that it could be an old 'separating' shed used for milk production. No further information to suggest heritage significance was obtained for this structure.

7.5.7 Potential impacts

Several heritage listed items were identified during the desktop study as outlined above but none of these will be directly impacted by the proposal. The Narrawa Homestead and property within proximity of the proposal area will not be impacted physically, as shown in Figure 7-12. The principle impact will therefore be upon the aesthetic and historical values of the property.

The property, and the region, has historically been the site of agricultural activities and the solar farm will introduce solar panel structures into what has been agricultural farmland. The solar farm will therefore alter the historical context into which the Narrawa Homestead was built and has been associated with since 1908. Whilst this is an impact, the Narrawa Homestead will remain, and the solar farm will eventually be decommissioned with the opportunity of returning the land to agricultural use. It is also proposed to use the Narrawa Homestead as the Operations and Maintenance (O&M) building for the solar farm, acknowledging the historic and heritage value of the property and ensuring the building will be maintained over the lifetime of the project.

The solar farm 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 historic heritage and specifically upon the locally listed Narrawa Homestead.

Figure 7-12 Narrawa Homestead and the solar farm proposal area.

7.5.8 Safeguards and mitigation measures

Table 7-32 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
• The Narrawa Homestead should not be altered whilst in use as an Office and Maintenance building for the solar farm.	C	O	
• The existing cultural plantings around the Narrawa Homestead and its driveway should be maintained.	C	O	D

8 ASSESSMENT OF ADDITIONAL ISSUES

8.1 TRAFFIC, TRANSPORT AND ROAD SAFETY

This chapter was prepared by NGH Environmental with peer review and contributions by Rhys Davies, Executive Director, ACT, ISG Projects.

8.1.1 Existing environment

Existing road infrastructure

The Wellington SF proposal site is bounded by Goolma Road to the south and east. Goolma Road is a two lane, single carriageway sealed public road with a speed limit of 100km per hour. It is approximately 7m wide, generally with 1m wide shoulders. Goolma Road is administered by Dubbo Regional Council. Goolma Road is accessed from the Mitchell Highway, approximately 1.9km north of Wellington. Goolma Road extends from the Mitchell Highway, past the proposal site and west through the town of Goolma and eventually ending where it intersects with Guntawang Road some 50km west of the proposal site.

Roads and Maritime Services (RMS) is the Road Manager of Goolma Road administered from the RMS Western Region Office in Parkes. Goolma Road extends from the Mitchell Highway, past the proposal site and west through the town of Goolma and eventually ending where it intersects with Castlereagh Highway at Gulgong, approximately 56 km north east of the proposal site.

From Sydney, the Great Western Highway and the Mitchell Highway would be the major transport routes for haulage of key infrastructure components during construction of the proposal. The Great Western Highway stretches from the southern fringe of the Sydney central business district to Bathurst at the junction of the Mitchell Highway and the Mid-Western Highway. The Mitchell Highway is a two lane, single carriageway sealed public road with a speed limit of 100km per hour. The Mitchell Highway has a total length of approximately 1,110km. Its northern terminus is at its junction with the Landsborough Highway, approximately 394km north of the Queensland – NSW border.

The Mitchell Highway's southern terminus is at its junction with the Great Western and Mid-Western Highways. The highway is part of the National Highway A32 corridor, which stretches from Sydney to Adelaide via Dubbo and Broken Hill. The Mitchell Highway also forms part of the shortest route between Sydney and Darwin, via Bourke and Mount Isa; making it an important road link for the transport of passengers and freight for regional New South Wales and Queensland.

There is an 80m long dedicated right turn lane on the northbound lane of the Mitchell Highway for traffic turning onto Goolma Road. There is good sight distance for vehicles turning right onto Goolma Road from this lane. Vehicles turning onto the Mitchell Highway from Goolma Road must give way, and the line of sight is good in both directions. There is also a 70m long merge lane on the Mitchell Highway, for vehicles that have turned right off Goolma Road.

Existing traffic volumes

The Roads and Maritime Services Traffic Volume Viewer (RMS, 2017) was reviewed for traffic counts along the proposed haulage route. A short-term average daily traffic classifier was carried out on the Mitchell Highway approximately 3km south of Wellington in 2009. The classifier recorded 1,841 northbound traffic movements and 1,788 southbound traffic movements. Approximately 16% of the northbound movements, and 17% of southbound movements were heavy vehicles. A permanent counter is located along the

Mitchell Highway between Orange and Wellington. In 2017 the average daily volume is approximately 2500 vehicles with approximately 23% are heavy vehicles (RMS, 2017).

There is no traffic volume data available for Goolma Road. Traffic along Goolma Road would currently include residential traffic, local farm traffic, school buses and traffic associated with the Wellington Correctional Centre. Traffic along Goolma Road would potentially also be associated with the construction of the approved Bodangora Wind Farm, located 10km north of the Wellington SF site.

Two local school bus routes, operated by Ogden's Coaches, utilise Goolma Road. The routes include:

- Mt Bodangora (Spicers Creek):
    - AM service begins at corner of Goolma Road and Spicers Creek Road at 8:05, and ends at Wellington Public School at 8:46am.
    - PM service begins at Wellington Public School at 3:07pm, and ends at corner of Goolma Road and Spicers Creek Road at 4:05pm.
- Umagalee (Wuuluman):
    - AM service begins on Twelve Mile Road at 7:52am, and ends at Wellington Public School at 8:47am.
    - PM service begins at Wellington Public School at Wellington Public School at 3:10pm, and ends on Twelve Mile Road at 4:18pm.

A search of the Transport for NSW Crash and casualty statistics search tool (2017) records the following accidents in the vicinity of the proposal site in the last 5 years:

- A motorcycle crash on Goolma Road, approximately 1.7km from the intersection with the Mitchell Highway. One person was involved in the crash and was seriously injured. The crash occurred during daylight hours and speeding was considered to be a factor.
- A car crash on Goolma Road, approximately 450m from the intersection with the Mitchell Highway. The crash was related to a car performing a U-turn in daylight hours. No injuries were sustained.
- A light truck crash, associated with an animal collision near the intersection of Goolma Road and the Mitchell Highway. The crash occurred at dusk. No injuries were sustained.

First Solar has consulted with neighbouring residents and representatives from the Department of Justice (Wellington and Macquarie Correctional Facilities) regarding traffic impacts. Results of the consultation have indicated that access roads to the Wellington Correctional Facility and the Soil Conservation Commission off Goolma Road are key points of traffic congestion. (

Other transport infrastructure

The Main Western Railway Line is a major railway in NSW, connecting Sydney to Far Western NSW through the Blue Mountains, Central West, North West Slopes. The railway line passes through Wellington. West of the proposal site, the Main Western Railway Line runs generally parallel to the Mitchell Highway. There is a rail overpass along Goolma Road, approximately 250m east of the intersection of Goolma Road and the Mitchell Highway.

8.1.2 Potential impacts

Proposed haulage and traffic routes

The proposed haulage route for the delivery of key components to the Wellington Solar Farm would be from Sydney via the Great Western Highway, Mitchell Highway and Goolma Road. This route would require transit of delivery vehicles through the town of Wellington. Great Western Highway, Mitchell Highway and Goolma Road are all Oversized Overmass Load Carrying Approved Roads.

Construction traffic associated with the Solar Farm may also travel to the site along the following routes:

- From Newcastle: Golden Highway, onto Ulan Rd, Cope Rd and Goolma Road.
- From Dubbo: Mitchell Hwy south towards Wellington. Then left onto Goolma Road.
- From Wellington: Mitchell Hwy, and right onto Goolma Road.

It is not proposed to transport any solar farm infrastructure by rail.

Site access

A new access road to the proposal site would be constructed off Goolma Road, approximately 4.6km east of the intersection with the Mitchell Highway (Figure 1-2). It is near the existing access road to the Wellington Correctional Centre and along the straight section of Goolma Road where there are adequate sight distances in both directions. A siding lane would be constructed on Goolma Road to accommodate traffic turning left off Goolma Road and into the Wellington SF site (described in further detail in Section 3.2).

Construction impacts

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

- Increased collision risks (other vehicles, pedestrians, stock and wildlife).
- Damage to road infrastructure.
- Associated noise and dust (particularly where traffic is on unsealed roads) which may adversely affect nearby receivers.
- Disruption to existing services (school buses).
- Reduction of the level of service on the road caused by platooning of construction traffic.

INCREASED VEHICLE NUMBERS

The proposed timeline for the proposal indicates that approximately 40 employees would be required during the first month rising to 200 employees during the peak construction period (approximately 6 months). Preliminary plans for the site propose onsite parking for approximately 60 vehicles. If the proposed carpark was utilised to full capacity, this would result in approximately 120 vehicle movements per day to and from the site.

Buses may be used to transport workers to and from the site. Approximately 200 construction personnel would be required onsite during the peak construction period. Assuming an uptake rate of 80% and a 20-person capacity, up to 8 bus trips would be required per day during peak construction. During non-peak periods, approximately half as many buses are expected to be required.

Table 8-1 provides an indication of the total overall one-way traffic movements including heavy vehicles for the delivery of equipment and infrastructure, anticipated throughout the construction period of 12 months. During the construction period, a total of 5,350 heavy vehicles would be required. This averages

approximately 20 heavy vehicles per working day for the construction period. The amount of deliveries per day would depend on the phase of works being undertaken. An increased volume of heavy vehicles is required for the delivery of modules and mounting frames, which would be delivered over a period of five months.

Table 8-1 Traffic volumes and requirements for Wellington SF.

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
Site set-up and de-mobilisation	Portacabin delivery and removal	Low loader	10
	Skip delivery and removal	Low loader	4
	Generator delivery and removal	Semi-trailer	1
	General Deliveries	Semi-trailer	12
	Crane mob and demob	Crane	2
	Water tank delivery and removal	Truck	4
Roads and hardstands	Delivery of imported capping for roads,	Truck and dog	690
	Plant delivery and removal: excavators,	Low loader	32
Generating equipment	Tool container delivery and removal	Low loader	4
	Module deliveries	Semi-trailer or B-double	1985
	Mounting structure and pile deliveries	Semi-trailer or B-double	1997
	Inverter Station deliveries	Low loader	86
	DC cabling, trays and combiner boxes	Semi-trailer or B-double	50
AC Cable Installation	AC Cable delivery	Semi-trailer or B-double	15
	Backfill material delivery	Dump Truck	72
	Plant delivery and removal: Telescopic	Low loader	8
Overhead Line	Conductor delivery	Semi-trailer or B-double	1
	Pole deliveries	RAV	2
	Pole dressing delivery	Semi-trailer or B-double	2
	Plant delivery and removal: Telescopic	Low loader	8
Sub Station	Concrete deliveries	Concrete agitator	20
	Switch room delivery	Low loader	4
	Operations and maintenance and workshop	Low loader	8
	Transformer delivery	RAV	4
	Electrical equipment deliveries	Semi-trailer or B-double	32
	Concrete deliveries	Concrete agitator	10

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
Energy Storage	Battery deliveries	Semi-trailer or B-	25
	Electrical equipment deliveries	Semi-trailer or B-	10
Other	Employee vehicle movements	Light vehicle	10,667
	Monitoring equipment, fibre, SCADA servers	Truck	12
	Waste collection	Truck	208
	Consumables (oil, petrol etc.)	Truck	32
	Miscellaneous deliveries	Light vehicle (Vans)	96
		Total [1]	**16,113**

[1] Assumes rock would be imported to site and water for dust suppression would be sourced onsite.

During the peak construction period there would be the following maximum movements:

- 100 heavy vehicles.
- 300 light vehicles.

Local traffic impacts would largely be confined to standard hours of construction (7am to 6pm Monday to Friday and 8am to 1pm on Saturdays). Exceptions would occur as staff arrive and leave the site, before and after shifts; some of this traffic may occur outside the standard construction hours. Additionally, the delivery of large components may take place outside normal working hours.

No cumulative traffic impacts are expected associated with the construction of the Bodangora Wind farm project which is currently under construction. Construction traffic associated with both of these projects would utilise Goolma Road and the Mitchell Highway. Bodangora Wind Farm construction time is approximately 18 months and full commercial operation is targeted to be in the second half of 2018. Should there be a delay in the Bondangora WF, a mitigation strategy requiring their consideration in the Wellington SF Traffic Management Plan is included below.

Decommissioning impacts are likely to follow a similar pattern as components are dismantled and removed, however this would occur over a reduced time period.

INCREASED COLLISION RISK

The increased vehicle collision risk relates primarily to traffic entering and exiting the Solar Farm site at the site access off Goolma Road, and traffic entering/exiting Goolma Rd at the Mitchell Highway. This is related to both oncoming traffic and traffic following behind turning vehicles. Slow moving vehicles may also present a risk to through traffic, requiring signage to warn motorists of the construction timeframes.

Construction of a dedicated left turn lane from Goolma Road into the Solar Farm site would reduce the potential for construction traffic, particularly slow-moving vehicles, to impact eastbound traffic flow on Goolma Rd. The right turn lane from the Mitchell Highway onto Goolma Road would help to maintain northbound traffic flow on the Mitchell Highway.

As set out above, the majority of the traffic would be standard vehicles used by onsite workers, limited overmass or oversize haulage vehicles. As such there are opportunities to rationalise traffic movements,

such as through the provision of shuttle buses for workers. This objective would be a requirement of the Traffic Management Plan to be developed for the proposal.

DAMAGE TO ROAD INFRASTRUCTURE

The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along the Great Western Highway and Mitchell Highway the impact is expected to negligible due to the existing capacity of the road network. Any damage as a consequence of the proposal would be rectified.

Internal access roads would be constructed or upgraded as required to accommodate the proposal volumes and loads of traffic. The tracks would be compacted but unsealed gravel.

ASSOCIATED NOISE AND DUST

The proposal may result in increased noise and dust, particularly on the unsealed access road and internal tracks. Impacts from dust generated from the proposed activity, including that associated with increased traffic, is considered in Section 8.10. During construction, water would be used to minimise dust generation along access tracks.

The DECCW (2011) *NSW Road Noise Policy* (NSW RNP) have been used to evaluate impacts from road traffic noise. This policy outlines a range of measures required to minimise road traffic noise and its impacts, including noise generated by developments that generate additional traffic on existing roads. A road traffic noise assessment is included in Appendix G and Section 7.4 of this EIS.

DISRUPTION TO EXISTING SERVICES

Local traffic in Wellington could potentially be affected by increased vehicles from construction staff seeking accommodation and services, and conducting commercial activities relating to the solar farm. This would extend outside construction hours.

Increased traffic along Mitchell Highway and Goolma Road during construction may cause disruptions to general traffic flows and to public transport services including school bus routes that operate along the road. The use of buses to transport workers to and from site will reduce the amount of disruption to traffic along both roads.

There would be no disruptions to rail services along the Main Western Railway Line.

Operation

Activities undertaken during the operation phase would include travelling to the site office or maintenance building and carrying out maintenance activities on the solar farm infrastructure. Operational staff would be confined to designated parking areas and access roads/tracks within the proposal site.

During operation, three full time equivalent staff would access the proposal site to operate and maintain the solar infrastructure. It is likely two light vehicles (4x4) and an All-terrain vehicle will be required to transport the staff around the site. The anticipated volume of staff would result in very minimal increase in traffic flow on the local road network. Operational staff may also be required to access the substation, adjacent to the proposal site.

It is considered unlikely that the low levels of operational traffic would obstruct public or private local access. Additional risks to road safety from operational traffic would be minimal.

Decommissioning

Decommissioning impacts are likely to follow a similar pattern as construction, as components are dismantled and removed. It is expected there would be fewer heavy vehicles and workers required for decommissioning as well as over a shorter time period than construction.

8.1.3 Safeguards and mitigation measures

Traffic and haulage impacts would be managed in consultation with the roads authorities covering issues such as, but not limited to, reinstatement of pre-existing road conditions, shuttle bus transport, intersection upgrade, scheduling of deliveries and traffic controls (speed limits, signage etc.), as detailed in Table 8-2.

Table 8-2 Safeguards and mitigation measures for traffic, transport and road safety impacts

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

Safeguards and mitigation measures	PC/C	O	D
• The proponent would consult with the Roads and Maritime Services regarding the proposed upgrading of the site access from Goolma Road. The upgrade would be subject to detailed design, and must be designed and constructed to the standards specified by RMS Guidelines.	Design stage		
• A Haulage Plan would be developed with input from the roads authority, including but not limited to: o Assessment of road routes to minimise impacts on transport infrastructure. o Scheduling of deliveries of major components to minimise safety risks (on other local traffic). o Consideration of cumulative traffic loads due to other local developments. o Traffic controls (signage and speed restrictions etc.).	PC		D
• Upon determining the haulage route(s) for construction vehicles associated with the Project, and prior to construction, undertake a Road Dilapidation Report. The Report shall assess the current condition of the road(s) and describe mechanisms to restore any damage that may result due to traffic and transport related to the construction of the Project. The Report shall be submitted to the relevant road authority for review prior to the commencement of haulage.	PC		
• A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Dubbo Regional Council and Roads and Maritime. The plan would include, but not be limited to: o The designated routes of construction traffic to the site. o Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. o Scheduling of deliveries. o Community consultation regarding traffic impacts for nearby residents and school bus operators. o Consideration of cumulative impacts, undertaken consultation with Bodangora Wind Farm. o Consideration of impacts to the railway. o Traffic controls (speed limits, signage, etc.).	PC		D

Safeguards and mitigation measures	PC/C	O	D
o Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. o Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.			
• If the ESF is constructed outside the main construction period, a specific traffic management plan would be undertaken to manage any additional impacts.	C		

8.2 LAND USE (INCLUDING MINERAL RESOURCES)

8.2.1 Approach and methods

The land use and resource values of the proposal site and locality, and potential impacts of the proposed solar farm have been assessed with reference to the NSW land and soil capability assessment scheme, Primefact 1063 Infrastructure proposals on rural land, Biophysical Strategic Agricultural Land and Important Agricultural Land identification processes, Land Use Conflict Risk Assessment Guide, the Minview and Common Viewer databases and landholder, ABS and ABARES agricultural production and water use figures.

8.2.2 Existing environment

Suitability for agriculture

Land capability is the inherent physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources (OEH, 2012). The NSW land and soil capability assessment scheme (OEH, 2012) describes and maps eight land and soil capability classes. The classification is based on the biophysical features of the land and soil (including landform position, slope gradient, drainage, climate, soil type and soil characteristics) and susceptibility to hazards (including water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement).

