



Environmental Impact Statement

BERYL SOLAR FARM



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Certification

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:

Jane Blomfield, NGH Environmental

Applicant:

Tom Best, First Solar

Proposed Development:

The Beryl Solar Farm proposal includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 95 Megawatts of electricity, and associated infrastructure.

Land to be developed:

The Beryl Solar Farm proposal site would be located on Lot 20 DP 1173059, Lot 1 DP 1012926, Lot 1 DP 190927 and Lot 1 DP 1016556, Beryl.

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.

Name: Jane Blomfield, Lead author

Signature:



Date: 22/3/2017

TERMS AND DEFINITIONS

ABS	Australian Bureau of Statistics
AC	Alternating Current
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHCRP	<i>Aboriginal cultural heritage consultation requirements for proponents 2010</i>
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASL	Above Sea Level
BAR	Biodiversity Assessment Report
BBAM	Biobanking Assessment Methodology
BCC	BioBanking Credit Calculator
BOM	Bureau of Meteorology
BOS	Balance of Systems
BOS	Biodiversity Offset Strategy (in BAR)
CBFMP	Cudgegong Bush Fire Management Plan
CEEC	Critically Endangered Ecological Community
CCP	Community Consultation Plan
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Application
dB	Decibel
DC	Direct current
DECC	Refer to OEH
DECCW	Refer to OEH
DEMP	Decommissioning Environmental Management Plan

DoE	Department of the Environment (Commonwealth)
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EECs	Endangered Ecological Communities
EIA	Environmental impact assessment
EIS	Environmental Impact Statement
ELF	Extremely Low Frequency
EMFs	Electromagnetic fields
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPL	Environment Protection Licence
ESD	Ecological Sustainable Development
FBA	Framework for Biodiversity Assessment
FM Act	<i>Fisheries Management Act 1994</i>
GDE	Groundwater Dependant Ecosystem
GHGs	Greenhouse Gases
GW	Gigawatts
ha	hectares
HAZMAT	Hazardous Material
Hz	Hertz
ICNG	NSW Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEA	International energy Agency
INP	Industrial Noise Policy
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
kL	kilolitre

km	kilometres
kV	kilovolts
LALC	Local Aboriginal Land Council
LCA	Lifecycle Analysis
LCU	Landscape Character Unit
LEP	Local Environment Plan
LGA	Local Government Area
LMZ	Landscape Management Zone
m	Metres
m/s	Metres per second
mm	Millimetres
MNES	Matter of National Environmental Significance
MW	Megawatt
NEM	National Electricity Market
NHMRC	National Health and Medical Research Council's
NOW	NSW Office of Water
NPW Act	National Parks and Wildlife Act 1974
NSW	New South Wales
EPA	Environmental Protection Authority
O&M	Operation and Maintenance
OEH	Office of Environment and Heritage
OEMP	Operational Environmental Management Plan
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
PCTs	Plant Community Types
PV	Photovoltaic
RBL	Rating Background Level
RE Act	<i>Renewable Energy (Electricity) Act 2000 (Commonwealth)</i>
RET	Renewable Energy Target

RFP	Request for Proposal
RMS	(NSW) Roads and Maritime Services, formerly Roads and Traffic Authority (RTA)
RNP	Road Noise Policy
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
SEPP (Infrastructure)	<i>State Environmental Planning Policy (Infrastructure) 2007</i> (NSW)
SF	Solar Farm
SHI	NSW State Heritage Inventory
sp/spp	Species/multiple species
SRD SEPP	<i>State Environmental Planning Policy (State and Regional Development) 2011</i> (NSW)
SSD	State Significant Development, as defined by section 89C of the EP&A Act (<i>c.f.</i>)
TMP	Traffic Management Plan
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)
UFP	Unexpected Finds Protocol
VDV	Vibration Dose Values
VIA	Visual Impact Assessment
VLM	Visual Landscape Management
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WM Act	<i>Water Management Act 2000</i>
WMP	Waste Management Plan
WSP	Water Sharing Plans
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 Beryl Solar Farm (the 'Proposal'). The proposed photovoltaic (PV) solar farm would have an upper capacity of 95 Megawatts (MW) of electricity generation. NGH Environmental has prepared this EIS on behalf of the proponent, First Solar 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).

PROPOSAL OBJECTIVES

The objectives of the Beryl Solar Farm (Beryl SF) are to:

- Select a 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.
- 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 NEED AND BENEFITS

The proposed Beryl SF would support Australia in its efforts toward achieving 23.5 per cent of its energy from renewable resources by 2020. Additionally, it would further establish regional NSW as a leader in renewable energy. On an annual basis, the proposed Beryl SF would provide enough clean, renewable energy for about 28,000 average NSW homes. At the same time, it would displace approximately 183,000 metric tons of carbon dioxide; the equivalent of taking about 49,000 cars off the road.

The proposed Beryl SF would provide the following benefits, specific to Australia's environmental commitments:

- Reduction in greenhouse gas emissions required to meet our energy demands.
- Assisting the transition towards cleaner electricity generation.
- Direct contribution to help in meeting the Renewable Energy Target (RET).

At a State level, the proposed Beryl SF proposal is consistent with current goals and targets for renewable energy generation in NSW. These include:

- Goal 22 of the NSW 2021: A plan to Make NSW Number One (NSW Government 2011). *Contribute to the national renewable energy target [i.e. 20% renewable energy supply] by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*
- The three goals of the NSW Renewable Energy Action Plan (NSW Government 2013) which include:
 1. Attract renewable energy investment and projects.
 2. Build community support for renewable energy.
 3. Attract and grow expertise in renewable energy.

Additionally, the proposal would allow for the provision of significant economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. 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. Working alongside the selected EPC contractor, this remains an important commitment by First Solar for the Beryl SF. The Beryl SF would also provide embedded electricity generation, to supply into the Australian grid closer to the consumption centres.

For the life of the project, the proposal would harness a natural resource (solar energy). While the activity would impact on land available for primary production during construction and operation, being fully reversible at the end of the project's life, the land would be available for continued agricultural production or alternative land uses, after decommissioning. While occupying a large area of land, being mounted above the ground, most of the solar array infrastructure requires limited ground disturbance.

PROPOSAL DESCRIPTION

The proposed Beryl SF site is located approximately 6km west of Gulgong and 80km east of Dubbo, within the locality of Beryl and the Mid Western Local Government Area (LGA). The site would be accessed directly off Beryl Road, on the northern site boundary adjacent to the existing Beryl Substation.

The Beryl SF proposal site would be located on Lot 20 DP 1173059 and Lot 1 DP 1012926, Beryl. The site is approximately 332ha and is used for grazing and cropping purposes. The majority of the site is derived from a community of conservation significance: Box Gum Woodland Endangered Ecological Community (EEC). Although tree cover has been removed across most of the site, the vegetation community, which can include derived grasslands, remains present across some of the site, mostly in low condition. The low condition EEC has limited potential for regeneration after a long history of grazing; only one tree species is present in low abundance and this is not dominant species of the EEC. Understorey vegetation is highly modified.

Three existing electricity transmission lines pass through the proposal site, mostly in a north-south direction and in alignment with the existing Beryl substation. The existing Beryl Substation is directly adjacent to the proposal site within the north-western section. In the centre of the site, a raised embankment indicates the location of the former railway line which passes through the proposal site in an east-west direction. Most of the railway line infrastructure has been removed; some concrete beams are present in the centre of the site. One house is located within the north-eastern section of the proposal site. Stock yards and two sheds are located on site.

Site suitability

The proposed Beryl SF site represents an ideal location for the deployment of photovoltaic generation.

- The site is predominately flat cleared land that has been highly modified by a long history of cropping and grazing activities.
- Despite proximity to water sources, more of the site (and surrounding area) is grazed than cropped, indicating lesser agricultural capability; these sandy soils present an ideal site for the installation of the driven piles used to support PV modules.
- The Irradiance levels at the site are consistently high and when combined with the humidity of the region provide an impressive capacity factor of 28%.
- The site directly connects the existing TransGrid Beryl Substation, a robust connection point for the injection of electricity to the National Electricity Market (NEM).

Solar farm

The key infrastructure for proposal would include:

- PV modules (solar panels).
- Single Axis horizontal tracking (likely) or fixed mounting frames.
- 22-40 inverter stations with associated transformer.
- An onsite substation containing one main transformer and associated switchgear.
- A 66kV transmission line to the adjacent existing Beryl Substation (300m).
- Modifications of existing Beryl Substation, including civil and electrical works.
- Underground electrical conduits and cabling to connect the inverters to the onsite substation
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access track off Beryl Road.
- 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.
- Native vegetation screening, where required to break up views of infrastructure for specific residences.

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 workers 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 150 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

Subdivision

The subject land comprises two allotments with the legal description of Lot 1 DP 1012926 and Lot 20 DP 1173059, Beryl Road, Beryl. It is proposed to:

- Consolidate land contained within Lot 1 with Lot 20. This land will contain the proposed solar farm development, and
- Excise the existing dwelling and surplus land with an area of approximately 12ha from Lot 20. The dwelling will remain in the ownership of the current landowners and will not be associated with the solar farm development.

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 four environmental aspects as key risks. Specialist investigations were subsequently undertaken in these areas as part of this EIS:

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

These issues are discussed in Section 6 of this EIS and specialist assessments are appended to the EIS. Lower risk issues are discussed in Section 7, primarily by desktop assessment.

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 (FBA) - NSW Biodiversity Offsets Policy for Major Projects* (Office of Environment and Heritage 2014). One Plant Community Type (PCT) was identified in the development site, *Rough-barked Apple – red gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions* (PCT281). This vegetation forms part of the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995* (TSC Act). No Critically Endangered Ecological Community (CEEC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) would be impacted.

Three threatened species listed under the NSW TSC Act were identified during surveys including Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Silky Swainson-pea (*Swainsona sericea*) and Pine Donkey Orchid (*Diuris tricolor*). Silky Swainson-pea and Pine Donkey Orchid were identified outside the proposal development footprint.

The layout has been revised twice and now excludes impacts on higher value Box-Gum Woodland EEC on the project site's western corner and most of the higher value EEC associated with the site's central laneway north-south. Residual impacts are mostly in low condition EEC including approximately 94 trees (about 30% of these would be considered mature). The low condition EEC has limited potential for regeneration after a long history of grazing; only one tree species is present in low abundance and this is not dominant species of the EEC. Groundcover vegetation is highly modified with a low percentage of native species. Mitigation measures which have been outlined to further to reduce the impacts to biodiversity. A 'worst case' offset requirement calculation has generated 684 ecosystem credits, in accordance with the FBA. Regarding offsetting the impacts of this proposal it is noted that the solar array

panels will modify not remove vegetation through shading, however for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed.

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 six artefacts in five site occurrences.

It is possible that additional stone artefacts could occur within the proposed development footprint. However, based on the land use history of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the solar farm and powerline easement areas. The archaeological features have been recorded as an artefact scatter (Beryl Solar Farm AS1) and four isolated finds (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3 and Beryl Solar Farm IF 4).

No additional archaeological investigations are considered to be required. The four isolated finds and one artefact scatter would be salvaged prior to development of the project by an archaeologist with representatives of the registered Aboriginal parties.

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 third 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, R2, R6, R9 and R10. 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.

Visual

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 (no date). 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.

Generally, the low height infrastructure and onsite screening will minimise the view shed, and therefore visual impact will be low at most locations assessed. A medium impact was determined for six

representative viewpoints. While mitigation is required for high impact locations (none of which were identified), in this instance mitigation has been suggested for specific medium impact locations, to address community expectations. Onsite vegetation screening is proposed to break up views of the proposed infrastructure for residences located to the north. This would reduce the impact to a low and acceptable level at all locations.

Lower risk issues

Ten lower risk issues were investigated, primarily using desktop assessment, in Section 7 of this EIS and include:

- Soil.
- Water use and water quality (surface and groundwater) and hydrology
- Traffic, transport and road safety.
- Land use impacts (including mineral resources)
- Historic heritage.
- Resource use and waste generation.
- Community and Socio-economic
- Climate and air quality.
- Magnetic fields
- Bush fire risk.

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 6 and 7 and summarised in Section 8.2 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 proposed Beryl SF would provide the following benefits:

- Reduce greenhouse gas emissions required to meet Australia's energy demands.
- Assist in the transition towards cleaner electricity generation.
- Directly contribute to helping in meeting the RET.
- Create significant economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. 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.

- Embed electricity generation, to supply into the Australian grid closer to the consumption centres.

The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. The proposal is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous land capability. The proposal would make a long-term contribution to meeting the energy demands of Australians, using renewable sources that would offset emissions generated through the burning of fossil fuels. 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 Beryl Solar Farm (henceforth Beryl SF or the 'proposal'). The proposed photovoltaic (PV) solar farm would have an upper capacity of 95 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 25 January 2017 (refer Appendix A).

1.2 PROPOSAL OVERVIEW

1.2.1 Site location

The proposed Beryl SF site is located approximately 6km west of Gulgong and 80km east of Dubbo, within the locality of Beryl and the Mid Western Local Government Area (LGA). The site would be accessed directly off Beryl Road, on the northern site boundary adjacent to the existing Beryl Substation.

The site is approximately 332ha in area. It is used for grazing and cropping purposes. The majority of the site is derived from a community of conservation significance: Box Gum Woodland Endangered Ecological Community. Although tree cover has been removed across most of the site, the vegetation community, which can include derived grasslands, remains present across some of the site.

In the centre of the proposal site, a raised embankment indicates the location of the former railway line. The raised embankment passes through the proposal site in an east-west direction. Most railway line infrastructure has been removed.

Three existing electricity transmission lines pass through the proposal site. These are mostly in a north-south direction. An existing substation, Beryl Substation, is located immediately adjacent to the north west section of the proposal site.

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.