The proposal site is located on land mapped in capability Class 3, under the Land and Soil Capability Mapping for NSW (OEH, 2017). Class 3 land (high capability land) has moderate limitations and is assumed to be capable of sustaining high-impact land uses, such as cropping. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation. It is further noted that this soil mapping is not extensively ground-truthed and the onsite inspection of the site suggests that sustained high productivity (such as annual cropping) would not be supported. Soil surveys are currently being undertaken to provide an accurate land capability assessment.

Additionally, all of the proposal site that would be developed for the array is mapped as Biophysical Strategic Agricultural Land (BSAL); featuring quality soil *and water resources* and assumed to best capable of sustaining high levels of productivity. As above, this soil mapping is not extensively ground-truthed and the onsite inspection of the site suggests that sustained high productivity (such as annual cropping) would not be supported. This will be verified by onsite soil surveys.

Currently, the development footprint (316ha, including all transmission line options) equates to 0.03% of the mapped BSAL within the Dubbo Regional LGA. Current land management on the site is focussed on grazing. Feed crops for stock are planted irregularly dependent on the season. No sustained cropping is

undertaken. Many of the drainage lines mapped for the site are ephemeral at best or have been highly modified. These are not capable of supporting irrigated agriculture and crops requiring high water usage.

Figure 8-1 Biophysical Strategic Agricultural Land (proposal boundary shown in red)

Further details regarding soils at the site and their constraints are detailed further in Section 8.3.

Existing land uses

AGRICULTURE

The site is agricultural land and has a history of agricultural cultivation. Aerial imagery and site inspections confirm most of the site has been cleared of trees and has been highly modified by agricultural practices. Parts of the site are used for cropping although not likely in a sustained manner (as set out above).

There are two landowners, one owning parcels to the east and the other parcels to the west. Grazing and occasional cropping of land in the eastern lots of the proposal site has been carried out by the current landowner for approximately 25 years. No cropping is currently being undertaken. Cattle currently graze the eastern lots of the site. It is assumed that similar land uses preceded this.

Cropping and grazing in the western lots of the proposal site has been carried out by the current landowner for approximately 30 years. Sheep currently graze the western lots of the site. It is assumed that similar land uses preceded this.

The land surrounding the proposed solar farm site includes irrigated crops and grazing land (cattle and sheep). The steeper land to the east supports mainly grazing activities and the gentle undulating land to the west supports mainly cereal production. No intensive agricultural land uses have been noted that are of relevance to the proposal site. As above, while mapped as being capable of sustaining high-impact land

uses, such as cropping, the site observations and historic use of the land does not bear this out. More likely it has been mapped due to its proximity to waterways and low relief; the soil and water resources at the site however are not conducive to irrigated agriculture or intensive cropping. Soil surveys are currently being undertaken to provide an accurate land capability assessment. Existing erosion and waterways are likely to be improved at the site with the reduction or exclusion of stock and commitment to maintaining ground cover vegetation. Land condition would be improved through less intensive management at this site.

RESIDENTIAL AREAS

One residential dwelling is located within the proposal site, within Lot 90/DP2987. The dwelling is a homestead and is listed as an item of local heritage significance under Schedule 5 of the *Wellington Local Environmental Plan 2012* (refer to Section 4.3.1). Aside from the dwelling that is located within the proposal site, the closest receiver is located 560m west of the proposal site (non-involved landowner).

The proposal site is located approximately 2km north east of Wellington. Wellington has a population of approximately 4,000 people and located at the junction of the Macquarie and Bell Rivers at the foot of Mt Arthur. Wellington is a service centre for the surrounding district with the principal production being wool, beef, wheat, some wine, manufacturing and tourism. Wellington is a popular stopover on the Mitchell Highway. The Wellington Caves and Phosphate Mine, Mount Arthur Reserve and the close proximity to Lake Burrendong (Dubbo Regional Council, 2017.).

INDUSTRY AND COMMERCIAL AREAS

There are several existing transmission lines within the proposal site, which connect to the substation south of Goolma Road. The proposal would require an additional transmission line to connect to the substation, which would be overhead.

The existing Transgrid Substation is located south of the proposal site and NSW Soil Conservation is located north of the proposal site.

The Wellington Correctional Centre is located off Goolma Road, east of the proposal site. The Correctional Centre is a maximum security prison for males and females, and is operated by Corrective Services NSW, an agency of the Department of Attorney General and Justice. Work on the expansion of the Wellington Correctional Centre commenced in August 2016 and has been completed.

MINERAL RESOURCES

A search of Department of Planning & Environment's MinView database (DPE, 2017) found the site to have two current Mineral Titles. These are described in Table 8-3 and depicted in Figure 8-2.

Table 8-3 Exploration licences relevant to the proposal site

Mineral Title/ Licence number	Owner	Grant date	Expiry date	Mineral type
EL 6178	Modeling Resources Pty Ltd	19.01.2014	18.01.2018	Group 1 (metallic minerals)
EL 8505	Drummond West Pty Ltd	06.02.2017	06.02.2020	Group 1 (metallic minerals)

First Solar have consulted with the mineral title holders, consultation is summarised is Section 5.3.

The MinView website indicates that there are several current Mineral Titles adjacent to the proposal. MinView also shows the mineral drill holes that have been carried out in the locality. Three mines/quarries within 5km of the proposal site including:

- Montfiores Pit (Nanima Quarry) - located south of Goolma Road, immediately south of the proposal site. It is stated that this Quarry relates to Mineral title EL 6178 and is understood to be operational. Consultation with the Mineral title EL 6178 confirmed that this Quarry is not related to EL 6178. It is a sandstone and siltstone quarry and classed as unprocessed construction materials - major.
- Brookfield Pit - located off Twelve Mile Road, approximately 3.8 km east of the proposal site. Is classed as unprocessed construction materials – minor and relates to mineral title EL 8252. The operational status of this pit is unknown.
- Maryvale via Wellington – located next to the Macquarie River, approximately 3 km west of the proposal site. The quarry is operational in coarse aggregate, river gravel and sand. It is classed as unprocessed construction materials – major.

First Solar consulted with the Quarry owners, consultation is summarized in Section 5.3.

AVIATION

There are a number of airstrips located in close proximity to the proposal site. The closest is the Bondangora airstrip located 8km north east of the proposal site. This airstrip is small and primarily used by council for light aircraft, private charter flights and medical services. The remaining airstrips include:

- A landing ground located approximately 9km north west.
- A landing ground approximately 18km east.
- A landing ground approximately 22km north west.
- Dubbo airport approximately 48km north west.
- Mudgee airport approximately 62km east.
- Narromine airport approximately 75km north west.

Dubbo city regional airport is one of the leading regional airports in Australia that provides direct services to major airports in Australia. The remaining airstrips are small airports primarily used by light aircraft, 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. Cropping is not dominant in the local area, although grazing properties would also have sections of pasture dedicated to more intensive feed production.

RENEWABLE ENERGY PROJECTS

The Bodangora Wind Farm project site is located approximately 10km north of the proposal site. The wind farm was developed, and will be owned and operated, by Infigen Energy. The wind farm will have a generating capacity of 113.2MW. The project construction time is approximately 18 months and full commercial operation is targeted to be in the second half of 2018.

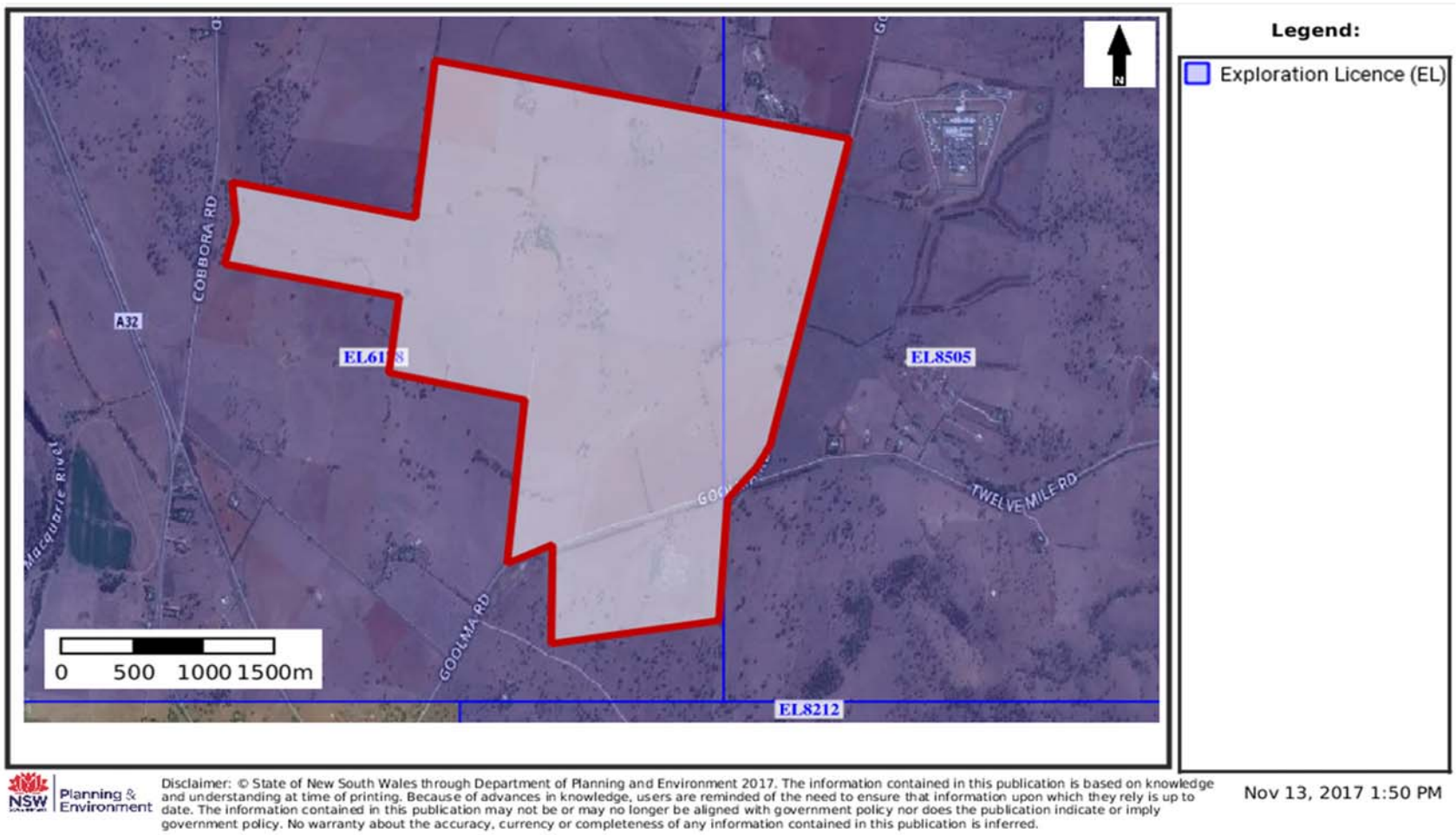


Figure 8-2 Exploration licences with regards to the proposal (red boundary) (DPE 2017).

8.2.3 Potential impacts

Construction

AGRICULTURE

From the commencement of construction, agricultural activities would cease in areas required for access and construction of the solar farm.

While temporary loss of the site for agricultural production would occur for the life of the proposal, except for the internal tracks and drainage and small footings onsite, for inverters, buildings and substation, the majority of the soil surfaces would not be impacted by the development in the long term; no large areas of reshaping or excavation are proposed. Therefore, post decommissioning, the land could return to existing agricultural use or an alternative use with relatively low level impacts on land productivity. A commitment to prompt rehabilitation post construction and operational maintenance of ground cover are included to ensure this result.

With the exception of temporary traffic impacts during construction and decommissioning (addressed in 8.1), the operational solar farm is not anticipated to impact on surrounding agricultural enterprises. The operational plant would generate minimal traffic, noise and dust that may affect surrounding production related land uses.

No land use conflicts are anticipated for existing adjacent agricultural land uses or future agricultural land uses on the proposal site or adjacent lands.

Specific to soil resources, soil surveys are currently being undertaken to provide an accurate land capability assessment and would assist post construction rehabilitation activities.

RESIDENTIAL AREAS

Residences located near to the site may experience noise, dust and traffic during construction. These are temporary and manageable impacts, addressed in Section 7.4, 8.1 and 8.8. No impacts on the use of any recreational areas would occur.

INDUSTRY AND COMMERCIAL AREAS

Consultation is being undertaken with TransGrid to ensure the construction of the solar farm and transmission line will have minimal impact on their adjacent substation and transmission lines onsite.

MINING

There would be no extraction of minerals onsite during the construction period. Due to the proposal being highly reversible, mineral exploration would not continue to be sterilised in the long term, post decommissioning.

AVIATION

There is unlikely to be any impacts on aviation during construction of the low-lying infrastructure proposed. Installation of electricity poles would be the tallest infrastructure to be constructed and would not impact on any flight paths of, or present a hazard to, aircraft.

Operation

During operation, the proposal site would change from agricultural land use to power generation. Grazing may occur as a maintenance strategy to reduce biomass and assist weed management but would likely not be conducted for agricultural profit. A groundcover management plan which includes the option of a grazing regime would be developed primarily to manage grass cover beneath the panels and prevent erosion. Existing erosion and waterways are likely to be improved at the site with the reduction or exclusion of stock and commitment to maintaining ground cover vegetation. Land condition would be improved through less intensive management at this site. The impacts of the proposal on impacts on agricultural resources and enterprises is detailed further below with respect to Primefact 1063 Infrastructure proposal on rural land.

Once the panels are installed, the proposal would result in the development of a large proportion of the 493ha property. The transmission easement is mostly sited adjacent to existing transmission lines and easement associated with the Wellington Substation, so this would not result in a significant land use change. The duration of the proposal would be 30 years. The loss of the development footprint (316ha) for agricultural production during this period is not considered a significant economic loss in the locality. The loss of agricultural productivity in the region is insignificant in relation to the extent of productive land in the South Western Slopes of New South Wales. It would only result in a loss of 0.03% of BSAL within the Dubbo Regional LGA.

The identified risk to aviation from the operation of the Wellington SF is reflective glint and glare. 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.
- Transmission line poles, if steel is used.
- On-site substation.
- Temporary construction site buildings.

The potential for glint or glare associated with non-concentrating solar panel systems which do not involve mirrors or lenses is relatively limited. Solar panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat. As such, they reflect only around 2% of the light received (Spaven Consulting, 2011).

Spaven Consulting (2011) provides a comparative reflection analysis against other surfaces and solar panels. In relation to water and snow, a solar panel (with an anti-reflectivity coating) reflects a much lower percentage of light. In addition, the Department of Planning (2010) in their discussion paper on planning for renewable energy generation, stated that solar panels would not generally create noticeable glare compared with an existing roof or building surfaces.

For other infrastructure on site such as the buildings and steel mounting frames and transmission line poles, impacts from glint and glare is considered minor due to their small size and low surface area. Careful design and colour schemes can further reduce any potential reflection problems.

Impacts of glint and glare on aviation as a result of the proposed solar farm's infrastructure are considered to be minor and can be effectively managed with the implementation of the mitigation measures outlined below.

Decommissioning

Due to the proposal site requiring relatively low levels of impacts on the soil surface, the proposal is viewed as highly reversible. Some compaction on access roads, from cabling and building footings would occur. Following decommissioning, the rehabilitated site would have similar opportunities for land use as the site currently possesses. At the end of the proposal, all above ground infrastructure would be removed. Underground cabling would be placed at least 500mm deep and would likely remain insitu at decommissioning. Allowing current agricultural activities or alternative activities to be undertaken.

A Rehabilitation Plan is a commitment of the proposal, relevant to decommissioning. The objective is to ensure the array site is returned to its pre-solar farm land capability. Cropping, other forms of agriculture, or alternative land uses could occur. The plan would be developed with reference to soil testing (conducted pre-construction as a requirement of the staged Groundcover Management Plan) and with input from an Agronomist. The site would be left stabilised, under a cover crop or other suitable ground cover. The plan would reference:

- 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)

There is unlikely to be any impacts on aviation during decommissioning of the proposal.

Primefact 1063 Infrastructure Proposal on Rural Land

Primefact 1063 Infrastructure proposals on rural land (DPI, 2013) provides the following guidelines to minimise impacts on agricultural resources and enterprises (summarised):

- Proposals should be clearly justified in a regional context and merits and community benefits identified
- Agricultural resource lands should be identified and avoided
- Land use conflicts should be minimised
- Landholders should be effectively consulted during planning, construction and rehabilitation works and the expectations of local communities should be managed
- Development proposals should identify suitable mitigatory/remediation responses for all likely agricultural impacts.

This EIS has strategically justified the proposal and identified community benefits (Sections 2.2 and 8.7. The proposal would result in reduced agricultural production for the life over the solar farm, but would not affect long term capability or use options. A Community Consultation Plan has been developed to inform the community and respond to concerns (Section 5.2). Neighbours in particular have been consulted to avoid land use conflicts. A comprehensive set of mitigation measures has been developed to avoid impacts to long term land use capability (Section 8.2).

The potential sustainable agriculture impacts identified in the Primefact are addressed below in relation to the current proposal.

Resource loss and fragmentation

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.

Impacts on farming operations and livestock

The proposal would displace approximately 316ha (includes all transmission line options and excludes substation option within the existing Transgrid substation) of extensive agricultural land at the site for the life of the solar farm (around 30 years). The property is typical of much of the land use in the locality, LGA and region.

Some sheep grazing may continue to be undertaken at the proposal site for production purposes and to control grass and weed growth around the solar arrays. Grass fuel levels within the site would be managed to minimise bushfire risks (refer Section 8.9). Adequate groundcover would be maintained to protect soil and water values (refer Section 8.3.3).

The proposal would not affect access or agricultural land uses on surrounding properties during the construction or operation phases.

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). Construction noise and traffic would be managed to minimise impacts to landholders around the site and along the access route (refer Section 7.4 and 8.1).

Impacts on soils and erosion risk are assessed in Section 8.3, impacts on downstream water quality are assessed in Section 8.4 and impacts on local air quality are assessed in Section 8.8. 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.

Increased weed, biosecurity and bushfire risks

High biosecurity standards would be applied during the construction period, including pre-works weed treatment and maintaining high levels of weed and disease hygiene for construction vehicles, machinery and materials. A Weed Management Plan would be prepared for the construction and decommissioning phases. Similarly pest plants and animals would be monitored and controlled as part of the continuing management of the solar farm site (refer Section 7.1). Impacts on flood risk, fire risk and aviation 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.