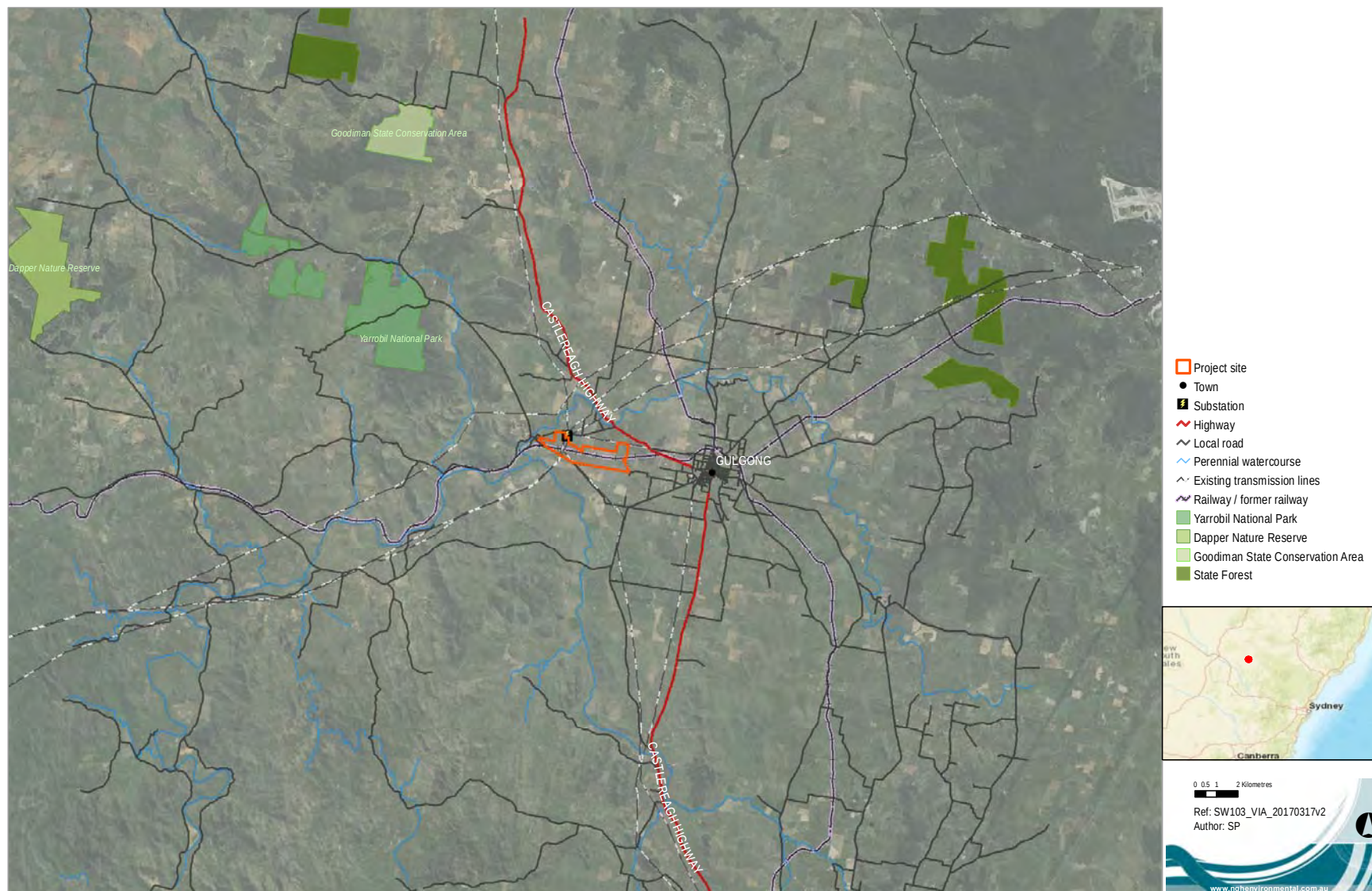


Figure 1-1 Location of the project

1.2.2 Key components of the proposal

The Beryl SF proposal would include the installation of a solar plant with an upper capacity of 95 MWac that would supply electricity into the National Electricity Market (NEM). The power generated would be fed by a proposed transmission line to the existing Beryl Substation, adjacent to the proposal site. On an annual basis, the proposed Beryl SF would provide enough clean, renewable energy for about 28,000 average NSW homes while displacing approximately 183,000 metric tons of carbon dioxide.

First Solar (Australia) Pty Ltd proposes to develop approximately 206ha of the 332ha proposal site. The Beryl SF would include the following elements:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation (66kV).
- Modifications of existing Beryl Substation, including civil and electrical works.
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

Refer Section 3.2 for further detail on these elements.

The Beryl SF is expected to operate for around 30 years. The construction phase of the proposal is expected to take twelve months. After the initial operating period, the solar farm would either be decommissioned or repowered with new PV equipment for continued solar power generation. At the end of the project's life, existing land capability would be restored, including removing all above ground solar plant infrastructure.

The Beryl SF design and construction, operation and decommissioning requirements are described in more detail in Section 3. 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 current layout has been determined following the outcomes of the assessments in this report, particularly the biodiversity assessment which resulted in removing arrays from the western portion of the site to minimise impacts on threatened communities and species (refer Appendix B for original and current layout).

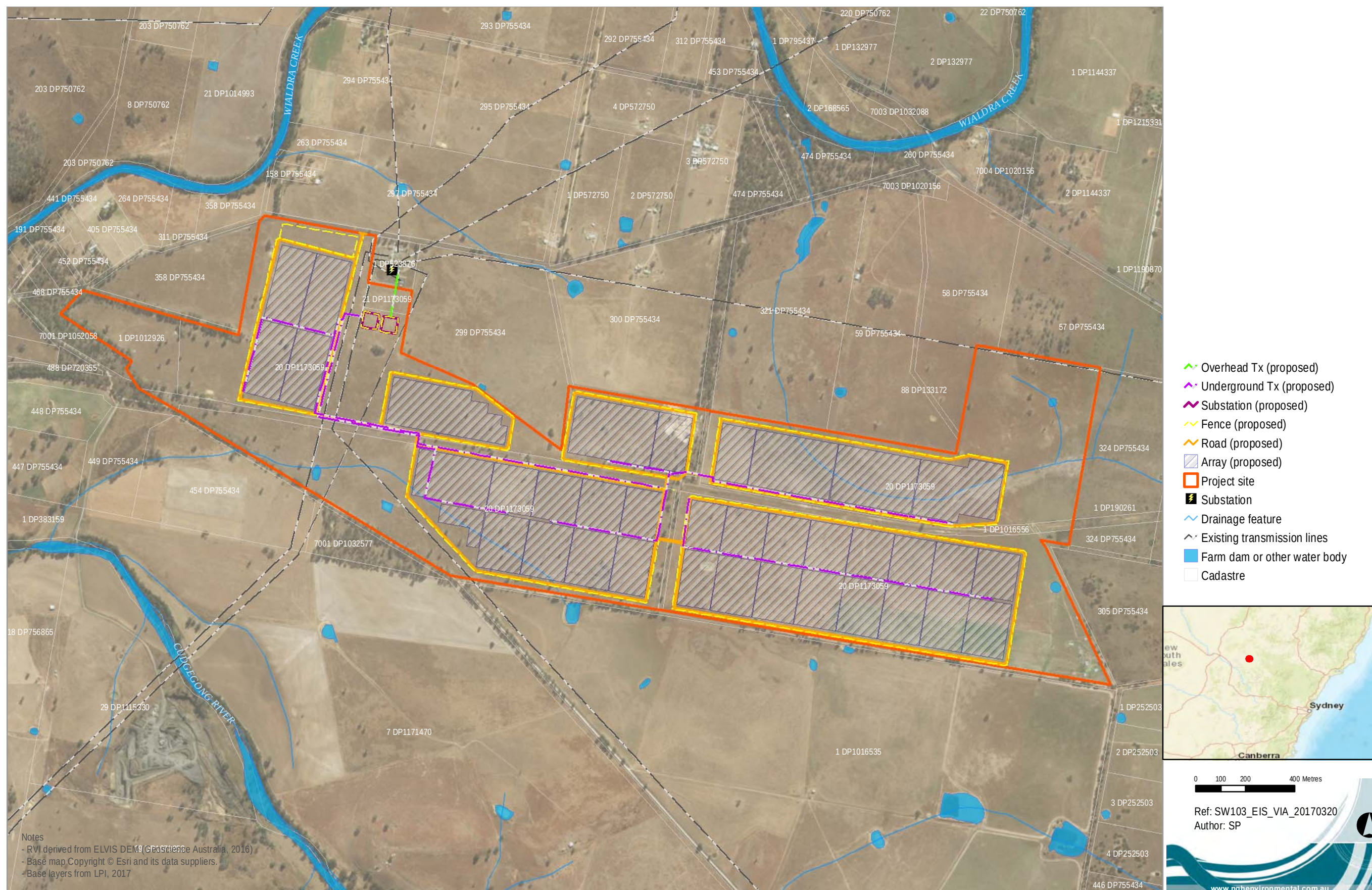


Figure 1-2 Indicative layout

To facilitate the solar farm development, subdivision of the land must occur. The subject land comprises two allotments with the legal description of Lot 1 DP 1012926 and Lot 20 DP 1173059, Beryl Road, Beryl. Details of the proposed subdivision are included in Section 3.

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 17Gigawatts (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 Beryl SF (First Solar 2017).

2 JUSTIFICATION AND BENEFITS OF THE PROPOSAL

2.1 PROJECT OBJECTIVES

The objectives of the Beryl SF are to:

- Select a 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.
- 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.

2.2 PROJECT NEED AND BENEFITS

The proposed Beryl SF would support Australia in its efforts toward achieving 23.5 per cent of its energy from renewable resources by 2020. Additionally, it would further establish regional NSW as a leader in renewable energy. On an annual basis, the proposed Beryl SF would provide enough clean, renewable energy for about 28,000 average NSW homes. At the same time, it would displace approximately 183,000 metric tons of carbon dioxide – the equivalent of taking about 49,000 cars off the road.

The proposed Beryl SF would provide the following benefits, specific to Australia's environmental commitments:

- Reduction in greenhouse gas emissions required to meet our energy demands.
- Assisting the transition towards cleaner electricity generation.
- Direct contribution to help in meeting the Renewable Energy Target (RET).

At a State level, the proposed Beryl SF proposal is consistent with current goals and targets for renewable energy generation in NSW. These include:

- Goal 22 of the NSW 2021: A plan to Make NSW Number One (NSW Government 2011).
Contribute to the national renewable energy target [i.e. 20% renewable energy supply] by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources
- The three goals of the NSW Renewable Energy Action Plan (NSW Government 2013) which include:
 1. Attract renewable energy investment and projects.
 2. Build community support for renewable energy.
 3. Attract and grow expertise in renewable energy.

Additionally, the proposal would allow for the provision of:

- Significant economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. 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. This remains an important commitment by First Solar for the Beryl SF.
- Embedded electricity generation, to supply into the Australian grid closer to the consumption centres.

For the life of the project, 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 fully reversible at the end of the project's life. Being mounted above the ground, most of the solar array infrastructure required limited ground disturbance. Therefore, it would not remove the potential to use the land for primary production (or some alternative land use) at the end of the solar farm's life. Upon decommissioning, all above ground infrastructure, and any infrastructure below the ground surface to a depth of 500mm, would be removed, returning the site to its current land capability.

2.3 OPTIONS CONSIDERED

2.3.1 The 'do nothing' option

The consequences of not proceeding with the proposed Beryl 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 Beryl site represented the best 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 structure

- Site vegetation
- Flood risk and location relevant to waterways
- Location of nearby sensitive receivers
- Locality population density

2.3.3 Technology alternatives

Solar farm technology options considered for the Beryl 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

First Solar modules were assessed during the development of the project as they require a smaller footprint and have a higher energy yield. 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.

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 (1-25 kW) 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 up to 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 manufacturers such as SMA, Ingeteam and GE.

For this project, 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 enables 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 systems are generally installed on steel piles that have been driven or screwed into the ground and there is generally very little ground disturbance associated with the pile installation.

Table 2-1 A comparison of the benefits of the different mounting technologies is included below.

Element	Fixed	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 Beryl site and is what is proposed, however the final supplier and technology is yet to be selected.

2.3.4 *Size of proposal*

First Solar have undertaken extensive grid modelling to determine the optimal size of the Beryl SF to ensure constraint free operation and dispatch into the National Electricity Market. 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 project. The current plant design includes First Solar's thin film modules mounted on a single axis tracking structure connected to 1500V central inverters.

The environmental impact assessment (as assessed within this EIS) is precautionary, has considered long term impacts that may result for future generations, assesses and manages for the conservation of biological diversity and values natural services and assets. As such, with the suite of management measures developed in this EIS that now form part of the proposal, the proposal is considered to be ecologically sustainable and justifiable.

3 DESCRIPTION OF THE PROPOSAL

3.1 OVERVIEW

The proposal is for the construction of a solar farm. To facilitate the development of the solar farm, subdivision of land must also occur. These project components are addressed separately in this section.

3.2 PROPOSAL SITE

The Beryl SF proposal site would be located on Lot 20 DP 1173059 and Lot 1 DP 1012926, Beryl. The site is approximately 332ha and is used for grazing and cropping purposes. Access to the Beryl SF proposal site would be by an upgraded existing farm access track from Beryl Road at the northern site boundary and adjacent to the existing Beryl Substation. This is a sealed Mid Western Regional Council road. The southern boundary is bounded by unsealed local Council roads: Spring Ridge Road and Perseverance Lane.

Three existing electricity transmission lines pass through the proposal site, mostly in a north-south direction and in alignment with the existing Beryl substation. The existing Beryl Substation is directly adjacent to the proposal site within the north western section. In the centre of the site, a raised embankment indicates the location of the former railway line which passes through the proposal site in an east-west direction (Lot 1 DP 190927 and Lot 1 DP 1016556). Most of the railway line infrastructure has been removed; some concrete beams are present in the centre of the site. One house is located within the north eastern section of the proposal site. Stock yards and two old sheds are located on site.

Two mapped waterways and eight wetlands/farm dams occur within the proposal site. One waterway, located within the south western area of site, is an ephemeral tributary of the Cudgegong River. The waterway enters the Cudgegong River approximately 900m south west of the proposal site. The other waterway is located on the eastern area of the site and is an ephemeral tributary of the Wialdra Creek. Its confluence with Wialdra Creek is located approximately 1.2km north of the site boundary. The site inspection noted the waterways are not incised channels, rather minor depressions with no water present or likely to be present except in high rainfall conditions.

The site has a history of agriculture including cropping and grazing. Although most overstorey vegetation has been removed, the majority of the site is derived from a community of conservation significance: Box Gum Woodland Endangered Ecological Community. The community remains present across some of the site low and moderate to good condition.

Part of the proposal site appears to have been used by the landowner for quarrying. An area measuring approximately 1.7ha is located near the centre of the site. The ground cover and soil surface have been disturbed by some excavation activities.

Figure 3-1 illustrates the existing electricity infrastructure onsite, dam and current crop paddocks. Figure 3-2 illustrates the embankment which supported the former railway line within proposal site. Figure 3-3 and Figure 3-5 illustrates areas where quarrying operations appear to have occurred within the proposal site. Figure 3-5 illustrates the waterways that are present within the proposal site.



Figure 3-1 View across the proposal site showing the existing transmission lines, cropping land, one of the dams and remnant Box Gum Woodland in the background.



Figure 3-2 Embankment of former railway line located within the proposal site.