Site rehabilitation

Following decommissioning of the solar farm, a Site Rehabilitation Plan would be implemented to allow agricultural and land use opportunities at the proposal site. All infrastructure to a depth of 500 millimetres and internal track surfacing would be removed, soils would be decompacted as required, any required reinstatement of paddock levels, small dams and irrigation and drainage channels would be undertaken, and a suitable cover crop sown to stabilise the site (refer Section 8.3). Soil restoration and treatments would be guided by the findings of a pre-works base line soil survey which is currently being undertaken (refer Section 8.3).

8.2.4 Safeguards and mitigation measures

Table 8-4 Safeguards and mitigation measures for land use impacts

C: Construction, O: Operation: D: Decommissioning

Safeguards and mitigation measures	C	O	D
• Consultation with local community, to minimise impact of construction of adjacent agricultural activities and access.	C	O	D
• Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C	O	D
• Consultation with proposal site mineral titleholders regarding the proposal and potential impacts.	C	O	D
• A Rehabilitation Plan would be prepared to ensure the array site is returned to it pre solar farm land capability. The plan would be developed with reference to 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 plan would reference: o Australian Soil and Land Survey Handbook (CSIRO 2009) o Guidelines for Surveying Soil and Land Resources (CSIRO 2008) o The land and soil capability assessment scheme: second approximation (OEH 2012)			D
• The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of the landscape.	C		

8.3 SOILS

8.3.1 Existing environment

Topography geology and soils

The topography of the proposal site is flat to gently undulating and sits at an elevation of between 300 and 415 metres above sea level (ASL). The site includes the following topographic features:

- A hill is located in the north-eastern part of the site (rising to 415 metres ASL).
- The Wuuluman Creek, and two tributaries of the creek, occur on the site and generally drain water from the site in an east to west direction.

The proposal area is located at the eastern edge of the Lachlan Fold Belt. The Wellington 1:100,000 Geological sheet (Scott *et al.,* 1999) indicates that the proposal site contains surface geology from:

- The Quaternary period, including:
  - Alluvial silt, clay and sand, variable humic content, sporadic pebble to cobble-sized unconsolidated conglomeratic lenses.

- The Silurian period, including:
    - Warderie Volcanic Member: Purple andesite and trachyte, volcaniclastic sandstone and breccia siltstone.
    - Wylinga member: Felsic crystal-lithic sandstone, fossiliferous limestone.
- The Ordovician period, including:
    - The Oakdale Formation: A variety of mafic (magnesium and iron rich) rocks, including basalt, basaltic andesite, latite lavas and intrusions. Associated sedimentary rocks include volcaniclastic breccia and conglomerate, siltstone, shale, chert; minor allochthonous limestone and calcareous sediments.

One soil landscape occurs at the proposal site: Bodangora (bz). This soil landscape has the following limitations:

- High erosion hazard under cultivation and low cover levels
- Moderate fertility
- Friable surface soils
- Moderate to high shrink-swell potential in subsoils
- Aggregated clays may leak in earthworks

One soil profile is recorded in the eSpade database (OEH, 2017) that is within the proposal site. The soil profile was taken in 2004 from Lot 99, DP 2987, close to Wuuluman Creek. The profile describes the site as having a slight erosion hazard and with no salting evident. The soil type is recorded as Red Dermosol.

eSpade (OEH, 2017) indicates that the proposal site has a moderate to very high salinity hazard. There is no potential for acid sulphate soils to occur at the proposal site.

Potential for soil contamination

An Environmental Site Assessment was completed for the Wellington SF proposal area (NGH Environmental, 2017a). The report is provided in full at Appendix I. The ESA involved carrying out database searches to determine whether there is any known contamination at the site, or whether there are any contaminants that have the potential to occur at the site. These included:

- NSW Environment Protection Authority (EPA) contaminated lands register
- POEO public register licence application and notices
- MinView geoscience and exploration title information
- State of the Environment (SoE) Report (Dubbo Regional Council, 2016)
- *Wellington Local Environmental Plan (LEP) 2012*

It was also informed by a site inspection and consultation with current landholders. No testing was undertaken.

While agricultural sites are noted as having potential particularly for buried contaminants (chemical drums, domestic waste, sheep dips), the ESA observed no evidence of contaminated land occurs within the proposal site. No evidence was found of historical POEO Act licences or current application on the proposed site. Land contamination risks were concluded to be low.

8.3.2 Potential impacts

Construction and decommissioning

Construction activities at the proposal site, such as excavation and earthworks, have the potential to disturb soils, cause erosion and subsequent sedimentation. The proposed disturbance area for the proposal is approximately 316ha (includes all transmission line options and excludes substation option within the existing Transgrid substation). It is identified that the soils onsite have a moderate to high erosion risk. Construction activities specific to the proposal that would result in ground disturbance include:

- Construction of internal access tracks and associated drainage.
- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground to a depth of approximately 1.5m (minimal soil disturbance).
- Substation bench preparation.
- Concrete or steel pile foundations for the inverter stations, onsite substation and maintenance building.
- Trenches up to 1000mm deep for the installation of cables.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing.

Given the generally low relief landforms within the proposal site, large scale bulk earthworks would not be required. The excavations and earthworks for the access tracks and associated drainage, foundations for infrastructure and buildings and the trenches for underground cabling would remove vegetation cover and disturb soils, potentially decreasing their stability and increasing susceptibility to erosion. The installation of the piles and security fence poles is unlikely to result in substantive ground distance due their small and discrete footprint at the pole location. Ground cover would be retained as far as possible prior to and during construction, and would be rehabilitated post-construction. A Ground Cover Management Plan would be prepared to ensure stability post construction and is ongoing into operation of the solar farm.

Erosion and sedimentation impacts associated with soil disturbance from the construction and decommissioning activities can be minimised by undertaking works 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 would occur as hardstands and internal access roads are created, which would reduce soil permeability thereby increasing runoff and the potential for concentrated flows across the site. During excavations, mixing of different soil horizons can retard plant growth due to inadequate top soil layer. Top soil management would be required as part of the construction process.

Dust may be generated as a result of the construction and traffic activities such as vehicles travelling on unsealed roads as well as excavations. Impacts of dust generation are discussed in Section 8.8.

Machinery and vehicles have potential to track sediments onto public roads. This has potential to create a risk to other road users through reduced road traction. Cleaning vehicles and machinery as part of the soil and water management plan would reduce this risk.

The use of fuels and other chemicals during fuelling of machinery and weed spraying onsite, poses a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Additionally the use of portable toilets onsite pose a contamination risk through spills or leakages. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. When mobilised, such as in a rain event or flooding, these substances may spread via watercourse onsite, affecting much larger areas of aquatic habitat such as Wuuluman Creek and the Macquarie River. This risk is considered manageable.

While a low risk, it is possible that contamination associated with past agricultural activities (e.g. buried pesticides, fuels) could be present on the site however, no evidence of contamination was detected during the site inspections and no extensive excavations are required for the proposal. A contaminated soil protocol has been included to manage this risk should it occur.

Operation

The risks to soils during the operation phase of the proposal, after all areas disturbed during construction have been rehabilitated, and groundcover has been established, are expected to be minimal. The maintenance of a stable ground cover on the site during operation will be beneficial for reducing erosion and weed ingress in comparison to agricultural cropping or even grazing (depending on seasonal conditions and stocking rates).

Rainfall and cleaning water runoff from the solar panels has potential to lead to localised soil splash impacts. However, this isn't a significant issue with tracking panels and the soils onsite are unlikely to be impacted by soil splash.

The potential for wind erosion (dust generation) during regular plant operation would be low given the ability to stabilise exposed soils soon after construction. Additionally, the volume of vehicles on the unsealed tracks during operation would be minimal. Areas that were temporarily used during construction (e.g. laydown and construction parking areas) would be rehabilitated. This would be covered in a Rehabilitation Plan developed for construction.

Shading may result from the panels, reducing the vigour of vegetation growing under the array. As the panels will be tracking, panels would not provide continuous shading. The microclimate created under the panels (reduced surface air movement, evaporation, and ground temperatures) is expected to offset the negative impacts of shading. A species mix, which is tolerant of intermittent shading, would be selected for the groundcover at the site. Potential responses to any persistent localised impacts under the array would include revegetation.

Soil stability and erosion throughout the site, including beneath the array would be monitored in association with the regular monitoring of groundcover under the Groundcover Management Plan.

8.3.3 Safeguards and mitigation measures

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

Table 8-5 Safeguards and mitigation measures for soil impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
• The array would be designed to allow sufficient space between panels to establish and maintain ground cover beneath the panels and facilitate weed control.	Design stage		
• 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: o Carry out soil testing prior to any impacts, to inform any soil treatments and provide baseline information for the decommissioning rehabilitation. o Install, monitor and maintain erosion controls. o 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. o 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. o 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. o 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		D
• 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: o 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. o Requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 *Protection of the Environment Operations Act*). o Manage the storage of any potential contaminants onsite.	C	O	D

Safeguards and Mitigation Measures	C	O	D
o Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation. o Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. o Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. o Monitor and maintain spill equipment o Induct and train all site staff.			
• A Groundcover Management Plan would be developed in consultation with an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: o Soil restoration and preparation requirements o Species election o soil preparation o Establishment techniques o Maintenance requirements o Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – ie. Live grass cover would be maintained at or above 70% at all times to protect soils, landscape function and water quality. Any grazing stock would be removed from the site when cover falls below this level. Grass cover would be monitored on a fortnightly basis using an accepted methodology. o Contingency measures to respond to declining soil or groundcover condition o Identification of baseline conditions for rehabilitation following decommissioning.	C	O	
• 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		D

8.4 HYDROLOGY (SURFACE AND GROUNDWATER), WATER QUALITY AND WATER USE

8.4.1 Existing environment

Surface water

The Wellington SF proposal site is located within the Central West Local Land Services Area. The site is located within the Macquarie catchment.

The closest Nationally Important Wetland and Ramsar Wetland to the proposal site is the Macquarie Marshes and Nature Reserve, which is approximately 150km downstream.

Two watercourses are located within the proposal site:

- Wuuluman Creek, a 3rd Order Stream runs though the centre of the development site. In the east of the development site Wuuluman Creek is slow flowing shallow creek with steep banks. Streamside vegetation is degraded consisting of exotic grasses grazed by stock and some scattered Boxthorn. As the creek flows towards the west, banks become shallow and water is deeper. The stream banks were well vegetated. Some scattered White Box eucalypts occur along the length of the stream.
- An ephemeral overland flow path runs from the centre of the development site and joins with Wuuluman Creek on the western edge of the site. This flow path is a dry gully, flowing only after rain events. Vegetation in these gullies is degraded and dominated by exotic grasses that have been grazed by stock.

At the time of the site inspection these waterways were not flowing. Pooled water was observed at some locations along Wuuluman Creek (see Figures 8-6 and 8-7 below). The water quality would be influenced by the surrounding land uses including cropping and grazing, varying seasonally.

Three dams occur within the proposal site, one dam is located along the eastern boundary, one is the middle of the site and one is located in the middle of the western portion of the site (refer to Figure 1-3).

Figure 8-6 Wuuluman Creek on the eastern lot onsite

Figure 8-7 Wuuluman Creek on the western lot onsite

Groundwater and water entitlements

There are three groundwater bores located in within the proposal site (see Figure 8-9):

- Bore GW016647 (associated with Licence 80BL008586), groundwater was intercepted at 11m and 34m.
- Bore GW016642 (associated with Licence 80BL008589), groundwater depth is not provided.
- Bore GW016641 (associated with Licence 80BL008590), groundwater depth is not provided.

All three bores are private and installed for stock, irrigation and domestic purposes. Additional bores are located on properties adjacent to the proposal site, as shown in in Figure 8-3. GW025296 intercepted groundwater at 9m depth.

During the site inspection, there was no evidence of high water tables, such as waterlogging or salt scalds. However, the Wellington LEP 2012 identifies the Wellington SF proposal site as groundwater vulnerable, suggesting groundwater has potential to be intercepted.

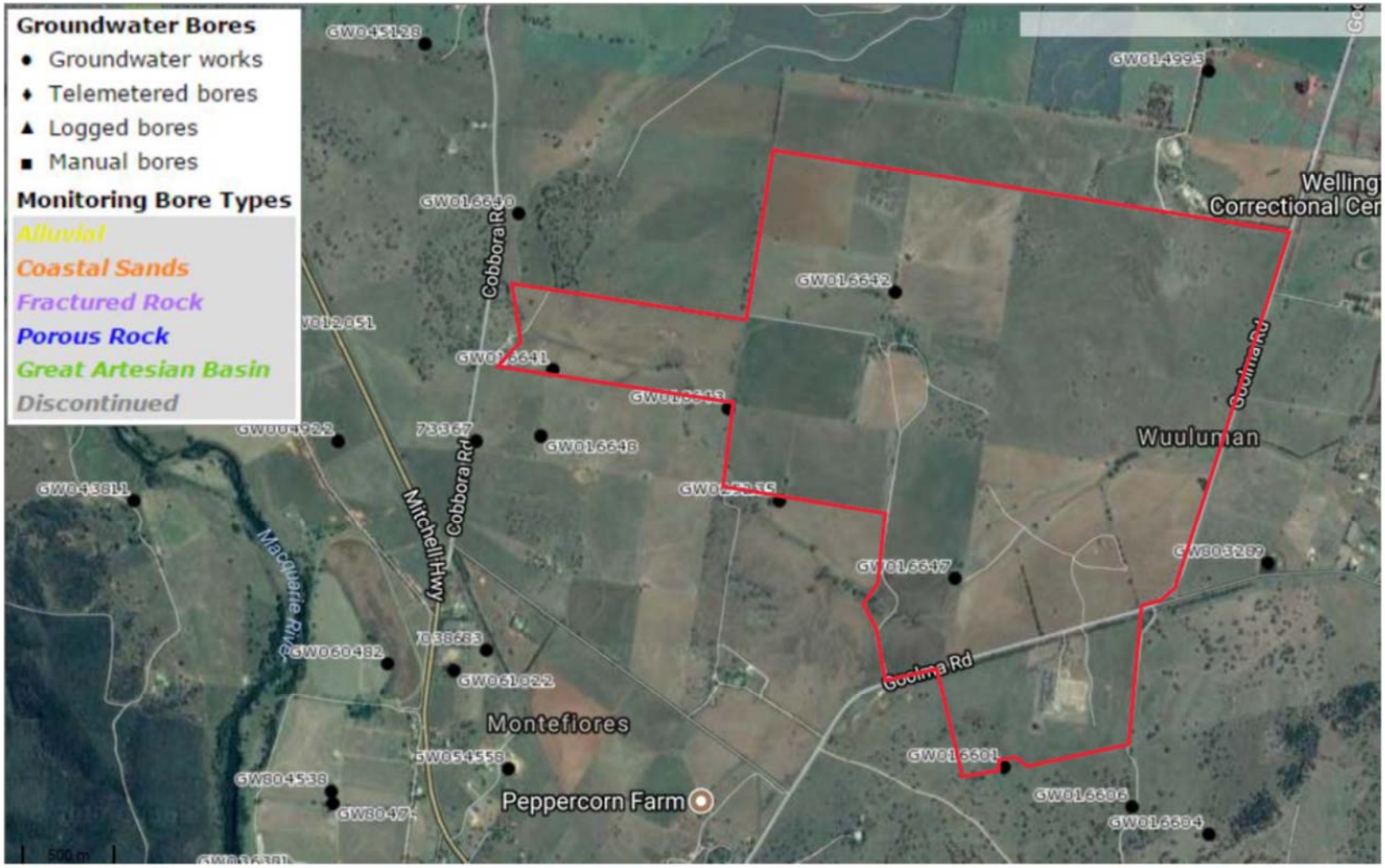


Figure 8-3 Groundwater bores within and adjacent to the proposal site (DPI, 2017).

The proposal site occurs in the Central West Water Management Area, and is subject to the Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources. The proposal site overlies the Lachlan Fold Belt MDB Groundwater Source, which is regulated by the Water Sharing Plan for the NSW Murray Darling Basic Fractured Rock Groundwater Sources 2011. Water is also extracted from bores within the water source through basic landholder rights (not requiring a licence).

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).

Potential Groundwater Dependent Ecosystems (GDEs) within the vicinity of the proposal site are mapped in the Groundwater Dependent Ecosystems Atlas (BOM, 2017) (refer Figure 8-4).

There are a number of Low and Moderate potential terrestrial vegetation GDEs mapped within the proposal site, including:

- *E. conica, E. melliodora, E. macrocarpa*
- *E. macrocarpa/Dodonaea viscosa subsp. Cuneate, Acacia buxifolia*
- *E. blakelyi, E. melliodora, E. bridgesiana/Acacia delabata*
- *Maireana microphylla, Pimela neo-anglica, Sclerolaena birchii/Dichanthium*
- *E. albens/Acacia decora, Acacia implexa, Acacia deanei*

There is a small area of high potential GDE mapped within the proposal site:

- *E. camaldulensis, Casuarina cunninghamiana/Callistemon sieberi, Leptospermum polygalifolium*

Wuuluman Creek is also mapped as a high potential Aquatic GDE.

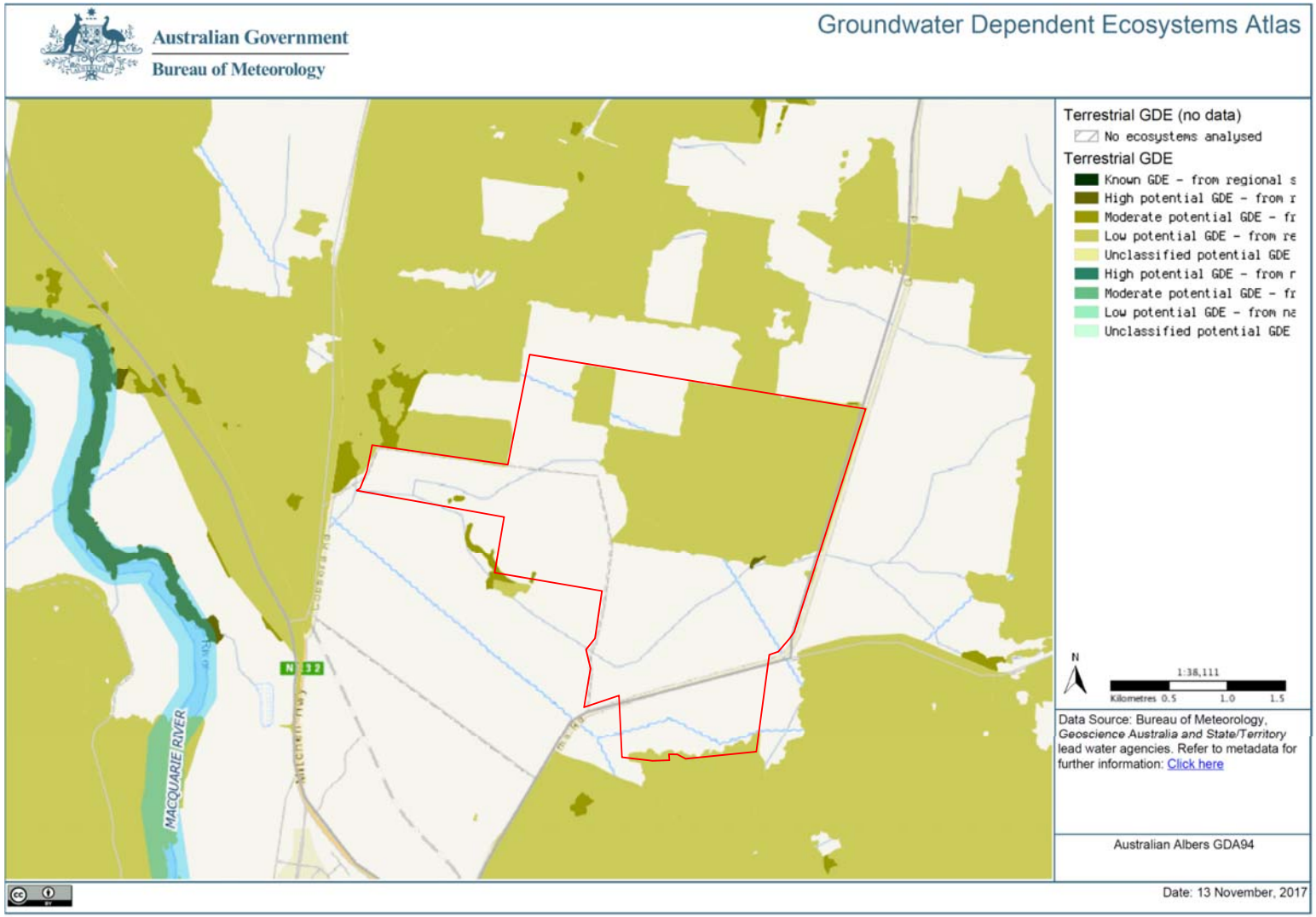


Figure 8-4 Terrestrial GDEs at the proposal site and surrounds (BOM, 2017).

8.4.2 Potential impacts

Construction and decommissioning

During construction, potable water would be trucked to the site on as needs basis and stored within temporary water tanks at the staff amenities area. Water for dust suppression would be sourced from on-site dams or from a local Council standpipe (following consultation with Council) or other appropriate sources. It would not be sourced from bores.

The proposal would not involve the extraction of any groundwater and therefore would not require any groundwater extraction licences.

SURFACE WATER

Construction of the proposal would involve a range of activities that would disturb soils and potentially lead to sediment laden or other pollutants being present in runoff, mobilising and entering local waterways. These activities 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 three waterway crossings for internal access roads. All would be located within the ephemeral overland flow path within the north western portion of the site.
- Trenching for underground cable installation and transmission line. Underground cabling would intersect waterways in two locations refer to Figure 1-2.
- Soil compaction would occur when hardstand areas and access tracks are created, which would reduce soil permeability thereby increasing surface water runoff and the potential for concentrated flows.

The existing surface water drainage patterns would not be altered by the construction of the proposal; no levelling or landforming is proposed. Surface water would still drain from the site primarily through Wuuluman Creek and the ephemeral overland flow path to the north, towards the Macquarie River west of the site. The waterways within the site would not be altered. Development within Wuuluman Creek would be limited to the construction of crossings for the internal access roads and for the installation of underground cables. No solar panels would be installed over Wuuluman Creek. As Wuuluman Creek is declared Key Fish Habitat (KFH), the design and construction of the waterway crossings would need to consider the requirements of the publications:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull & 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).

Solar panels would be installed over some sections of the ephemeral overland flow path within the site, however this is not likely to change the hydrology of the ephemeral overland flow path or present any risk to bank stability. The ephemeral overland flow path is well grassed in the eastern portion of the proposal site, and is not declared to be KFH.

The construction phase would entail the following water chemical 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 have potential to enter the Wuuluman Creek and its tributaries, which eventually drain into the Macquarie 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 Section 8.1. 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

Impacts to groundwater during construction and decommissioning are unlikely to occur due to the depth of groundwater. The deepest infrastructure to be installed would be the mounting frames to a depth of 1.5m. Additionally the clearing of trees on site would unlikely have an impact on the groundwater levels, approximately 1.8ha of moderate to good condition woodland would be removed.

Terrestrial GDEs are known to occur within the proposal site, as detailed in Section 8.4.1. Impacts to GDE's within the proposal site would not occur as a result of impacts to groundwater supplies, as groundwater supplies would not be affected. No groundwater is anticipated to be intercepted, and no groundwater would be extracted. However, the GDE vegetation communities would be directly impacted through vegetation removal. Impacts associated with vegetation removal are considered in Section 7.1 of this EIS.

WATER USE

Water use during the construction phase would be minimal and mainly for dust suppression on unsealed tracks. This water requirement is likely to vary depending on weather conditions such as rainfall and wind and is estimated to be up to 9000ml per annum. The water would be sourced from onsite dams. If the dams diminished below an acceptable level, water for dust suppression would be sought from a local council standpipe, in consultation with Council.

Potable water requirements for staff during construction would be approximately 180kL per annum. The non- potable water would be trucked to the site on as needs basis and stored within temporary water tanks at the staff amenities area.

Impacts on water use during the decommissioning would be similar to those during construction. The amount would be low and managed using standard measures

Operation

During operation, non-potable water would be required for cleaning panels, onsite toilet and showers, landscaping and animal care. Potable water would be required for the workers. Rain water would be collected onsite.

SURFACE WATER

During operation, there is minimal potential for any impacts to surface water quality to occur. Appropriate drainage features would be constructed along internal roads (such as vegetated swales) to minimise the

risks of dirty water leaving the site or entering waterways. With the exception of internal roads, parking areas and areas around onsite substation, the site would be revegetated with grass cover. Water quality impacts at the site would therefore be low and are not considered substantially different to the current potential water quality impacts occurring from existing activities onsite including cropping and use of machinery.

There would be a low risk of contamination in the event of a chemical spill (fuels, lubricants, herbicides etc.) as storage and emergency handling protocols would be implemented (refer to Section 8.1).

GROUNDWATER AND GROUNDWATER DEPENDENT ECOSYSTEMS

No operational activities would affect groundwater at the proposal site. No groundwater is proposed to be sourced during operation of the solar farm.

There would be no impacts to groundwater or GDEs during the operation phase.

WATER USE

Water use volumes during operation would minimal. Water would be required for staff amenities and may be required for panel cleaning. Panel cleaning may be required in dry conditions when cropping operations in the locality are generating dust. Rain water will be gathered from the O&M building roof and stored within on site tanks, in cases of prolonged drought water would be trucked to site as required.

8.4.3 Safeguards and mitigation measures

Additional measures that would be implemented to manage hydrological, water quality and water use impacts are provided below.

Table 8-6 Safeguards and mitigation measures for water impacts

C: Construction, O: Operation, D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
• Design waterway crossings and services crossing in accordance with the publications: o *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003); and o *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). o *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012) o Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land (NSW DPI, 2012	Design		
• 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
• The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
• All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D

Safeguards and Mitigation Measures	C	O	D
• 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	O	

8.5 FLOODING

8.5.1 Existing environment

The Wellington Local Flood Plan covers preparedness measures, response operations and flood recovery. Flooding can occur at any time of the year in the Wellington area, but floods are most common in the winter months. There have been more floods on the Macquarie River in June, July and August than in any other months. At different times of the year, different mechanisms are responsible for producing floods. Flooding in the Wellington area usually results from:

- Well-developed low-pressure troughs
- Cyclonic depressions
- High-intensity, short-duration convective thunderstorms.

Flooding in Wellington itself is influenced by the magnitude and synchronisation of flows in the Macquarie and Bell rivers. Flood waters enter the town first by surcharging the banks of the Bell River either due to high flows in the Bell River alone, or in conjunction with backwater flooding from the Macquarie River.

The Wellington Local Flood Plan states that the 1955 flood is the largest flood to have occurred in Wellington this century, reaching a height of 14.66m on the Macquarie River gauge, at Wellington Bridge.

The western boundary of the proposal site is located approximately 1.5km east of the Macquarie River. Wuuluman Creek and two of its tributaries occur within the proposal site, which carry surface water in a generally westerly direction. The catchment area of Wuuluman Creek and its tributaries was estimated to be 60.45km^2.

The Wellington Local Flood Plan identifies rural roads that may be affected by local flooding; the only road of relevance to the proposal site is the Mitchell Highway. The Australian Flood Risk Portal (Geoscience Australia, 2017) indicates that water is not detected at the site during any observations (Figure 8-5).

The Floodplain Development Manual 2005 (NSW Government, 2005) sets out state policies and strategies in relation to the management of flood risk and development control in urban and rural floodplain areas across NSW. The proposal site is not located within the 'Flood Planning Area' shown in the Wellington LEP 2012 (Figure 8-6). The Flood Planning Area is the area of land below the Flood Planning Level (FPL) and thus subject to flood related development controls. The FPL is equivalent to the level of a 1:100 average recurrent interval (ARI) flood event, plus 0.5m freeboard.

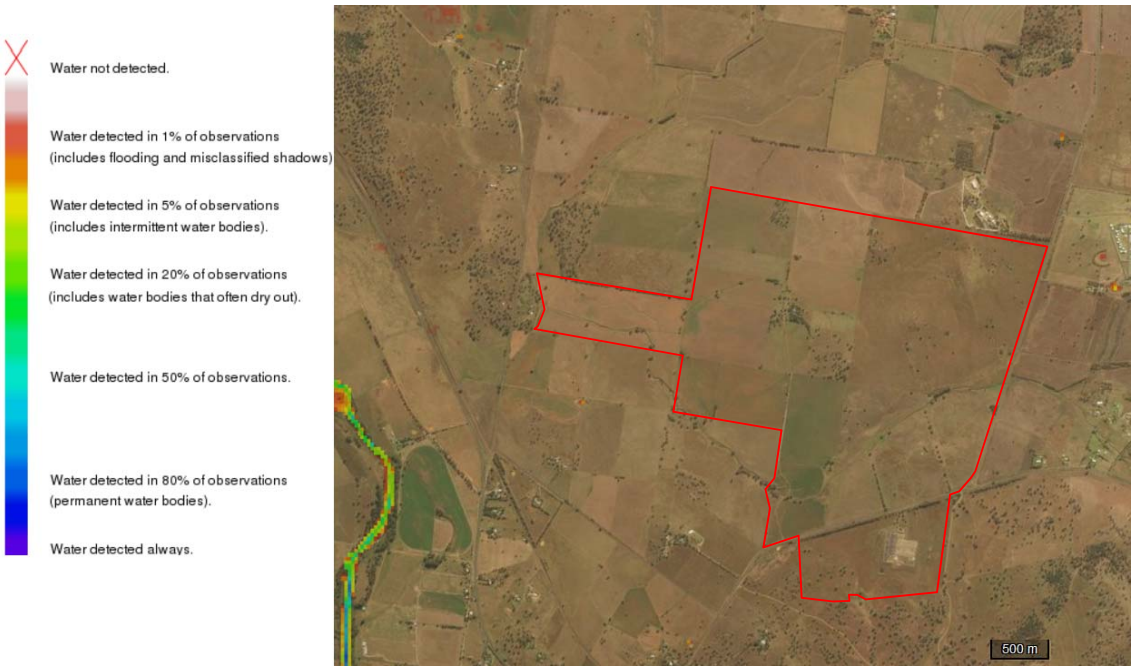


Figure 8-5 Flood Risk Information Map (Geoscience Australia 2017)

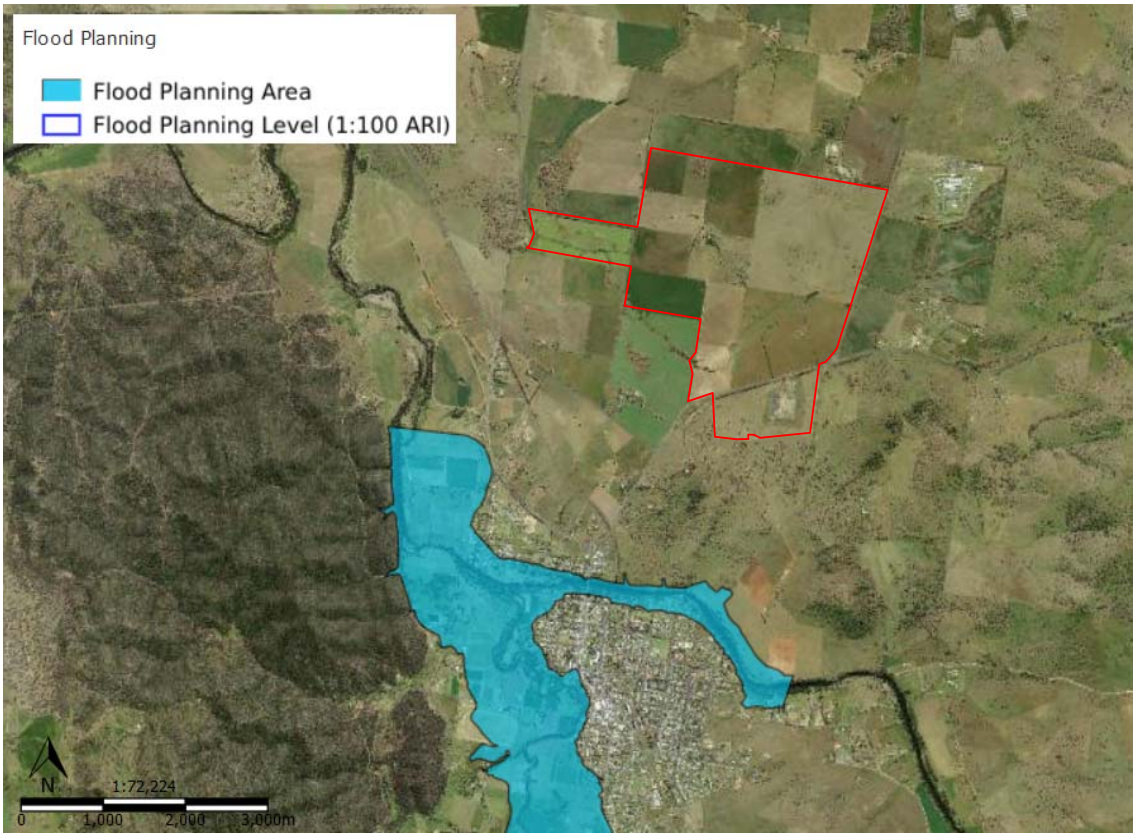


Figure 8-6 Flood Planning Area, DPE Planning Viewer 2017 (Solar Farm proposal boundary in red)

A Hydrological and Hydraulic Analysis Report was prepared by Footprint NSW Pty Ltd on behalf of First Solar Australia to assess potential impacts of the proposal on existing hydrological conditions of the site (Footprint, 2017). The report has been provided as Appendix J. The aims of the report included:

- Define the flood behaviour, including depth of inundation for watercourses within the proposal site
- Guide design including solar array extent and elevation
- Assess the potential impact of the proposal infrastructure on existing flood behaviour.

The scope of works included:

- Review of background information including site survey, topographic maps and proposed development plans.
- Undertake hydrologic calculations to determine peak flows arriving at the site for each watercourse for the 20%, 10%, 5%, 2% and 1% AEP events.
- Undertake hydraulic modelling (using HEC-RAS) to determine the depth and extent of flooding over the each of the three watercourses for each of the above rainfall events.
- Provide a summary of the findings and recommendations in report

The results from the report indicate that the Wuuluman Creek overflow channel within Lot 99 DP 2987 and Lot 1 DP520396 represents an area of high flood risk. Significant overbank flows are predicted to occur within the upper reaches of Wuuluman Creek. Flow depths in excess of 1m are predicted on the right overbank, where the overflow channel exists. Elsewhere, with the exception of within Lot 2 DP807187 where the watercourses merge, flows are largely confined to the watercourses, with overbank flows limited to several hundred millimetres in depth. These overflow results are likely to be an overestimation due to the variable channel profile. The report has been provided as Appendix J.

8.5.2 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.

Construction of the proposal would not substantially affect landforms or watercourses at the site and existing flood patterns are unlikely to be affected.

Parts of the site may be at risk of temporary minor flooding during high rainfall events and high flows through Wuuluman Creek, particularly within the low relief of areas of the site. 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.

The design of buildings, equipment foundations and footings would consider 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.

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

Operation

The proposal would slightly increase flood levels at the site due to the installation of the solar frame piles. The addition of the solar frame piles and their associated infrastructure will result in an increase in surface roughness over the proposal site, from grazed/cropped pasture to a regular grid of steel piles. The hydrology report indicates that an increase in surface roughness would produce localised increases in flood levels in the vicinity of the arrays. This increase is predicted to be in the order of 70mm within the overflow channel along Wuuluman Creek. The predicted changes in flood levels would be limited to the proposal site and are likely to reduce flood levels downstream of the arrays.

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.

Design of footings for electrical componentry will consider flood risk. All infrastructure would be located above the 1% Annual Exceedance Probability (AEP) flood level and would be designed to withstand periods of local flooding. The proposed new substation would be located in close proximity to an existing substation, so risks are considered low. No components are considered susceptible to becoming mobile and entering waterways.

8.5.3 Safeguards and mitigation measures

Table 8-7 Safeguards and mitigation measures for flooding impacts

C: Construction, O: Operation, D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
• 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: o 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, giving regard to the depth and velocity of floodwaters; o The layout of the solar array mounting piers are designed to minimise encroachment within the areas of highest velocity and depth. This may necessitate solar module frame spans in excess of those proposed. o The mounting height of the solar module frames should be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. o All electrical infrastructure, including inverters, should be located above the 1% AEP flood level. o Where electrical cabling is required to be constructed below the 1% AEP flood level it should be capable of continuous submergence in water. o The proposed perimeter security fencing should be constructed in a manner which does not adversely affect the flow of floodwater and		Design	

Safeguards and Mitigation Measures	C	O	D
should designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater.			
• An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the project. The plan would: o Detail who would be responsible for monitoring the flood threat and how this is to be done. o Detail specific response measures to ensure site safety and environmental protection. o 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). o Consideration of site access in the event that some tracks become flooded. o Establish an evacuation point. o Define communications protocols with emergency services agencies.	C	O	D

8.6 RESOURCE USE AND WASTE GENERATION

8.6.1 Resource use and payback

Key resources and estimated quantities (pending the completion of the detailed proposal design) required to construct the proposed solar farm are listed in Table 8-8.