Figure 3-3 Possible existing quarry area within the project site (central southern portion of site)



Figure 3-4 Another existing possible quarry area within the project site (central northern part of the site)



Figure 3-5 Existing drainage depressions located within the project site with Box Gum Woodland in the background, more evident from soil moisture than the presence of a formed channel.

Access to the site would be from Beryl Road which bounds part of the site to the north. Beryl Road is a sealed road with two lanes (Figure 3-6). The Castlereagh Highway, which intersects with Beryl Road 2.5km from the proposed site entrance, would be the major transport route for haulage and site vehicles during construction and operation of the project.



Figure 3-6 Beryl Road.

3.2.1 Surrounding locality

The proposed solar farm is within the locality of Beryl, a small rural locality approximately 6km west of Gulgong, NSW. Residences generally occur on large rural properties with grazing and cropping activities. Approximately 60 residences are located within 2km of the proposal site, one being an involved landholder.

Gulgong is the closest township to the locality of Beryl. The population of Gulgong was 2,383 in the 2011 Census (ABS 2011b). The main industries are coal mining at 16.6%; followed by school education at 6.6%, supermarket and grocery stores 4.2% and sheep, beef cattle and grain farming at 3.3% (ABS 2011b). The main local industry for employment in Gulgong is the coal mining industry (ABS 2011b).

This area of rural NSW is rich in European heritage and was settled in the 1860's during the Australian gold rush (Destination NSW 2016b). There are currently 130 buildings, within the town of Gulgong, listed under National Trust classification many still have the original verandahs and iron-lace balconies (Destinations NSW 2016b).

The Yarrobil National Park is approximately 6.2km north west of the site and is not visible from the site. No formalised amenity areas (such as picnic areas) are located in the park. An operational quarry is located approximately 1.2km south of the proposal site, along Spring Ridge Road.

3.3 SOLAR FARM

3.3.1 Key infrastructure components

The proposed Beryl SF would comprise of the installation of a solar plant with an upper capacity of 95MW that would supply electricity to the national electricity grid. First Solar (Australia) Pty Ltd proposes to

develop around 225ha of the 332ha proposal site. 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.
- 22-40 inverter stations with associated transformer.
- An onsite substation containing one main transformer and associated switchgear.
- A 66kV transmission line to the adjacent existing Beryl Substation (300m).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access track off Beryl Road.
- 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.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

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 workers 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).

Solar arrays

The solar arrays would be comprised of 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.

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 3m high when tracked to the extent of their range. 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 3-7 Indicative First Solar ThinFilm modules



Figure 3-8 First Solar modules and a single axis tracker installed at the Gatton Research Facility in Queensland.



Figure 3-9 Piling installation for a single axis tracker

Inverters

Depending on the final inverter selected for the project approximately 20 to 40 inverter stations would be installed across the site with each inverter station containing the following equipment:

- Inverter – up to forty 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 3 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 3-10 and Figure 3-11 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 3-10 Example 20' skid solution.



Figure 3-11 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.

Underground cables

All underground cabling would be installed 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. Cables would be installed across the solar farm site and would cross the railway easement in two locations.

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 shows 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 300m from the new on site substation north to the existing TransGrid Beryl Substation. The new line would be constructed in a similar manner to the existing on site transmission lines utilising either timber or concrete poles, cross member, insulators and strung conductor (Figure 3-13).

The transmission line would be owned by TransGrid. 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 Existing onsite transmission line.

Substation

A new smaller substation would be located near the existing Transgrid Beryl Substation in the north west of the site. Power generated in the solar plant would be transformed in the substation to grid voltage, 66kV. A 66kV transmission line would then connect the substation to the existing Transgrid Beryl Substation (refer to Figure 1-2).

The final substation design is yet to be finalised but it is anticipated the substation would feature an elevated busbar, switchroom, a lightning protection system, circuit breakers, disconnectors, current transformers, voltage transformers, and a 66kV transformer.

The substation would be constructed on 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 Beryl Substation is roughly 2 times bigger than the proposed substation onsite.

Connection to the existing substation would require civil and electrical works, including site excavation and construction of footings for the proposed infrastructure. This infrastructure would include a 66kV linebay, primary electrical equipment including control, and protection equipment, communications equipment, and any additional infrastructure required for the connection.

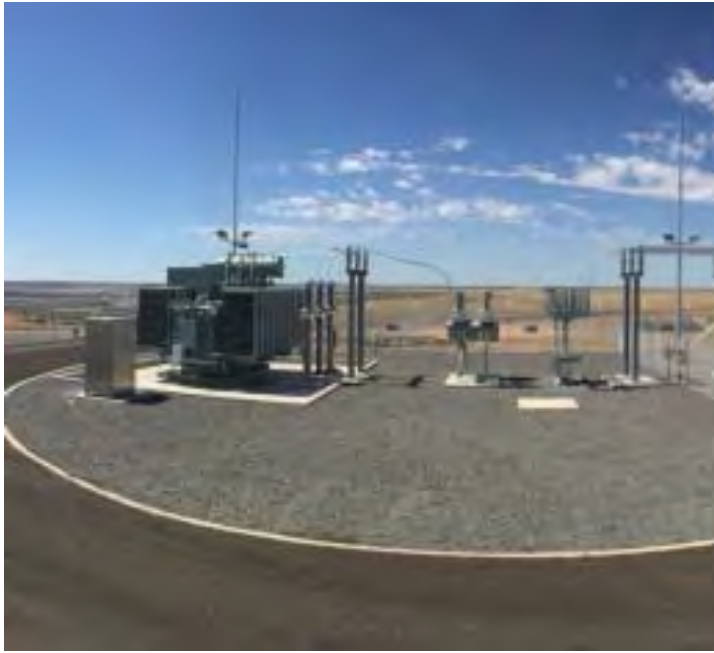


Figure 3-14 Example of a typical 66kV substation.

Access track and internal tracks

The entrance to the site would be off Beryl Road located next to the existing Transgrid Beryl Substation in the same location as the current farmer access way. The existing access way would be upgraded. The intersection with Beryl Road would also be upgraded to the appropriate standard to accommodate the increased traffic flows that would occur during construction and delivery vehicles. Although the final design has not yet been complete, the location and form of the main access road intersection with Beryl Road would provide adequate sightlines (approximately 350m) for vehicles entering and exiting the site. The final intersection design would be completed with input from Council, this being a Council administered road.

Internal solar farm access tracks 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 (Figure 3-15). The access road and all internal tracks would be maintained throughout the construction and operation of the solar farm. The track would cross the railway line in two locations.

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.



Figure 3-15 Example of an access track formed thorough cropping land

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 150 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.

Perimeter security fencing

The perimeter of the site would be fenced with a 2.3m high security fence. It is expected to be cyclone fencing with a 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 3-16.



Figure 3-16 Example of a typical 2.3m high security 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.

3.3.2 Construction and commissioning

Indicative timeline

An indicative timeline for the proposal is outlined in Table 3-2.

Table 3-2 Indicative timeline.

Phase	Approximate commencement	Approximate duration
Construction	1 st Quarter 2018	12 months
Operation	4 th Quarter 2018	30 years
Decommissioning	2048	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. The main construction activities 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.
- Modifications of existing Beryl Substation, including civil and electrical works
- Construction of the 66kV overhead transmission line, onsite substation and equipment, and interconnection to the existing Beryl substation.
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

Earthworks

Figure 1-2 indicates the development envelope which covers approximately 225ha of the 332ha project. A majority of the 225ha area is already disturbed due to farming and quarry 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 1000mm deep for the installation of cables.
- Construction of footings for the transmission line to the existing Beryl substation.
- Establishment of temporary staff amenities and offices for construction.
- Construction of perimeter security fencing.