Table 8-8 Resource requirements for the proposal Wellington SF

Resource	Quantity
Gravel (access tracks)	6,900m^3
Sand (bedding for cables)	2,800m^3
Concrete	3,980m^3
Metal (components for mounting system, transmission line poles, inverters, cabling and deliver system containers)	7000t
Glass for panels	258t
Water during construction	9000ML

The majority of the required resources will 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 8.4 of this EIS.

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates

of energy and emissions based on the total life cycle of materials used for a project, i.e. the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A life cycle inventory of polycrystalline PV panels has been undertaken by the International Energy Agency Photovoltaic Power System Program. In their report, Life Cycle Inventories and Life Cycle Assessments of Photovoltaic Systems (IEA-PVPS-T12-04:2015) the 'energy payback time' for thin film modules has been estimated at less than 1 year for a solar installation in Southern Europe. This is consistent with the estimation that the Wellington SF would have an energy payback period of approximately 2 years. Over the panels 30 year lifetime, they are expected to produce less than 18g of greenhouse gas per kWh generated, almost 50% lower than for Csi (Fthenakis *et al.,* 2015).

First Solar is committed to lifecycle management and recycling. They have developed their own module recycling process that results in 90% of the semiconductor material to be reused in new modules and 90% of the glass can be reused in new glass products (First Solar, 2017).

The production of the frames and other system components including cabling would also produce emissions and waste but less than the production of modules. Solar farms are favourable in a number of aspects when compared to the major electricity generating methods employed in Australia:

- CO2 emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the Wellington SF Project.
- Potential to reuse and recycle component parts such as metals and glass from frames and panels.

Reuse, recycling and waste generation

POLICY POSITION

Guidelines for the legal requirements for waste management are stipulated under the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2005*. Unlawful transportation and deposition of waste is an offence under Section 134 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The proposal resource management options would be developed using the *Waste Avoidance and Resource Recovery Act 2001* objectives. Specifically, these would be designed to:

- encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development;
- ensure that resource management options are considered against a hierarchy of the following order:
    I. avoidance of unnecessary resource consumption,
    II. resource recovery (including reuse, reprocessing, recycling and energy recovery),
    III. disposal

Adopting the above principles would encourage the most efficient use of resources, and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development.

CONSTRUCTION WASTE

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:

- 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.

OPERATIONAL 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 Wellington SF.

DECOMMISSIONING

Decommissioning of the site, if undertaken, would involve the recycling or reuse of materials including:

- Solar panels and mounting system
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Buildings and major electrical equipment would be removed for resale or reuse, or for recycling as scrap. 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.

Items that cannot be recycled or reused, such as excess of above, would be disposed of in accordance with applicable regulations and to appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

8.6.2 Potential impacts

Construction and decommissioning

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the proposal are not currently limited or restricted. In 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 8.4.

During decommissioning, all above ground infrastructure and materials would be removed. Underground cables buried at 500mm deep and greater would likely remain in situ. Materials removed from the site would be recycled or otherwise disposed of at approved facilities. 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.

Potential hazardous waste is discussed in Section 8.9.

Operation

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (US Department of Energy, 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the solar farm. Operational waste streams would be very low as a result of low maintenance requirements of the solar farm.

Some balance of system electrical components (e.g. inverters, transformers, electrical cabling) would likely need replacement over the proposed life of the solar farm, requiring further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste during plant operations however, such activities would occur very infrequently and there would be a high potential for recycling or reuse of such waste.

Potential hazardous waste is discussed in Section 8.9. 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. 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.

8.6.3 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 8-9.

Table 8-9 Safeguards and mitigation measures for resource use and waste generation impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: o Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. o Quantification and classification of all waste streams. o Provision for recycling management onsite. o Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). o Tracking of all waste leaving the site. o Disposal of waste at facilities permitted to accept the waste. o Requirements for hauling waste (such as covered loads).	C	O	D
• Septic system is installed and operated according to the Dubbo Regional Council regulations.	C	O	

8.7 COMMUNITY AND SOCIO-ECONOMIC

8.7.1 Background

Socio-economic profile

The proposal site is located within the Dubbo Regional LGA. The surrounding towns include Wellington, Dubbo, Bodangora and Geurie.

DUBBO

The estimated resident population of the Dubbo Regional LGA as at June 30, 2015 was 51,007 people. Between 2005 and 2015 the Dubbo Region estimated resident population increased by 3,969 people (8.44%), with an average annual compound population growth of 0.81% between 2005 and 2015. (Dubbo Regional Council, 2016). Between 2016 and 2036, the population of Dubbo Region is projected to increase by 5,750 people, which is less than the average growth rates experienced over the previous 10 years (DPE, 2016).

The main industries in the Dubbo Regional LGA are health, retail, education, government services, tourism, manufacturing, construction, agriculture, business services and transport (Dubbo Regional Council, 2016). The Region is recognised as a growing mining services centre with mining and exploration projects, both established and emerging, flourishing across the surrounding region (Dubbo Regional Council, 2016). A diversification of industry into the renewable sector has the potential to create new employment opportunities in the area, and increase business activity into the Wellington locality significantly during construction.

The health care and social assistance industry sector is the largest employment sector (3,084 jobs); followed by retail trade (2,467 jobs) and education and training (1,870 jobs) (Dubbo Regional Council, 2016). Workers in Dubbo Region are predominately in the 45 to 54 (23.5%), 35 to 44 (21.8%) and 25 to 34 (18.4%) year age groups, with 4.3% of workers aged 65 years and over.

The unemployment rate in Dubbo is typically below the State average and is currently at 4.9% compared to 5.6% for NSW (Dubbo City 2017). Between 2011 and 2016, the industries with the largest increase in employment, was the health care and social assistance sector (Dubbo Regional Council, 2016). The agriculture, forestry and fishing sector experienced the largest decline in jobs (Dubbo Regional Council, 2016). By August 2018 is estimated that total employment in Dubbo will be at 21,919 jobs, which represents an annualised growth rate of 2.20% (Evocities, 2017).

Socio Economic Indexes for Areas (SEIFA) is a suite of indexes that have been created by the Australian Bureau of Statistics (ABS) from social and economic Census information. Each index ranks geographic areas across Australia in terms of their relative socio-economic advantage and disadvantage, with LGA scores ranging from 121 (most disadvantaged) to 1,193 (least disadvantaged). The SEIFA score for Dubbo Region in 2011 was 961.

WELLINGTON

Wellington is the nearest township to the proposal site, located approximately 2 km to the south. The town of Wellington has approximately 4,500 people and is located 362 km north-west of Sydney and 50km south east of Dubbo (Regional Development Australia – Orana, 2016). Wellington is located at the junction of the Mitchell Highway, Bushrangers Creek Road, Cobbora Road and Goolma Road. The town is located on the Main Western railway line and served by a daily NSW TrainLink XPT service between Sydney and Dubbo.

Agriculture is the key industry in Wellington, with the steeper land to the east supporting mainly grazing activities and the gentle undulating land to the west supporting mainly cereal production. Mining exploration activity is of continuing interest, with a number of mineral deposits within the area (Regional Development Australia – Orana, 2016).

The proposed solar farm would provide opportunity of employment diversification as NSW moves towards a carbon neutral economy by the year 2050. The unemployment rate for the Wellington LGA for 2011 was high at 8.3%, compared to the Australian average of 5.6% (ABS, 2011).

Other large developments in close proximity to the proposal site is the Wellington Correctional Centre, a maximum security prison. It is located approximately 400m east and accessed via Goolma Road. The facility is operated by Corrective Services NSW and employs over 200 staff. The Wellington Airport, also known as Bondangora Airport, is owned and operated by Dubbo Regional Council. It is located approximately 5km north east of the proposal site.

BODANGORA

Bodangora is a small rural locality approximately 10km north east of Wellington and approximately 6 km north east of the Wellington Solar Farm site. The locality of Bodangora is a collection of larger rural properties accessed from Goolma Road. Bodangora has an airfield for small planes and an old cemetery. A wind farm is currently being built in the Bodangora area.

There was no data available from the ABS on population, businesses or number of dwellings in the Bodangora locality.

GEURIE

Geurie is a small village located between Wellington (21km) and Dubbo (29km) on the Mitchell Highway. Geurie is approximately 17km north west of the proposed Wellington Solar Farm site. The village is on the Main Western railway line and served by a daily NSW TrainLink XPT service between Sydney and Dubbo.

At the 2011 census, Geurie had a population of 895. The SEIFA score for Geurie in 2011 was 996, (compared to 961 for the overall Dubbo Region) (REMPLAN, 2017). Geurie has a public swimming pool, cross country mountain biking trails, parks and reserves.

Community attitudes to renewable energy

A high percentage (77%) of Australians believe that large scale solar farms could supply a significant source of Australia's energy requirements (ARENA, 2015). Attitudes in Australia are greatly divided about the visual impacts of large scale solar farms; 30% agree and 26% disagree that large-scale solar farms have a negative visual impact (ARENA, 2015). Approaches to improving community understanding of the visual impacts of large scale installations include (ARENA, 2015).:

- 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.
- Understanding of what steps are needed to prepare the proposed land for the installation and how the condition of the land after decommissioning.

This EIS and the CCP address these issues.

Attitudes towards renewable energy proposals can vary significantly from community to community. Often this is due to lack of information on the ability and efficacy on the renewable energy sector (ARENA, 2015).

Key lessons learned from other solar farm proposals in regards to community and stakeholder engagement was that transparency is essential. Listening to the issues that are important to the community is essential over what issues outsiders (developer) may think are important and fit-for-purpose consultation needs to be a priority (FRV, n.d.). Fit-for-purpose consultation can become a problem in the community consultation phase due to inconsistencies and confusion within the community (FRV, n.d.). Various proposal stages would cause much activity, whilst other stages no consultation activity; this leads to confusion and misconceptions about the proposal, and interest and attitudes were adversely affected (FRV, n.d.).

The International Energy Agency (IEA) reported that the renewable energy sector is now the largest source of installed power capacity in the world, surpassing coal (OECD/IEA, 2016). Large scale solar energy proposals within Australia have been steadily increasing over the last decade (ARENA, 2015).

In 2015, eight major solar farms and five new wind farms become operational in Australia (Clean Energy Council, 2016). The Australia's largest three solar power plants are, Nyngan and Broken Hill (both owned by AGL/First solar), which become operational in 2015 and the Moree SF (owned by FRV) which become operational in 2016 (Clean Energy Council 2016). Currently Australians renewable energy sector is not even halfway towards meeting its 2020 RET (Clean Energy Council, 2016). A $40 billion economic stimulus and potentially over 15,000 jobs opportunities currently exist in the renewable sector to meet the 2020 target (Clean Energy Council, 2016).

In Australia today, electrical consumption is at unprecedented high levels. This is causing great stress on our energy sector with high residential electricity bills and continually disruptions to household electricity in times of peak demand, Australia's demand for clean energy alternatives as seen the renewable energy sector provide 14.6% of Australia's overall electricity, up by 13.5% from 2014 (Clean Energy Council 2016). In May 2016 there were 2500MV of solar power projects under construction or have planning approval, with employment in the sector reaching 14,020 at the end of the 2015 (Clean Energy Council, 2016).

Australia averages the highest average solar radiation potential per square metre in the world (ARENA, 2015). It is expected that strong policy support, climate change mitigation, and quality of information may help change attitudes towards renewables in the future (OECD/IEA, 2016).

Proposal consultation activities and results

Section 5.4 of this EIS details the specific consultation and feedback received so far for the proposed Wellington SF. One issues raised that is not addressed by other sections of this EIS included:

- Two participants raised concerns regarding water supply for their property from watermills that are in close proximity to the development.
- Land value concerns were raised by one community member with regard to another solar farm adjacent to her property.

8.7.2 Potential impacts

Construction

The Wellington SF would assist in providing direct economic stimulus to the Dubbo region, utilising up to 200 staff during peak construction. Many of these would be drawn from the local area, hence increasing employment opportunities. First Solar (Australia) Pty Ltd has a proven track record of hiring local, qualified labour for plant construction and long-term positions for the maintenance and monitoring of daily

operations and considers this to be an important commitment to the community for the development of the Wellington SF. Additional workers, moving to the area temporarily during construction, may stimulate local economic activity directly. Service industries such as the accommodation, retail and tourism industries would be stimulated.

Conversely, the temporary influx may place pressures on local services such as schools, health services and accommodation. Additional traffic may be noticeable and could present an adverse effect on local tourism, if coinciding with local festivals for example. Additional hazards accompany construction traffic (refer to Section 8.1). Mitigation strategies to address these impacts centre on consultation with the community, so that benefits can be maximised, and conflicts resolved where possible.

The solar farm would be a new type of infrastructure for the Dubbo LGA. It would change the character of the site from extensive agriculture to electricity generation. This change in land use can be viewed as either positive or negative within a community depending on the values of each individual, views among the community vary substantially. The development may be viewed as an opportunity for jobs and economic stimulus within the region and sign of protecting the environment through the generation of renewable energy. Alternatively, some community members are hesitant of changes to the rural landscape and would consider the development to be in conflict with the existing environment and scenic values.

The site would be visible to the public during construction, for traffic travelling along Cobbora and Goolma Road and glimpsed from some connecting local roads. Several houses are within 1km of the site but only three would have a direct view of the site. Visual, noise and traffic impacts and mitigation have been discussed in previous sections.

Operation and decommissioning

The development of rural land uses compatible with agricultural activities, such as solar power generation, have potential to provide increased economic security to rural economies through the following means:

- Diversification of employment opportunities and income streams.
- They provide a substitute for carbon emission producing electricity production that is stable and renewable, and consistent with State and National greenhouse emission reduction objectives.

There is a limited amount of information specifically regarding the effect of rural solar farms on local land values. The key land value driver of land value is and has been historically, the agricultural productivity of the area. It is relevant to note that the soil capabilities at the proposal site limit intensive agriculture (refer to Section 8.2). The highly reversible nature of the project aims to ensure that existing land capability is restored during decommissioning. Amenity values, such as views, rural lifestyle and proximity to Wellington, could also be considered to enhance land value. While visual impacts will occur during operations (and will be minimised via specific areas of vegetation screening), they will similarly be reversible during decommissioning.

It is noted that global warming will increase potential evaporation and water demand, potentially reducing the capacity of arable land. Pittock (AGO, 2003) observed that a significant proportion of Australian exports are agricultural products that are sensitive to global warming impacts. Federal Government publications note that failure to adequately mitigate increases in emissions will lead to greater costs for adaptation to the consequences of climate change. In this way the proposal may assist in addressing a threat the productivity and land value on a regional level.

Minimal adverse social-impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be at low levels, 3-4 employees. The additional accommodation and traffic impacts of a number of operational staff are not likely to be noticeable.

Decommissioning is likely to require less staff onsite than for construction. It would offer a similar economic benefit to construction in terms of opportunities for local staff and industries. It may also include local recycling of infrastructure components.

8.7.3 Safeguards and mitigation measures

Table 8-10 Safeguards and mitigation measures for Community and Socio-economic impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
• Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
• Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
• The Community Consultation Plan would be implemented to manage impacts to community stakeholders, including but not limited to: o Protocols to keep the community updated about the progress of the proposal and proposal benefits. o Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.). o Protocols to respond to any complaints received.	C		
• If the ESF is constructed outside the main construction period, a specific community notification procedure would be undertaken to manage any additional impacts of this installation.	C		
• A site inspection is to be undertaken prior to construction to ensure no watermills would be impacted by the proposal.	C		

8.8 AIR QUALITY AND CLIMATE

8.8.1 Existing environment

Air quality

Air quality for the Dubbo Regional LGA is generally expected to be good and typical of that found in a rural setting of NSW. Existing sources of air pollution include vehicle emissions, dust during dry periods, mining activities and agricultural activities, particularly stubble burning and harvest. During colder months, there may be a minimal increase in air contaminants due to smoke emissions from the operation of solid fuel heating. A search of the National Pollutant Inventory (Australian Government, 2017) identified no facilities within the Dubbo Regional LGA that are required to record emissions.

The closest receiver to the proposal site is 560m to the west.

Climate and climate change

The proposal site is located in the Dubbo Regional LGA in NSW. The closest climate data for the region is from the Wellington (D&J Rural) weather station (site number 065034). The following data for this weather station is available from the Bureau of Meteorology (BOM):

- The annual mean maximum temperature is 24.4°C, with a range between 32.9 °C (January) and 15.2 °C (July). The annual mean minimum temperature is 9.4 °C, with a range between 16.9 °C (January) and 2.2 °C (July).[3]
- The annual mean rainfall is 618.7mm. The highest rainfalls generally occur during January, which has an average rainfall of 59.4mm. Lowest rainfalls occur in April, which has an average rainfall of 45mm.[4]
- Wind speeds average between about 3.9 and 8.0 km per hour at 9am, and 7.0 and 11.7 km per hour at 3pm.[5]

Climate change refers to the rise in Earth surface temperatures due primarily to the human use of fossil fuels, which produce carbon dioxide and other greenhouse gases. Other human activities such as agriculture and deforestation also release greenhouse gases and contribute to climate change.

Climate change predictions for Australia include more frequent and hotter hot days and fewer frost days, rainfall declines in southern Australia and more extreme weather events including intense rainfall, severe drought and harsher fires (CSIRO, 2015). 2016 was Australia's fourth-warmest year on record, and March and autumn as a whole were the warmest on record (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).

Climate change is recognised as a key challenge for the Central West Region, specifically changes in rainfall and temperature patterns, expected increases in the frequency and intensity of extreme weather events (floods, storms, heatwaves, frosts) and changes in water sharing arrangements (LLS, 2016). Temperatures have been increasing since about 1970, with the largest increase in temperature experienced in recent decades (OEH, 2014). The projected climate change impacts for the Central West and Orana Region are discussed in OEH (2014) and summarized in Figure for the near future (2030) and far future (2070).

[3] Based on data collected between 1907 – 2017.
[4] Based on data collected between 1881 – 2017.
[5] Based on data collected between 1965 – 2017.

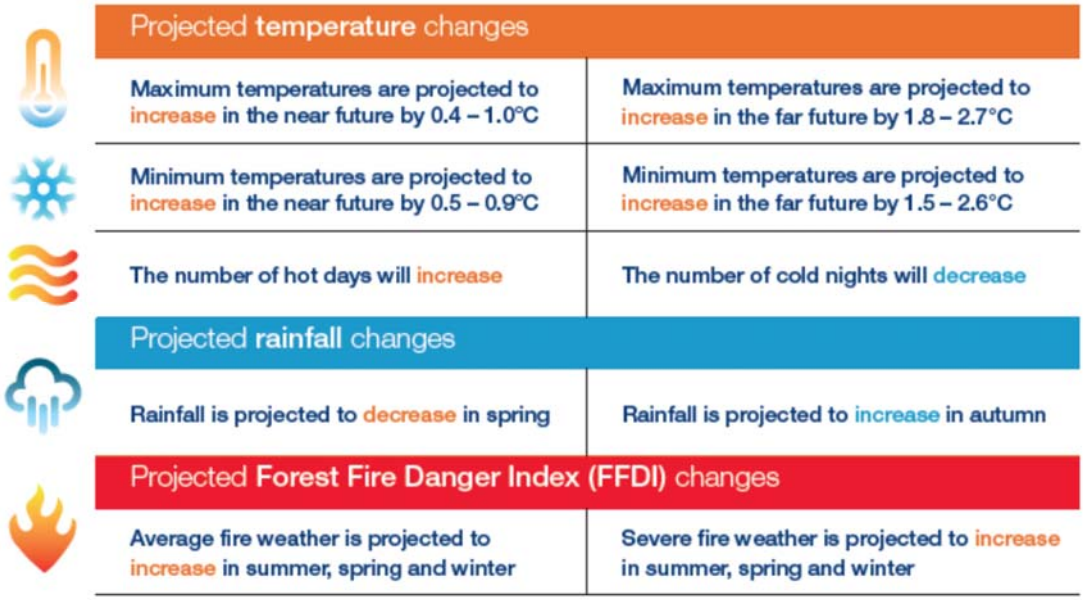


Figure 8-7 Projected climate change impacts for the Central West and Orana region of NSW (OEH, 2014).

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 will be straightforward, but the more transformational adaptive changes may be risky and expensive, especially for individual farmers (Climate Council, 2016).

8.8.2 Criteria

The POEO Act requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m/m^2 are also specified.

8.8.3 Potential impacts

Air quality

CONSTRUCTION AND DECOMMISSIONING

During construction, dust is likely to be generated from excavation activities and other earthworks as well as the movement of trucks and vehicles along unsealed access tracks. Earthwork associated with construction would be relatively minor and mostly involve levelling the ground to construct the access road and laydown areas, and trenching work for cable installation. Posts for the module frames would either be pile driven or screwed which would generate little dust. The impact area for the piles would be less than 1% of the site area.

Traffic using the unsealed roads and tracks during the decommissioning phase would also have the potential to generate dust impacts.

Air emissions would be generated from the use of construction machinery including earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site,

including the daily construction labour force and haulage traffic delivering construction components, would also generate air emissions.

Dust and air emissions can be a nuisance to nearby receivers including residences, farm workers and traffic. 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. Rainfall at Wellington is relatively evenly distributed throughout the year, however evaporation rates in winter would be lower. Construction work during summer months may require greater dust suppression measures to manage any increased impacts.

The construction phase is expected to be approximately twelve months in duration with a peak period lasting six months. With the minor earthworks proposed and implementation of mitigation measures, air quality issues for sensitive receivers would be considered manageable.

OPERATION

Unlike fossil fuel power generation, solar farms have very low air emissions of air pollutants including sulfur dioxide, nitrogen oxides, carbon monoxide and carbon dioxide during the operation phase.

Maintenance activities during operation would result in some minor, localised vehicle emissions and dust generation from vehicles travelling on the unsealed access roads. A groundcover management plan would be implemented to reduce dust production from disturbed areas and planting of the site would provide screening to Goolma Road (Section 7.3). The impacts on local and regional air quality are expected to be negligible during normal operation; during normal operation, 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 be required for maintenance vehicles during operation of the solar farm and for temporary power generation in the event of an unplanned outage. During operation, the proposal would have a positive impact on global climate change by assisting to reduce Australia's reliance on fossil fuels for electricity generation.

Due to the existing minimal impacts on air quality during operation, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 8.10.

Climate and climate change

The proposal would not affect local weather or climate patterns. The proposal would, as part of the transition to renewable energy sources, contribute to reduced greenhouse gas emissions and the mitigation of the negative effects of climate change. On an annual basis, the proposed Wellington SF would provide enough clean, renewable energy for about 46,000 average NSW homes. At the same time, it would displace approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road.

8.8.4 Safeguards and mitigation measures

Table 8-11 Safeguards and mitigation measures for climate and air quality impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• 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

Safeguards and mitigation measures	C	O	D
• Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
• 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

8.9 HAZARDS

An environmental hazard is a thing or situation which can threaten the environment or human health. Hazards may be natural or artificial, or result from the interaction between human activity and the natural environment. Hazards relevant to the proposal and proposal site include risks associated with hazardous goods, electromagnetic fields, aviation impacts, fire, flooding and hail.

8.9.1 Hazardous materials and development

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 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 or operation of the proposed solar farm are identified in Table 8-12, 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 ESF would be located south of the onsite substation (refer to Figure 1-2). 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 8-12 Dangerous goods and SEPP 33 thresholds relevant to the proposal

Hazardous material	Storage threshold	Transport threshold		Storage arrangements for the proposal	Exceeds SEPP 33 thresholds ?
		Movements	Quantities		
Class 2.1 Flammable gases					
LPG	10 tonnes or 16m³ (above ground)	>500 cumulative >30/week	2-5 tonnes	45kg cylinders beside control building, 800 metres from boundary.	No
Class 2.2 Non-flammable, non-toxic gases					
Inert fire suppression gas	NA	NA	NA	Compressed in steel bottles in ESF	No
Class 3 – Flammable liquids (PGII)					
Fuel (petrol)	5 tonnes	>750 cumulative >45/week	3-10 tonnes	Stored in a bunded area, 800 metres from boundary.	No
Class 6.1 Toxic substances (PG II, III)					
Pesticides (herbicides)	2.5 tonnes	All	1-3 tonnes	Secure storage shed 800 metres from boundary.	No
Class 9 Miscellaneous dangerous substances and articles					
Li-ion batteries	NA	>1000 cumulative >60/week	No limit	ESF container in a secure compound 50 metres from boundary.	No

Class 2.2 Non-flammable, non-toxic gases

The inert gas stored in compressed form in the proposed 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 comprise approximately 670 power-packs that include 16 battery pods and 1000 lithium ion cells per pod. The location and description of the ESF is provided in Section 3.2.1. The average life of the lithium-ion PV solar batteries is assumed to be 10 years (Randell Environmental Consulting, 2016). 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 Australian Code for the Transport of Dangerous Goods by Road and Rail (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.

Given the rapid rise of lithium-ion battery use in Australia, including in renewable energy projects and electric cars, cost-effective local recycling may be available at the time of battery replacement or decommissioning. AEMO (2015) predict strong growth in the consumption of lithium-ion batteries for both electric vehicles and PV solar over the next 20 years. This growth will begin to significantly affect the waste stream from 2025 (Randell Environmental Consulting, 2016).

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 8.9.2 below. 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 7.4. 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 (refer section 8.4).

8.9.2 Fire

Existing environment

The proposal site is within the area of operation of the Orana Bush Fire Management Committee (BFMC). A Bush Fire Management Plan (BFMP) has been established for the Orana BFMC area (BFMC, 2011).

The bush fire season in the Orana BFMC area generally commences on the 1st of October and concludes on 31st March. The area experiences warm to hot summers, ranging from 17°C to 34°C, with some extremes exceeding 38°C for many days (BFMC, 2011). Prevailing weather conditions associated with the bush fire season in the Orana BFMC area are North to Westerly winds created by consecutively high pressure systems causing high daytime temperatures.

The Orana BFMC area has on average 250 fires per year, of which 10 – 15 can be considered to be major fires. The main sources of ignition in the Orana BFMC area have been campfires, lightning strikes, electrical power supply lines, agricultural machinery, vehicle exhaust systems when in contact with vegetation on the sides of roads, escaped controlled permit burns, burning of stolen vehicles, arson activity and careless acts by individuals (such as the use of cutting/welding equipment).

The Orana Rural Fire Service team has over 60 Rural Fire brigades, covering an area or 12,803 square kilometres. Fire brigades in the locality include Wuuluman, Maryvale. There a NSW Rural Fire Service station in Wellington town.

The proposal site is currently used for grazing and agricultural purposes and therefore understorey bush fire fuel loads vary from season to season. In terms of existing bush fire hazards onsite, there are several patches of open woodland at the site, and there are some planted rows of trees at several locations within the proposal area. There are several existing powerlines (66 and 132kV) intersecting the site, mostly in a north-south direction and in alignment with the existing Wellington Substation. The existing Wellington Substation is within the proposal site in the south-eastern section. There is one dwelling located near the centre of the proposal site.

A very minor small portion of the proposal area is identified as Bush Fire Prone Land in the NSW Planning Viewer (DPE, 2017) (Figure 8-8). There are several large patches of open woodland that occur immediately north and west of this Lot, which link to larger areas of open woodland to the west and along the Macquarie River.

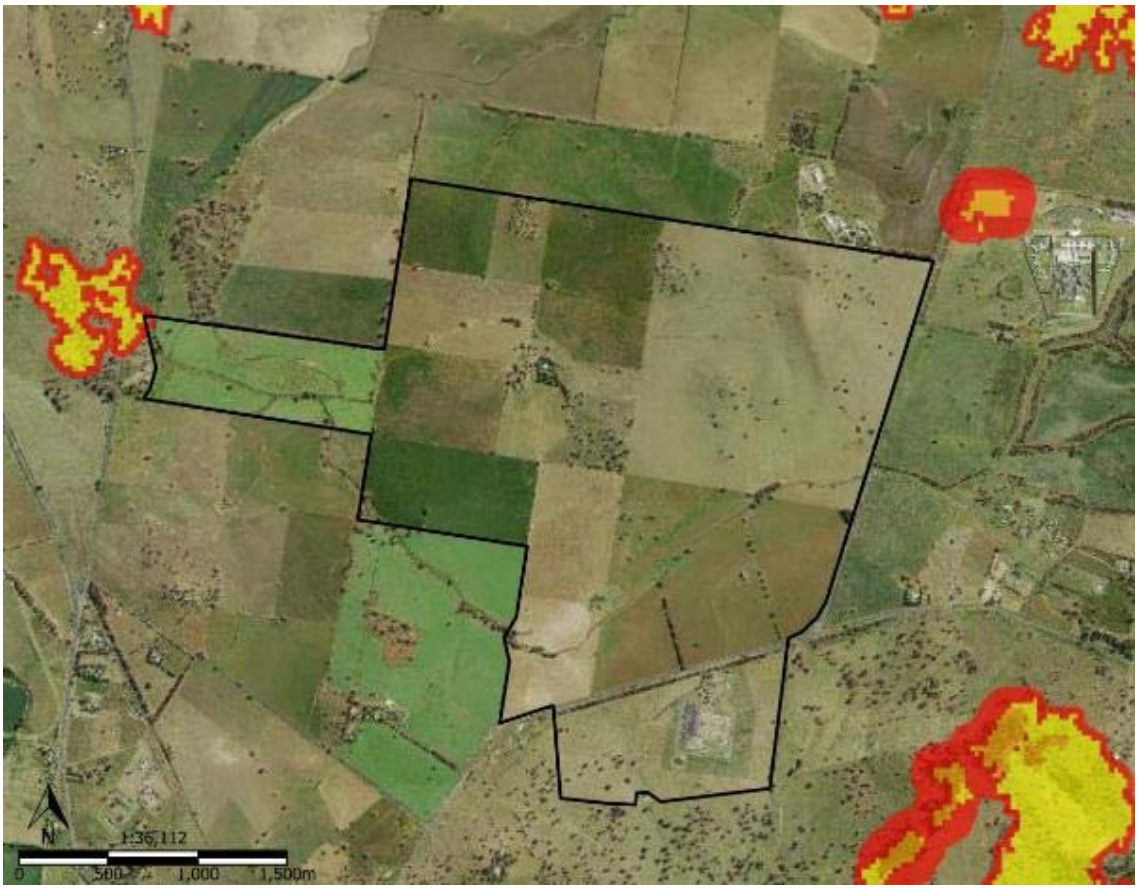


Figure 8-8 Bush Fire Prone Land (proposal site outlined black)(NSW DPE, 2017)

Water resources at the proposal site include farm dams, and water tanks associated with the residential dwelling. Two ephemeral watercourses traverse the site, including Wuuluman Creek.

The effect of anthropogenic climate change on extreme weather, increasing the number of hot days and heatwaves, is driving up the likelihood of very high fire danger weather (Climate Council, 2016).

Potential impacts

BUSH FIRE AND STRUCTURAL FIRE RISKS

Potential bushfire (including grass fire) hazards relate to the risk of the development causing a bushfire and the risk of any bushfires affecting the solar farm. Potential ignition sources associated with construction and decommissioning of the Wellington SF would 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 construction works would take place on flat land in a low fuel environment, in cleared paddocks formerly used for cropping and grazing. The ignition risks listed above are manageable with standard best

practice, and the implementation of additional mitigation measures outlined below. In addition, site access would be formalised at the beginning of the construction phase which would increase the ability to access and suppress any fire onsite or on adjoining sites if required.

The operation phase of the solar farm carries the following potential fire risks:

- Powerline failure or contact with vegetation within clearances
- Overheating in the substation
- Grass fire ignition from vehicles and maintenance machinery.

Bushfire and structural fire risks during operation of the solar farm are considered manageable subject to the control of grass fuels at the site, the appropriate maintenance of equipment, adoption of applicable best practice and technical standards and the implementation of safeguards provided below. Potential ignition sources not associated with the solar farm site would continue to present bushfire risks in the locality, including lightning, machinery, discarded cigarette butts from public road traffic, powerlines and local stubble burn escapes.

Repairs and maintenance activities during the operation of the facility could increase bush fire risk. All electrical components would be designed to minimise potential for ignition. Ground cover beneath panels would be maintained and not allowed to build up to high fuel levels (access and solar input requirements are in line with this activity).

PLANNING FOR BUSHFIRE PROTECTION GUIDELINES

In accordance with Planning for Bushfire Protection (PBP) guidelines (RFS, 2006), an acceptable level of protection from bushfires is achieved through a combination of strategies which:

- Control the types of development permissible in bush fire prone areas
- Minimise the impact of radiant heat and direct flame contact by separating the development from the bush fire hazard
- Reduce the rate of heat output (intensity) of a bush fire close to a development through control of fuel levels
- Minimise the vulnerability of buildings to ignition from radiation and ember attack
- Enable relatively safe access for the public and facilitate fire-fighting operations
- Provide adequate water supplies for bush fire suppression operations
- Implement community education programs, focusing on property preparedness, including emergency planning and property maintenance requirements
- Facilitate the maintenance of Asset Protection Zones (APZs), fire trails, access for firefighting and on-site equipment for fire suppression.

The PBP guidelines provide six key Bush Fire Protection Measures for developments:

a) The provision of clear separation of buildings and bush fire hazards, in the form of fuel reduced APZ (comprising inner and outer protection areas and defendable space)
b) Construction standards and design
c) Appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation
d) Adequate water supply and pressure
e) Emergency management arrangements for fire protection and/or evacuation
f) Suitable landscaping, to limit fire spreading to a building.

CONSTRUCTION AND MATERIALS

The solar farm buildings will be constructed of low combustibility or non-combustible materials suitable for buildings of class 5 to 8 and 10 of the Building Code of Australia (BCA). All electrical components would be designed and managed to minimise potential for ignition. The solar array, which would occupy the majority of the site, would be largely constructed of glass, silicon, steel and aluminium and would have very low flammability.

LITHIUM-ION BATTERY STORAGE

The proposal involves battery storage which would involve the construction of an ESF. This would comprise of power packs that contain lithium-ion cells. All ESF carry risks associated with the uncontrolled release of energy. The location of the ESF is shown on Figure 1-2. It would be surrounded by an Asset Protection Zone (APZ) including gravel surfacing to minimise the risk of fire escaping from the facility and the risk of external fire affecting the facility.

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 predominant types of hazards associated with battery systems are: electric shock, stored energy, chemical, flammable emission, thermal runaway, transportation, kinetic energy and manual handling (ESC, 2016). A lithium-ion based ESF must be designed with proper disconnects, relays, thermal management, enclosures, layout, monitoring and controls to mitigate risks 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 safety 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 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 keeps the cells within the recommended operating temperature range under normal conditions. Excessive overcharging leads to heating within cells that can initiate 'thermal runaway'. Thermal runaway is when stored chemical energy is converted to thermal energy (Hewson and Domino, 2015). This triggers a new chemical reaction through the 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 in 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; i.e. separation distances between cells and including APZs.

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). Lithium-ion batteries 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).

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 (Standards Australia, 2017). Generally an ESF overall system design needs to comprise of numerous individual component blocks that interconnect functionally and safely (Standards Australia, 2017). Lithium-ion fires require specific training, planning, storage, and extinguishing interventions, catering for both progressive burn-off or explosive events (Butler, 2013).

The Wellington Solar Farm would manage the fire risks associated with the ESF by:

- Locating the ESF as far as practicable from any sensitive receivers (residences) 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).
- The design of the enclosure will need to consider temperature stability through installation or ventilation (CEC, 2014).
- Ensure the batteries are not vulnerable to external heat effects in the event of a bushfire.
- Designing appropriate separation and isolation between individual battery blocks and between batteries and other infrastructure, including gravel surfacing around the facility.
- For Australian conditions, the battery enclosure should be located on a south or east facing side of a premises (CEC, 2014).
- Other recommended features are: easily accessible for safety and emergency response, restricted access, vermin-proof and signed appropriately (CEC, 2014).
- Compliance with all relevant guidelines and standards (adaptive elements from AS 4777, see Standards and guidelines below).
- Preparation of a specific Battery Fire Response Plan, under the general Fire Response Plan, in consultation with fire authorities, fire suppression experts, RES' experienced storage team, and in reference to relevant standards and guidelines.
- Facilitation (including funding) of first responder training in the management of lithium-ion battery fires at the site for local brigades.

These features have been addressed in the location of the battery storage area in a readily accessible location on the east of the site, the inclusion of an APZ and design and response protocol requirements. 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. Temperature control would either be air condition units or a thermal management system that uses liquid in power packs to

cool. The fire suppression system within the ESF would comprise the storage and release of inert gas within each battery block using either electrical detectors/ionisers, or a mechanical system in which the heat destroys a seal to release the gas.