The ground disturbance from pile foundations would be less than 1% (approximately 1ha) 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 56% of the total site area ground cover 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, 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 7.00am to 1.00pm on Saturdays). Any construction outside of these normal working hours, if required, would only be undertaken with prior approval 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 150 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.

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 project indicates that approximately 40 employees would be required during the first month rising to 150 employees during the peak construction period. Table 3-3 provides an indication of the total overall one-way traffic movements anticipated throughout the construction period.

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

Table 3-3 Traffic volumes and requirements for Beryl SF.

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
Site set-up and de-mobilisation	Temp office delivery and removal	Low loader	10
	Skip delivery and removal	Low loader	4
	Generator delivery and removal	Semi-trailer	4
	General Deliveries	Semi-trailer	12
	Crane mob and demob	Crane	1
	Water tank delivery and removal	Truck	2
Roads and hardstands	Delivery of imported capping for roads, laydowns and crane hardstands	Truck and dog	390
	Plant delivery and removal: excavators, compactors, drill rig	Low loader	16
Generating equipment	Tool container delivery and removal	Low loader	2
	Module deliveries	Semi-trailer	1198
	Mounting structure and pile deliveries	Semi-trailer	2130
	Inverter Station deliveries	Low loader	44
	DC cabling, trays and combiner boxes	Semi-trailer	50
AC Cable Installation	AC Cable delivery	Semi-trailer	8
	Backfill material delivery	Dump Truck	72
	Plant delivery and removal: Telescopic handler and excavator	Low loader	8

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
Overhead Line	Conductor delivery	Semi-trailer	1
	Pole deliveries	RAV	2
	Pole dressing delivery	Semi-trailer	2
	Plant delivery and removal: Telescopic handler and excavator	Low loader	8
Sub Station	Concrete deliveries	Concrete agitator	20
	Switchroom delivery	Low loader	4
	Operations and maintenance and workshop deliveries	Low loader	8
	Transformer delivery	RAV	2
	Electrical equipment deliveries	Semi-trailer	16
Other	Employee vehicle movements	Light vehicle	16000
	Monitoring equipment, fibre, SCADA servers etc.	Truck	12
	Waste collection	Truck	104
	Consumables (oil, petrol etc.)	Truck	24
	Miscellaneous deliveries	Light vehicle (Vans)	144
Total ¹			22294

¹ Assumes rock would be imported to site and water for dust suppression would be sourced from existing dams onsite.

Materials

In total, approximately 3,900m³ of gravel would be required to cap the access and internal network of service tracks.

Approximately 1400m³ of sand would be required for the bedding of cables that are to be direct buried throughout the project site.

Potable water would be trucked to the site on as needs basis and stored within temporary water tanks at the staff amenities area. While water required for dust suppression water be drawn from dams located on the proposal site. Should the level of the dams be diminished below an acceptable level, water for dust suppression would be sought from a local council standpipe.

3.3.3 Operation

The operational phase of the proposal is anticipated to commence in the fourth quarter of 2018. Once operational, activities would include daily operations and maintenance. This would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays, 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

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 permanently lit 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 project, it is anticipated there would be three full time staff located on site supported by First Solar's Asset management team of 6 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 three 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.

3.3.4 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 onsite buildings, inverter stations and substation would be left in place where there is no impact to the agricultural viability of the land.

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.

3.4 SUBDIVISION

3.4.1 Existing environment

The subject land comprises two allotments with the legal description of Lot 1 DP 1012926 and Lot 20 DP 1173059, Beryl Road, Beryl. A map of the subject land and its current environment is provided in Figure 3-17 below and described in Table 3-4.

Table 3-4 Summary of existing environment

Lot & DP	Area (approx)	Zone	Min lot size	Comment
Lot 1 DP 1012926	10 ha	RU1 Primary Production	100 ha	Vacant with dwelling entitlement (M271/00)
Lot 20 DP 1173059	290 ha	RU1 Primary Production R5 Large Lot Residential	100 ha 12 ha	Existing dwelling

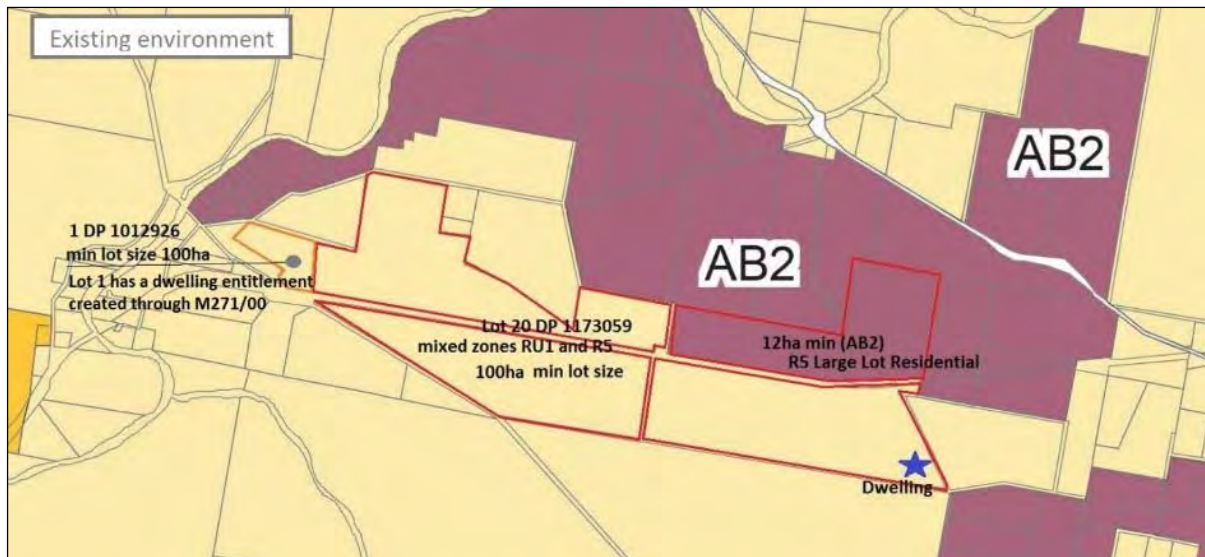


Figure 3-17 Existing environment

3.4.2 Proposed modified environment

It is proposed to:

- Consolidate land contained within Lot 1 with Lot 20. This land will contain the proposed solar farm development, and
- Excise the existing dwelling and surplus land with an area of approximately 12ha from Lot 20. The dwelling will remain in the ownership of the current landowners and will not be associated with the solar farm development.

The proposed arrangement is shown below in Figure 3-18 below.