Standards and guidelines

Standards Australia has recognised that there is a gap between Australia and International standards in relation to ESF for lithium-ion batteries (Standards Australia Limited 2017). The Australian Standards for design, planning and performance of battery storage will focus specifically on safe operation, location, electrical integrity and communication of ESF. Australian Standards are also currently being assessed for the location, storage and training guidelines for ESF, this is to ensure correct installation and reduce fire risks. Australian Standards recommends adapting elements of AS 4777 for electrical installation procedures to ensure Australian ESF Standards are more in line with international standards (Standards Australia Limited 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).

ASSET PROTECTION ZONES

Appendix 2 of the PBP guidelines provides minimum Asset Protection Zone (APZ) requirements for habitable buildings in residential developments designated as bush fire prone. While the proposal is not residential, these APZ prescriptions would be applied to the solar farm infrastructure to provide defendable space and to manage heat intensities at the infrastructure interface.

The PBP guidelines indicate a minimum APZ width of 10 metres for grassy woodlands (total fuel load 15 tonnes/hectare) and semi-arid woodlands (total fuel load 18 tonnes/hectare) on flat ground. This setback is based on the need to conform to Level 3 construction (AS 3959 – 1999) for a building of Class 1 or 2 under the BCA.

An APZ of minimum width of 10m would be provided around the solar farm buildings, substation and Energy Storage Facility, and around the outside perimeter of the solar array. The 10m APZ setback requirement would also be applied to any woody vegetation plantings undertaken around the perimeter of the solar farm. All of the APZ would be managed as an Inner Protection Area.

The APZ surrounding the proposed Energy Storage Facility and substation would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

FUEL HAZARD MANAGEMENT

According to the PBP guidelines, the APZ should provide a tree canopy cover of less than 15% located greater than 2m from any part of the roofline of a dwelling. Trees should have lower limbs removed up to a height of 2m above the ground. The understorey should be managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season.

There would be no trees or shrubs within the APZ established for the solar farm, or within the solar array area. Grassland Fuel Hazard is a function of grass height and cover, with variation according to curing and species fuel characteristics. Grass fuel would be monitored and managed using stock grazing or mowing to maintain safe fuel levels. Grass height within the APZ would be maintained at or below 5cm throughout the October-March fire season. Grass height outside the APZ, including beneath the solar array, would be maintained at or below 15 centimetres throughout the fire season.

The overhead powerlines at the site would be managed by maintaining appropriate vegetation clearances to minimise potential ignition risks, in accordance with the ISSC 3 Guideline for Managing Vegetation Near Power Lines.

FIRE-FIGHTING RESOURCES AND PREPAREDNESS

A steel or concrete water storage tank would be installed adjoining the main internal access road for fire-fighting and other non-potable water uses. Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity. Suitable fire extinguishers and PPE would be maintained at site buildings.

Safe and efficient access (suitable for firefighting appliances) would be established and maintained over the solar farm site. The APZ around the perimeter of the site would incorporate a 6m wide gravel access track. The perimeter track would comply with the requirements for Fire Trails in section 4.1.3 of the PBP guidelines, including:

- A minimum carriageway width of 4m with an additional 1m wide strip on each side of the trail clear of bushes and long grass
- Capacity for passing using reversing bays and/or passing bays every 200m suitable for fire tankers
- Connection to the property access road and/or to the through road system at frequent intervals of 200m or less.

A Bush Fire Management Plan would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the solar farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through site orientation and information events and the facilitation of training in the management of lithium-ion battery fires. An Emergency Response Plan would also be developed to enable rapid, safe and effective incident response.

CONCLUSION

In view of the likely fire hazards and risks, and subject to the implementation of the safeguards below, the proposal is not considered likely to present a substantial bushfire ignition and structural fire threat, or to represent an unacceptable hazard in the event of a bushfire affecting the site.

8.9.3 Electromagnetic fields

Background

Electromagnetic fields (EMFs) consist of electric and magnetic fields and 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, and while electric fields are insulated by air and insulation material, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. EMF field sources to which people may be exposed are predominantly in three frequency ranges. The Extremely Low Frequency (ELF) range of 0-300 Hz incorporates the 50 and 60 Hz frequencies of the electric power supply and of electric and

magnetic fields generated by transmission lines and other electrical devices and infrastructure (Repacholi, 2003).

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 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.

Exposure to ELF magnetic fields is mostly considered to be harmless, however, a policy of prudent avoidance has been taken to account for any uncertainty. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, 2015) advises that 'the scientific evidence does not establish that exposure to ELF EMF found near power lines is a hazard to human health'.

The International Commission on Non-Ionizing Radiation Protection (ICNPR) published *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz)* in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that will provide protection against known adverse health effects. To prevent health-relevant interactions with 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 will also be met (in the body) (ICNIRP, 2016). Reference levels for occupational and general public exposure are shown in Table 8-13.

Table 8-13 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

Research into electric and magnetic fields undertaken at utility scale photovoltaic 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.

[6] Note the U.S.A electricity supply operates at 60 Hz frequency.

Potential impacts

RECEIVERS

There are approximately 19 residences within 1km of the Wellington SF proposal site, and approximately 169 residences within 2km. The solar farm would be fenced, with no public access. During the operation phase, the solar farm would require a small number of maintenance personnel (1-3 full time equivalent staff) to attend the site. Property owners or farm managers may access the site for short periods for maintenance and stock management.

EMF SOURCES AND LEVELS

Potential for EMF impacts occurs only during the operational phase of the solar farm when electrical infrastructure is capable of generating EMFs. In relation to potential occupational exposure for solar farm personnel, the electromagnetic fields would vary in different locations at the site. The proposal includes the following components that could generate EMFs:

- 132kV to 330kV overhead transmission line
- Underground 22-33kV cables
- 30 to 50 invertor stations up to 5.5MW capacity
- A 132kV to 330kV substation
- The solar array (up to 1.5kV DC).

Typical and maximum EMF levels for these types of infrastructure are discussed below. Strength attenuates with distance from the infrastructure.

Overhead powerlines

Figure 8-9 displays the typical electric fields emitted from different voltage overhead powerlines. The proposal site has existing 132kV powerlines on the southern and eastern boundaries. Most cabling installed for the proposal would be buried and located along the access tracks. A short section of overhead electrical cabling would be used to connect the substation to the existing TransGrid 132kV or 330kV powerline. The existing and proposed overhead powerlines are less than the recommended 5kV/m and 10kV/m limits.

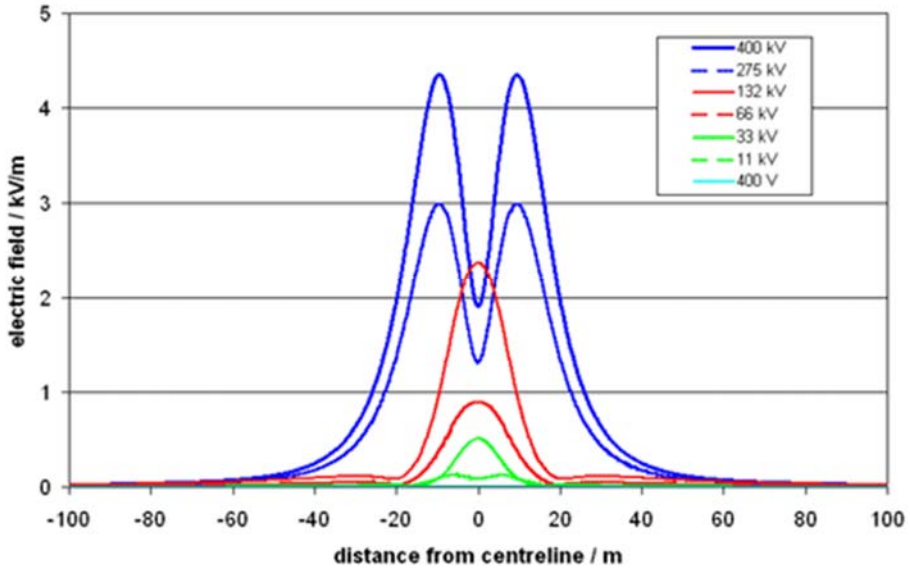


Figure 8-9 Typical electric fields from overhead powerlines (EMFs.info, 2017)

Figure 8-10 and Table 8-14 show a range of magnetic field levels measured by the ARPANSA around powerlines and substations. The existing and proposed overhead powerlines are less than the recommended 200µT and 1000µT limits, even if directly underneath the powerline.

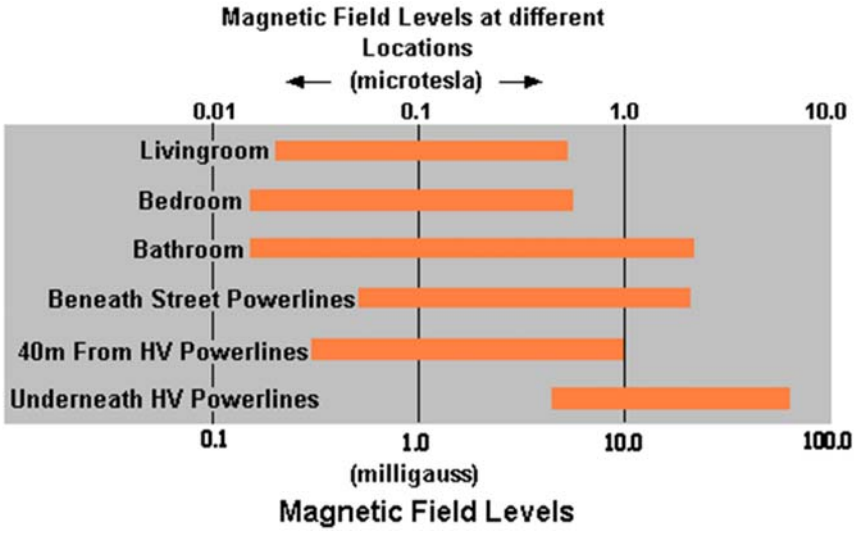


Figure 8-10 Magnetic field levels at different locations (ARPANSA, 2016)

Table 8-14 Typical magnetic fields near overhead powerlines and substations

Source	Location of measurement	Range of measurement	
		(mG)	(µT)[7]
Transmission line	Directly underneath	10 - 200	1 - 20
Transmission line	At edge of easement	2 - 50	0.2 - 5
Substation	At substation fence	1 - 8	0.1 – 0.8

Underground cabling

External electric fields from underground cables are shielded by the soil. EMFs.info (2016) provides typical magnetic field data for a single 33kV underground cable at 0.5m depth. Magnetic fields for this cabling would be under the recommended limits of 200 µT and 1000 µT.

Table 8-15 Magnetic field levels from underground 33kV cabling

Magnetic Field (µT) at distance from centreline			
0 m	**5 m**	**10 m**	**20 m**
1.00	0.29	0.15	0.07

[7] Converted from mG where 1 mG = 0.1 µT.

The solar farm proposal would require the installation of internal reticulated 22kV or 33 kV cabling. During detailed design and construction, the electric and magnetic fields produced by the cable would be maintained at much lower levels than the ICNIRP reference levels for the general public.

Inverters

Between 30 and 50 inverter stations would be installed across the site. The inverters stations would have a total output of 5.5MW. The inverters would have an AC power frequency range between 47 and 63Hz and fall into the Extremely Low Frequency (ELF) range of 0-300Hz. Within this range, EMFs are not considered to be hazardous to human health. In addition, the PCUs would be located within the fenced solar farm site with no public access and would operate only during the day time reducing the total time that EMFs are generated by the infrastructure.

Substation

For the substation and transformers the magnetic fields at distances of 5-10 metres are generally indistinguishable from typical background levels in a home. The fenced exclusion area around the substation components is sufficient to reduce EMF to negligible levels.

Solar array

The solar farm would require installation of DC wiring between panels and the inverters. This cabling would be underground or above ground on cable tray and would conduct around 1500V. The potential for electromagnetic interference as a result of the solar array cabling is considered to be negligible.

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.

8.9.4 Mitigation measures

Table 8-16 Safeguards and mitigation measures for hazards

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Hazardous materials and development			
• Design of the ESF would be undertaken to address fire risks (spacing and setbacks).	Design		
• 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
• Protocols would be developed for lithium-ion battery storage, maintenance, and incident response to mitigate Li-ion fire risks.	C	O	D
• The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and	C	O	D

Safeguards and mitigation measures	C	O	D
'packing instructions' applying to the transportation of Li-ion batteries.			
Fire			
• Develop a Bush Fire Management Plan to include but not be limited to: o Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting) o Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements o Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies o Document all firefighting resources maintained at the site with an inspection and maintenance schedule o Monitoring and management of vegetation fuel loads o 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 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
• Fire risks associated with the Energy Storage Facility would be managed by: o Locating the ESF as far as practicable from any sensitive receivers (residences) or large stands of vegetation. o Installing reliable automated monitoring (voltage and temperature), alarm and shutdown response systems. o Installing reliable integrated fire detection and fire suppression systems (inert gas). o Ensuring the battery buildings/containers are not vulnerable to external heat effects in the event of a bushfire. o Designing appropriate separation and isolation between individual battery containers and between batteries and other infrastructure. o Compliance with all relevant guidelines and standards.	C	O	D

Safeguards and mitigation measures	C	O	D
o Preparation of a specific Battery Fire Response Plan under the general Fire Response Plan, in consultation with fire authorities, fire suppression experts, storage team, and with reference to relevant standards and guidelines.			
• An APZ of minimum 10 metres would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4 metre 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	
• 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	
• Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment will 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		
• The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
• 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	
• 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 possible. Dead end tracks would be signposted and include provision for turning firetrucks.	C	O	D

Safeguards and mitigation measures	C	O	D
• 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 possible hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D
• Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	C	O	D
• Prior to operation of the solar farm, an Emergency Response Plan (ERP) must be prepared in consultation with the RFS and Fire & Rescue NSW. This plan must include but not be limited to: o Specifically addresses foreseeable on site and off site fire events and other emergency incidents. o Detail appropriate risk control measures to mitigate potential risks to the health and safety of firefighters and other first responders o Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. o A copy of the ERP is to be stored in a location directly adjacent to the sites main entry points o Once constructed and prior to operation, the operator is to contact with the relevant local emergency management committee regarding the site.		O	
Electromagnetic fields			
• All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
• All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
• Design of electrical infrastructure would minimise EMFs.	C		

8.10 CUMULATIVE IMPACTS

8.10.1 Existing environment

Cumulative impacts relate to the combined effect of similar or different impacts on a particular value or receiver, and may occur concurrently or sequentially. For these purposes, cumulative impacts are

associated with other known or foreseeable developments occurring in proximity to the proposal. The incremental effects of the proposal on existing background conditions in the study area have been taken into account in the preceding assessment sections.

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

- The Bodangora Wind Farm, 10km north east of the site

The Bodangora WF would also use Goolma Road as travel route. Additionally, the Wellington SF would be adjacent to an existing substation, and the site has existing transmission lines.

It is possible another large scale development could be approved within view of the proposed solar farm, however none are known to be proposed at this time.

8.10.2 Potential impacts

Potential cumulative impacts are primarily associated with the following issues:

- Biodiversity impacts
- Visual and landscape character impacts
- Noise impacts
- Traffic impacts
- Capacity of the electricity transmission network
- Pressures on local facilities, goods and services.

These issues have been assessed individually in relation to the Wellington SF proposal in relevant sections of the EIS. Mitigation measures have been developed for each of the impact areas.

Biodiversity impacts

The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 per cent of the native vegetation in NSW has been cleared or highly modified since European settlement (NSW Scientific Committee, 2011), and the removal of vegetation for the Wellington SF is contributing to this process. The cumulative impact of similar renewable energy projects, particularly where EECs are involved, can be considerable given that many poorly-conserved vegetation communities have a substantial portion of their extents represented on private land where the majority of renewable energy projects are proposed. Small losses of such communities, which may be insignificant at a project level, may accumulate over time to cause a significant reduction in the extent of remnant patches.

Cumulative impacts are considered best addressed by avoiding and minimising. Where avoidance is not possible, the impacts of each contributing project is assessed on a case by case basis. Long term mechanisms like offsetting through the BioBanking assessment methodology, are structured to address the ongoing impacts of multiple projects in a cohesive manner. For the Wellington SF, credits were generated through the BCC, therefore offsetting of biodiversity impacts has been considered.

Visual and landscape character impacts

The visibility of the facility, that translates into the operational view of the solar farm, may generate a cumulative impact with the existing substation and powerlines. The array site and substation require security fencing and steel dominated infrastructure. The mitigation recommended in this report will act to reduce the cumulative impact. Screen planting would be undertaken onsite but outside the perimeter

fencing to minimise views of the fence as well. Visually the receiver along Goolma Road would also increase in vehicles parked on the proposal site, approximately 60 vehicles.

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

Noise impacts

Noise impacts through the use of plant machinery and vehicles would be heightened if the construction of other developments including Bodangora Wind farm and the Wellington Correctional Centre are undertaken concurrently.

However, residential and other noise sensitive receivers are a considerable distance from the proposal area (560m) and construction noise from the Wellington SF are considerable lower than noise management levels (refer to Section 7.4). Cumulative impacts are therefore unlikely to increase construction noise impacts above noise management guideline levels. Overall, cumulative noise impacts are expected to be minor and would be managed within a Noise Management Plan.

Traffic impacts

Cumulative traffic impacts may occur on common construction access and freight transport routes, primarily on the Mitchell Highway and Goolma Road. The Mitchell Highway is a high capacity road designed for heavy vehicle traffic, as is likely to be able to absorb any cumulative impacts of the projects. Cumulative impacts to traffic on Goolma Road are likely to be more noticeable. There would be a significant increase in the amount of heavy vehicles along Goolma Road with the construction of Wellington SF and Bodangora WF. The potential impact from increased traffic and traffic movements to the site would be predominantly limited to construction (approximately 12 months). Cumulative traffics impacts are considered unlikely or would be for a short period of time if there is delays in the Bodangora Wind Farm construction time. Bodangora Wind Farm aims to be operating in the second half of 2018, while construction of the Wellington Solar farm is proposed to commence start of 2019.

During operation, excepting unusual maintenance operations such as inverter or transformer replacement, a small maintenance team using standard vehicles are all that will be required.

Pressures on local facilities, goods and services

There is potential that the possible concurrent construction of the proposal with Bodangora WF would increase pressures on local community services including accommodation. However, there is also potential for positive cumulative economic effects from the construction of multiple developments in the area. As mentioned above, the construction of the Wellington Solar Farm is likely to commence once Bodangora Wind Farm is operational, therefore the socio-economic benefits in relation to both these projects would be a continuous ongoing benefit for the community. The increased creation of jobs and economic input into local businesses would provide a benefit to local communities.