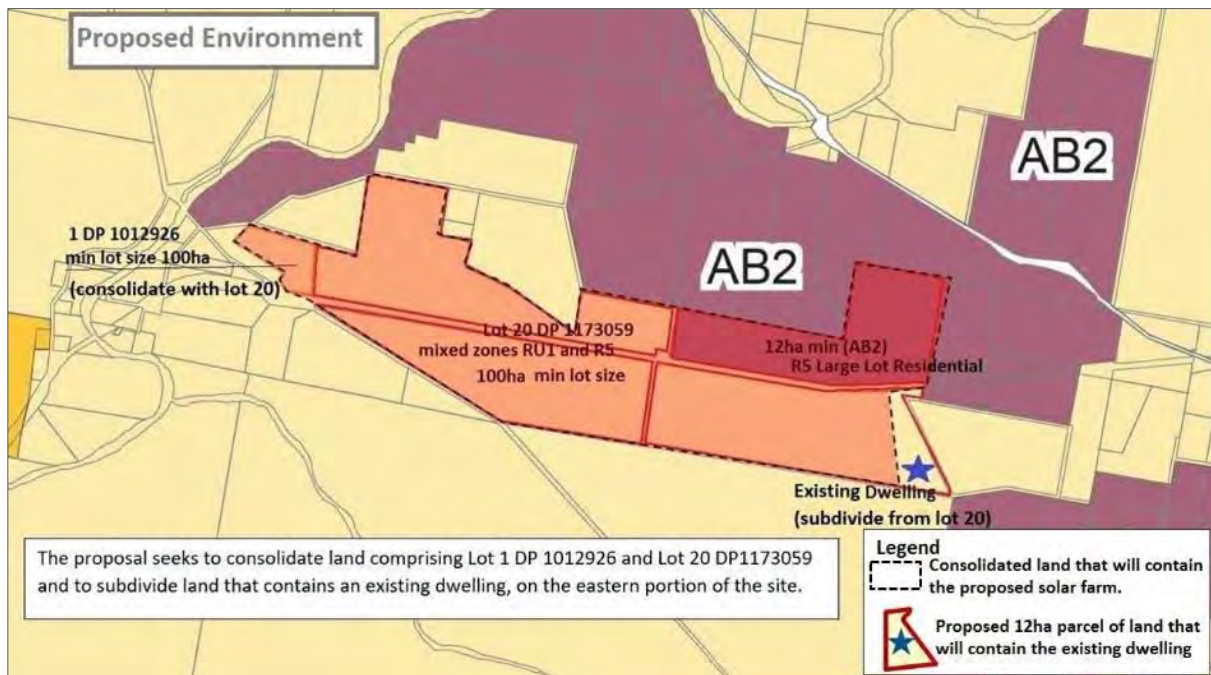


Figure 3-18 Proposed modified environment

The proposed solar farm development is reliant upon the ability to subdivide the surplus agricultural land and dwelling from the site as shown in Figure 3. In principle, the proposed subdivision would result in a land swap within the RU1 Primary Production zone. The dwelling entitlement attached to Lot 1 would be surrendered once the land is consolidated with the greater part of Lot 20, and the existing dwelling would continue to operate on a smaller parcel of land. Agricultural activities associated with the existing dwelling would also continue on a smaller scale. The proposed subdivision would not result in any change or impact to the existing environment or increase in the dwelling potential of the land.

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 (SSD)

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 Beryl 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 Beryl 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 Beryl SF including key environmental issues. The request for SEARs was registered as SSD 8183.

On 25 January 2017, the Secretary issued the SEARs for the Beryl 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. Table 5-1 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:

Provision	Relevance to the proposal
	• <i>State Environmental Planning Policy (State and Regional Development) 2011</i> • <i>State Environmental Planning Policy (Infrastructure) 2007</i> • <i>State Environmental Planning Policy (Rural Lands) 2008</i> • <i>State Environmental Planning Policy No. 55 - Remediation of Land</i> • <i>State Environmental Planning Policy 44 - Koala Habitat Protection</i> • <i>Mid-Western Regional Council Local Environmental Plan 2012</i>
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 <i>Dark Sky Planning Guideline</i>. The Beryl 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 <i>Coastal Protection Act 1979</i>), 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 7 and 8 of this EIS. This EIS demonstrates that the environmental impacts of

Provision	Relevance to the proposal
social and economic impacts in the locality;	the proposal have to the extent, reasonably and feasibly possible, been avoided or minimised through careful proposal design and through the implementation of mitigation measures provided within this EIS.
The suitability of the site for the development;	As discussed in Section 2, 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 Beryl 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 Beryl SF. Consultation with stakeholders that has been undertaken during the planning stages including the preparation of this EIS is summarised in Section 5.4.
The public interest.	The Beryl SF is in the public interest for a number of reasons. The plant would produce up to 95MW. On an annual basis, the proposed Beryl SF would provide enough clean, renewable energy for about 28,000 average NSW homes while displacing approximately 183,000 metric tons of carbon dioxide – the equivalent of taking about 49,000 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 Engagement Plan has been prepared and implemented to inform the community and stakeholders about the proposal and their opportunities to provide input into the

Provision	Relevance to the proposal
	assessment and development process. Further details on the consultation process is provided in Section 5.4.

4.3 NSW LEGISLATION

4.3.1 Environmental Planning and Assessment Act 1979

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

The relevant objects of the EP&A Act are:

- a) to encourage:
 - i. The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.
 - ii. The promotion and coordination of the orderly and economic use and development of land.
 - iii. The protection, provision and coordination of communication and utility services.
 - vi. The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.
 - vii. Ecologically sustainable development.
- c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.

The objects of the EP&A Act have been considered throughout this environmental assessment. The Beryl SF aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The proposed solar farm has been located and designed such that it would avoid protected areas and generally minimise the use of natural and artificial resources while still promoting the social and economic welfare of the local community.

Given the Beryl SF would support a number of the objects of the EP&A Act, and is not inconsistent with the remaining objects of the Act, the proposal is considered appropriate in the context of the EP&A Act.

The Beryl SF would be assessed under Part 4 of the EP&A Act.

Environmental Planning and Assessment Regulation 2000

Clauses 82 to 85B of the EP&A Regulation addresses public participation in SSD.

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

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

The provisions of the SEPP are relevant given the proposed development is deemed a State significant development.

The proposed solar farm development involves:

- the construction of four arrays within the R5 Large Lot Residential zone, and
- consolidation and subdivision of land that within the RU1 Primary Production zone.

The Mid-Western Regional Council Local Environmental Plan 2012 prohibits photovoltaic solar farms in the R5 zone and the subdivision of land that is less than the minimum lot size map shown in relation to that land.

Given the limitations of the LEP2012, development consent is sought under the provisions of the SEPP and the *Environmental Planning and Assessment Act 1979*. These matters are discussed in detail below in the relevant sections this report.

4.3.3 State Environmental Planning Policy (Rural Lands) 2008

The provisions of the State Environmental Planning Policy (Rural Lands) 2008 are relevant to the proposed development given the proposal to subdivide land that involves a dwelling.

Consideration has been given to the Rural Planning Principles, which are as follows:

- (a) *The promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,*
- (b) *Recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,*
- (c) *Recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,*
- (d) *In planning for rural lands, to balance the social, economic and environmental interests of the community,*
- (e) *The identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,*
- (f) *The provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,*
- (g) *The consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,*
- (h) *Ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.*

It is considered that the proposed subdivision is in accordance with the above rural planning principles given the proposal will continue to provide the opportunity for a rural lifestyle that contributes to the social welfare of the rural community whilst accommodating a productive, sustainable economic activity in the rural area.

This proposed development will facilitate the establishment of a state significant development that is consistent with the principles of strategy endorsed by the Department of Planning and Environment.