Assessments concluded that the proposal would not result in significant impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. Due to the number of local communities in the area, any cumulative impacts on local services are likely to be spread between communities. There is sufficient residual capacity within the existing communities. It is unlikely that there would be negative cumulative impacts to local facilities goods and services.

Construction

During construction, the additional traffic impact is likely the greatest potential for cumulative impact in regard to potential dust, noise and visual impacts for receivers. There would be an increase in the amount of heavy vehicles using the travel rout The potential impact from increased traffic and traffic movements to the site would be predominantly limited to construction (approximately 12 months).

There would be no cumulative impact of onsite noise and air quality from the concurrent construction of Bodangora WF due to the distance between the sites and low density of receivers in the area.

8.10.3 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 FRAMEWORK

The environmental risks associated with the proposed Wellington SF 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 Plan (PEMP). The PEMP 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 PEMP 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 MITIGATION MEASURES

The mitigation measures contained in this report comprise project-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 project 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 in Table 9-1. 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

C: Construction; O: Operation; D: Decommissioning

No.	Mitigation measure	C	O	D
Biodiversity				
B1	• Hollow-bearing trees within the development site would not be cleared between June and January, to avoid the breeding season of Superb Parrot and Corben's Long-eared Bat and the core hibernation period for Corben's Long-eared Bat. • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure these species do not occur.	C		
B2	• Preparation of a Flora and Fauna Management Plan (FFMP) that would incorporate protocols for: o Protection of native vegetation to be retained o Best practice removal and disposal of vegetation o Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist o Weed management o Unexpected threatened species finds o Rehabilitation of disturbed areas The FFMP would form part of the Wellington Solar Farm Construction Environmental Management Plan (CEMP).	C		

No.	Mitigation measure	C	O	D
B3	• Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree. • Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be clearly demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	C		
B4	• A riparian buffer zone of 10-50m along Wuuluman Creek should be clearly delineated prior to works commencing. Works should be avoided within the riparian buffer zone. • Existing native riparian vegetation is retained to the greatest extent possible in an undamaged and unaltered condition. • Works occurring around the Wuuluman Creek should be in accordance with the DPI Fisheries Policy and Guideline Document *Policies and Guidelines for Fish Habitat Conservation and Management.*	C		
B5	• A groundcover management plan would be developed and implemented to ensure an appropriate perennial ground cover is established and maintained beneath the arrays during operation of the solar farm. This will require consideration of existing groundcover and may require expert input and trials to achieve the objective.	C	O	
B6	• Where possible, landscape plantings will be comprised of local indigenous species with the objective of increasing the diversity of the existing vegetation. Planting locations would be designed to improve the connectivity between patches in the landscape where consistent with landscaping outcomes.	C		
B7	• Carry out refuelling of plant and equipment, chemical storage and decanting off site or at least 50m away from farm dams in impervious bunds. • Ensure that dry and wet spill kits are readily available.	C	O	
B8	• The Construction Environmental Management Plan will include measures to avoid noise encroachment on adjacent habitats such as avoiding night works as much as possible.	C		

No.	Mitigation measure	C	O	D
B9	• Avoid night works. • Direct Lights away from vegetation.	C	O	
B10	• Weed, hygiene and pest management protocols will be prepared and implemented as part of the Flora and Fauna Management Plan for the proposal.	C	O	
B11	• Awareness training during site inductions regarding enforcing site speed limits. • Site speed limits to be enforced.	C	O	
Aboriginal heritage				
AH1	• The development must avoid the site Wellington Scarred Tree 1, as per the current development design plans detailed in this report. A minimum 10m buffer around the tree should be in place to protect the tree given its current condition.	Design		
AH2	• If complete avoidance of the ten artefacts scatters and 15 isolated find sites recorded within the proposal area 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		
AH3	• The collection and relocation of the artefacts should be undertaken by an archaeologist with representatives of the registered Aboriginal parties. A new site card/s will need to be completed once the artefacts are moved to record their new location on the AHIMS database.	C		
AH4	• A minimum 5m buffer should be observed around all sites including those outside the development footprint.	C	O	D
AH5	• As the complete avoidance of PAD1 and PAD2 is not possible, First Solar have agreed that further archaeological research should be undertaken in the form of excavations in order to establish the presence or absence and significance of any sub surface deposits. The excavations would be conducted prior to any development and would be undertaken in consultation with the Registered Aboriginal Parties in compliance with the OEH Code of Practice. A technical report on the results of the testing would be provided and management strategies recommended depending on the outcome.	C		

No.	Mitigation measure	C	O	D
	The testing would be conducted by a qualified archaeologist and members of the registered Aboriginal parties.			
AH6	• First Solar 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		
AH7	• 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		
AH8	• Further archaeological assessment would be required if the proposal activity extends beyond the area of the current investigation. This would include consultation with the registered Aboriginal party and may include further field survey.	C	O	D
Visual				
V1	• Solar farm vegetation screening: o A sparse vegetation screen, 1 -2 rows deep, would be established with reference to Appendix C Proposed onsite screening. o The screen would be comprised of varying native species appropriate to the area and of varying height to soften not block the view of the site. o Breaks in the screen, reflecting natural breaks in existing remnants would be appropriate. o Planting should be undertaken as soon as practical in the construction process depending on the season, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered. o The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.	Pre-construction		

No.	Mitigation measure	C	O	D
	• Residential receiver screening Establish plantings for receivers R2 and R8, in consultation with landowners, based on the as-built views of the solar farm.			
V2	• Where feasible, underground rather than overhead power lines would be considered. • Where feasible, co-location of powerlines would be undertaken to minimise the look of additional power poles. If additional poles are required, these would match existing pole design as much as possible. • The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical: o Proposed new buildings will be non-reflective and in eucalypt green, beige or muted brown. o Pole mounts will be non-reflective. o Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.	Design stage		
V3	• During construction, dust would be controlled in response to visual cues. • Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil. • Ground cover would be maintained beneath the panels and within the site boundary, to break up views of the infrastructure from the side and back views. • Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).	C		
V5	• Maintenance of ground cover beneath panels, to reduce dust. • Minimise traffic movements on unsealed tracks, to reduce dust. • Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).		O	
Noise				

No.	Mitigation measure	C	O	D
N1	• Implement noise control measures such as those suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", to reduce predicted construction noise levels.	C		
N2	• A Noise Management Plan would be developed as part of the CEMP and will specifically target R1 and R7 in order to achieve compliance. The plan would include, but not be limited to: o Use less noisy plant and equipment where feasible and reasonable o Plant and equipment to be properly maintained. o Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. o Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel. o Avoid any unnecessary noise when carrying out manual operations and when operating plant. o Any equipment not in use for extended periods during construction work should be switched off. o 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. o Establish good relations with people living in the vicinity of the site at the beginning of proposal and maintain. Keep people informed, take complaints seriously, deal with complaints expeditiously. The community liaison member of staff should be adequately experienced.	C		
N3	• If the ESF is constructed outside the main construction period, a specific construction noise management plan would be undertaken to manage any additional impacts.	C		
Historic Heritage				

No.	Mitigation measure	C	O	D
HH1	• 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
HH2	• The Narrawa Homestead should not be altered whilst in use as an Office and Maintenance building for the solar farm.	C	O	
HH3	• The existing cultural plantings around the Narrawa Homestead and its driveway should be maintained.	C	O	D
Traffic, transport and road safety				
T1	• The proponent would consult with the Roads and Maritime Services regarding the proposed upgrading of the site access from Goolma Road. The upgrade would be subject to detailed design, and must be designed and constructed to the standards specified by RMS Guidelines.	Design stage		
T2	• A Haulage Plan would be developed with input from the roads authority, including but not limited to: o Assessment of road routes to minimise impacts on transport infrastructure. o Scheduling of deliveries of major components to minimise safety risks (on other local traffic). o Consideration of cumulative traffic loads due to other local developments. o Traffic controls (signage and speed restrictions etc.).	PC		D
T3	• Upon determining the haulage route(s) for construction vehicles associated with the Project, and prior to construction, undertake a Road Dilapidation Report. The Report shall assess the current condition of the road(s) and describe mechanisms to restore any damage that may result due to traffic and transport related to the construction of the Project. The Report shall be submitted to the relevant road authority for review prior to the commencement of haulage.	PC		
T4	• A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Dubbo Regional Council and Roads and Maritime. The plan would include, but not be limited to: o The designated routes of construction traffic to the site.	PC		D

No.	Mitigation measure	C	O	D
	o Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. o Scheduling of deliveries. o Community consultation regarding traffic impacts for nearby residents and school bus operators. o Consideration of cumulative impacts, undertaken consultation with Bodangora Wind Farm. o Consideration of impacts to the railway. o Traffic controls (speed limits, signage, etc.). o Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. o Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.			
T5	• If the ESF is constructed outside the main construction period, a specific traffic management plan would be undertaken to manage any additional impacts.	C		
Land use (including mineral resources)				
L1	• Consultation with local community, to minimise impact of construction of adjacent agricultural activities and access.	C	O	D
L2	• Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	C	O	D
L3	• Consultation with proposal site mineral titleholders regarding the proposal and potential impacts.	C	O	D
L4	• A Rehabilitation Plan would be prepared to ensure the array site is returned to it pre solar farm land capability. The plan would be developed with reference to 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 plan would reference: o Australian Soil and Land Survey Handbook (CSIRO 2009) o Guidelines for Surveying Soil and Land Resources (CSIRO 2008)			D

No.	Mitigation measure	C	O	D
	o The land and soil capability assessment scheme: second approximation (OEH 2012)			
L5	• The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of the landscape.	C		
Soils				
S1	• The array would be designed to allow sufficient space between panels to establish and maintain ground cover beneath the panels and facilitate weed control.	Design stage		
S2	• 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: o Carry out soil testing prior to any impacts, to inform any soil treatments and provide baseline information for the decommissioning rehabilitation. o Install, monitor and maintain erosion controls. o 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. o 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. o 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. o 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		D

No.	Mitigation measure	C	O	D
S3	• 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: o Respond to the discovery of existing contaminants at the site (eg. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements. o Requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 *Protection of the Environment Operations Act*). o Manage the storage of any potential contaminants onsite. o Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation. o Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks. o Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation. o Monitor and maintain spill equipment Induct and train all site staff.	C	O	D
S4	• A Groundcover Management Plan would be developed in consultation with an agronomist and taking account of soil survey results to ensure perennial grass cover is established across the site as soon as practicable after construction and maintained throughout the operation phase. The plan would cover: o Soil restoration and preparation requirements o Species election o Soil preparation o Establishment techniques o Maintenance requirements o Perennial groundcover targets, indicators, condition monitoring, reporting and evaluation arrangements – ie. Live grass cover would be maintained at or above 70% at all times to protect soils, landscape function and water quality. Any grazing stock would be removed from the site when cover falls below this level.	C	O	

No.	Mitigation measure	C	O	D
	Grass cover would be monitored on a fortnightly basis using an accepted methodology. o Contingency measures to respond to declining soil or groundcover condition o identification of baseline conditions for rehabilitation following decommissioning.			
S5	• 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		D
Hydrology (surface and groundwater), water quality and water use				
W1	• Design waterway crossings and services crossing in accordance with the publications: o *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003); and o *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003). o *Guidelines for Watercourse Crossings on Waterfront Land* (NSW DPI, 2012) o *Guidelines for Laying Pipes and Cable in Watercourses on Waterfront Land* (NSW DPI, 2012)	Design		
W2	• 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
W3	• The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
W4	• All potential pollutants stored on-site would be stored in accordance with HAZMAT requirements and bunded.	C	O	D
W5	• 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	O	
Flooding				

No.	Mitigation measure	C	O	D
F1	• 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: o 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, giving regard to the depth and velocity of floodwaters; o The layout of the solar array mounting piers are designed to minimise encroachment within the areas of highest velocity and depth. This may necessitate solar module frame spans in excess of those proposed. o The mounting height of the solar module frames should be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. o All electrical infrastructure, including inverters, should be located above the 1% AEP flood level. o Where electrical cabling is required to be constructed below the 1% AEP flood level it should be capable of continuous submergence in water. o The proposed perimeter security fencing should be constructed in a manner which does not adversely affect the flow of floodwater and should designed to withstand the forces of floodwater, or collapse in a controlled manner to prevent impediment to floodwater.	Design		
F2	• An Emergency Response Plan incorporating a Flood Response Plan would be prepared prior to construction covering all phases of the project. The plan would: o Detail who would be responsible for monitoring the flood threat and how this is to be done. o Detail specific response measures to ensure site safety and environmental protection. o 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). o Consideration of site access in the event that some tracks become flooded. o Establish an evacuation point.	C	O	D

No.	Mitigation measure	C	O	D
	o Define communications protocols with emergency services agencies.			
Resource use and waste generation				
RW1	• A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: o Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. o Quantification and classification of all waste streams. o Provision for recycling management onsite. o Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). o Tracking of all waste leaving the site. o Disposal of waste at facilities permitted to accept the waste. o Requirements for hauling waste (such as covered loads).	C	O	D
RW2	• Septic system is installed and operated according to the Dubbo Regional Council regulations.	C	O	
Community and socio-economic				
C1	• Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
C2	• Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
C3	• Liaison with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
C4	• The Community Consultation Plan would be implemented to manage impacts to community stakeholders, including but not limited to: o Protocols to keep the community updated about the progress of the proposal and proposal benefits. o Protocols to inform relevant stakeholders of potential impacts (haulage, noise, air quality etc.). Protocols to respond to any complaints received.	C		
C5	• A site inspection is to be undertaken prior to construction to ensure no watermills would be impacted by the proposal.	C		

No.	Mitigation measure	C	O	D
C6	• If the ESF is constructed outside the main construction period, a specific community notification procedure would be undertaken to manage any additional impacts of this installation.	C		
C7	• A site inspection is to be undertaken prior to construction to ensure no watermills would be impacted by the proposal.	C		
Air quality and climate				
A1	• 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
A2	• Vehicle loads of material which may create dust would be covered while using the public road system.	C		D
A3	• 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
Hazards				
H1	• Design of the ESF would be undertaken to address fire risks (spacing and setbacks).	Design		
H2	• 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
H3	• Protocols would be developed for lithium-ion battery storage, maintenance, and incident response to mitigate Li-ion fire risks.	C	O	D
H4	• 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
H5	• Develop a Bush Fire Management Plan to include but not be limited to: o Specific management of activities with a risk of fire ignition (hot works, vehicle use, smoking, use of flammable materials, blasting) o Incorporation of fire safety and response in staff and contractor induction, training, OHS procedures and Work Method Statements o Designation of a staff safety officer tasked with ensuring implementation of the plan and regular liaison with firefighting agencies	C	O	D

No.	Mitigation measure	C	O	D
	○ 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 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.			
H6	• An APZ of minimum 10 metres would be maintained between remnant or planted woody vegetation and solar farm infrastructure. The APZ around the perimeter of the site would incorporate a 4 metre 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	
H7	• 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	
H8	• Appropriate fire-fighting equipment would be held on site to respond to any fires that may occur at the site during construction. This equipment will 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		
H9	• The NSW RFS and Fire and Rescue would be provided with a contact point for the solar farm, during construction and operation.	C	O	
H10	• 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	
H11	• 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	C	O	D

No.	Mitigation measure	C	O	D
	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 possible. Dead end tracks would be signposted and include provision for turning firetrucks.			
H12	• 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 possible hot works would be carried out in specific safe areas (such as the Construction Compound temporary workshop areas).	C	O	D
H13	• Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	C	O	D
H14	• Prior to operation of the solar farm, an Emergency Response Plan (ERP) must be prepared in consultation with the RFS and Fire & Rescue NSW. This plan must include but not be limited to: o Specifically addresses foreseeable on site and off site fire events and other emergency incidents. o Detail appropriate risk control measures to mitigate potential risks to the health and safety of firefighters and other first responders o Outline other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site. o A copy of the ERP is to be stored in a location directly adjacent to the sites main entry points o Once constructed and prior to operation, the operator is to contact with the relevant local emergency management committee regarding the site.		O	
H15	• All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
H16	• All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
H17	• Design of electrical infrastructure would minimise EMFs.	C		

10 CONCLUSION

10.1 PROPOSAL OVERVIEW

The proposed Wellington SF would be located approximately 2km north east of Wellington in NSW. The site is accessed directly off Goolma Road. The proposal would connect to the existing substation south of Goolma Road.

The Wellington SF proposal would comprise the installation of a solar plant with an upper capacity of 174MW that would supply electricity to the National Electricity Market (NEM). 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 previous land capability for agricultural or other existing alternative land uses.

10.2 BENEFITS OF AND NEED FOR THE PROPOSAL

The proposal would result in a number of benefits including:

- Generation of enough clean, renewable energy for about 46,000 average NSW homes.
- Displacement of approximately 305,000 metric tonnes of carbon dioxide – the equivalent of taking about 81,000 cars off the road.
- Diversification of fuel sources for electricity generation on the NEM therefore increasing energy security.
- Creation of local job opportunities.
- Injection of expenditure in the local area.
- Exploitation of a new land use thereby diversifying the regional economy.

In summary, there is a clear need for the proposal to meet Australia's greenhouse gas reduction, renewable energy and electricity needs. It will additionally 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
- Visual impact
- Noise impacts

Key concerns raised via community engagement have been addressed in the EIS and proposal design. These include:

- Impact on land value,
- Impacts to agricultural businesses,
- Visual impacts to landscape,
- Glare from the panels,
- Noise emissions during construction,

- Electromagnetic Interference,
- Possibility of increased temperature to the immediate surroundings residents.

All these matters have been discussed directly with the local community and included in this environmental assessment. Overall there has been considerable support for the proposal within the community.

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 4.
- 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 project.

Consideration has been given to the compatibility of the project 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 project and its contribution to meeting our energy needs into the future. Considerations during initial site investigations included:

- Access to electrical network
- Availability of suitably sized lots
- Existing land use and quality
- Soil capability and limitations
- Site vegetation
- Flood risk and location relevant to waterways
- Location of nearby sensitive receivers
- Locality population density

The consequences of not proceeding with the proposed Wellington SF would result in:

- Loss of opportunity to reduce GHG emissions and move towards cleaner electricity generation.
- Loss of a renewable energy supply that would assist in reaching the RET.
- Loss of additional electricity generation and supply into the Australian 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. It would not result in significant impacts to environmental, cultural, social and economic values. Furthermore, the proposal is consistent with the principles of Ecologically Sustainable Development and forms an important part of Australia's transition to renewable energy generation.

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