Rural Subdivision Principles

The Rural Subdivision Principles are as follows:

- a) *The minimisation of rural land fragmentation,*
- b) *The minimisation of rural land use conflicts, particularly between residential land uses and other rural land uses,*
- c) *The consideration of the nature of existing agricultural holdings and the existing and planned future supply of rural residential land when considering lot sizes for rural lands,*
- d) *The consideration of the natural and physical constraints and opportunities of land,*
- e) *Ensuring that planning for dwelling opportunities takes account of those constraints.*

It is considered that the proposed subdivision would not generate any land use conflicts or have an impact on the nature of existing surrounding agricultural holdings given the proposal will not alter the existing environment. The proposed subdivision would facilitate the management of the solar farm while ensuring surplus land remains as productive agricultural land.

Furthermore, the proposed subdivision would prevent the potential fragmentation of resource lands that may arise from subdivision should the proposed solar farm not proceed. It is estimated that a total of 8 dwellings could potentially be created under clause 4.2 Rural subdivision of the LEP 2012 given the existing zoning and minimum lot sizes applicable to the subject land.

The proposed subdivision satisfies the subdivision principles of this clause.

Clause 10 – Matters to be considered in determining development applications for rural subdivisions or rural dwellings

Clause 10 of the Rural Lands SEPP lists the following matters to be taken into account when determining a rural subdivision:

- (a) *The existing uses and approved uses of land in the vicinity of the development,*
- (b) *Whether or not the development is likely to have a significant impact on land uses that, in the opinion of the consent authority, are likely to be preferred and the predominant land uses in the vicinity of the development,*
- (c) *Whether or not the development is likely to be incompatible with a use referred to in paragraph (a) or (b),*
- (d) *If the land is not situated within a rural residential zone, whether or not the development is likely to be incompatible with a use on land within an adjoining rural residential zone,*
- (e) *Any measures proposed by the applicant to avoid or minimise any incompatibility referred to in paragraph (c) or (d).*

In consideration of the above matters the proposed subdivision would not have an impact on surrounding land uses, would not be incompatible with a preferred land use and would facilitate the management of an approved land use on the subject land. The proposed subdivision satisfies the requirements of this clause.

4.3.4 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. SEPP No.55 applies to the whole of the State.

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

A search of the NSW EPA Contaminated Land Register of notices (NSW Government 2017a) on 3 February 2017 identify one site within the Mid-Western LGA. The site is however located within Mudgee, over 27km for the proposed site. The proposed site does not appear on the List of NSW contaminated sites notified to the EPA, as at 3 February 2017 (NSW Government 2017b).

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.

4.3.5 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. Mid-Western Regional LGA is not listed in Schedule 1 of SEPP 44. As such, this SEPP does not apply to the proposal site.

Beryl SF may not be located within listed LGAs of Schedule 1 of the SEPP however, it is identified that the sites previous LGA before augmentation in 2012 (Mudgee LGA) is listed in Schedule 1 of the SEPP. Additionally, Koalas are known to occur within the Central West CMA. Therefore, the biodiversity assessment undertaken for the proposal (summarised in Section 7.1 and provided in full in Appendix D) considers the proposals potential impact on Koalas and their habitat.

4.3.6 Mid Western Regional Council Local Environmental Plan 2012

The site is located within the Mid Western LGA and is therefore subject to the provisions of the *Mid Western Regional Council Local Environmental Plan 2012*. The solar farm site is located on land zoned RU1 - Primary Production and R5 – Large Lot Residential.

RU1 Primary Production

Electricity generating works are permitted with consent within the RU1 Zone. 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 maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.*
- *To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.*

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). The solar farm would be decommissioned at the end of its operational life, removing all above ground infrastructure.

Mitigation measures contained within this 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 as well as protect the visual amenity and landscape quality of the region.

The proposed development would also involve the consolidation and subdivision of land within the RU1 zone.

As indicated in Section 3.4 of this report, it is proposed to:

- Consolidate land contained within Lot 1 with Lot 20. This land will contain the proposed solar farm development, and
- Excise the existing dwelling and surplus land with an area of approximately 12ha from Lot 20. The dwelling will remain in the ownership of the current landowners and will not be associated with the solar farm development.

Clause 4.3(3) of the Mid-Western Local Environmental Plan (LEP) 2012 states that the size of any lot resulting from a subdivision of land to which this clause applies is not to be less than the minimum size shown on the Lot Size Map in relation to that land.

With respect to the subject land, which contains land zoned RU1 Primary Production, the minimum lot size shown on the Lot Size Map is 100ha. Therefore, the proposed subdivision is under the prescribed minimum lot size and not permitted under the provisions of the Plan.

However, the proposed development being a State Significant Development is subject to the provisions of the State Environmental Planning Policy (State and Regional Development) 2011. In this regard, Clause 8(2) of the SEPP State & Regional Development 2011 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. Furthermore, Section 89E (3) of the *Environmental Planning and Assessment Act 1979* states "development consent may be granted despite the development being partly prohibited by an environmental planning instrument".

Consultation with the Department of Planning and Environment on Friday 3 February 2017, confirmed the intent of the provisions set out under Clause 8(2) of the SEPP and Section 89(3) of the EP&A Act 1979 that provide justification for the proposed subdivision.

Following this, a written submission was made to Mid-Western Regional Council on 2 March 2017, seeking support for the development under Clause 8(2) of the SEPP and Section 89(3) of the EP&A Act 1979. A copy of the submission is attached as Appendix C.2 to this report.

The submission justifies the proposed subdivision of land based on the merits of the proposal against the LEP2012 and Rural Lands SEPP 2008 given the proposed subdivision is not inconsistent with the objectives of the RU1 zone. The solar farm met the objective to encourage diversity in primary production. The proposed subdivision would not fragment resource lands, given there will be no alteration to the existing environment.

Without the subdivision, the residual agricultural land and dwelling would be taken away from agricultural production as it would be incorporated into the solar farm site. The subdivision would facilitate the management of the solar farm while ensuring surplus land remains as productive agricultural land.

Council responded to the submission with a letter dated 21 March 2017 (refer Appendix C.3). No objection was raised to the proposed subdivision even though it is not compliant with Council's LEP. Council acknowledged that the proposal would not result in any additional dwelling entitlements for the site and will essentially relocate the existing smaller Lot 1 to encompass the existing dwelling that sits upon the larger Lot 20. Council requested that direct access arrangements to Perseverance Lane for the dwelling be retained and the location of the new lot boundaries ensure that all ancillary structures and septic systems in association with the dwelling are retained within the same lot with adequate setbacks. Council's requirements would be met by the development.

R5 Large Lot Residential

Electricity generating works are prohibited within the R5 Zone. The objectives for development in this zone are:

- *To provide residential housing in a rural setting while preserving, and minimising impacts on, environmentally sensitive locations and scenic quality.*
- *To ensure that large residential lots do not hinder the proper and orderly development of urban areas in the future.*
- *To ensure that development in the area does not unreasonable increase the demand for public services or public facilities.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

The proposed site layout includes the construction of four arrays within the R5 Large Lot Residential zone. Under the provisions of the Mid-Western Regional Council the proposed development is prohibited in the R5 zone, however given the proposed development is deemed a State significant development approval 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 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".

4.3.7 Roads Act 1993

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

The proposal would use one existing access point from Beryl Road, adjacent to the existing Transgrid Beryl substation, for operation and construction. The entry point would be upgraded in consultation with Mid Western Regional Council to the appropriate standard to accommodate the increased traffic flows during construction and delivery vehicles. The upgrade would include the improving of sight lines for vehicles entering and exiting the site. These upgrades would involve work within the road reserves and require a Section 138 approval from Mid Western Regional Council.

4.3.8 Crown Lands Act 1989

The objective of the *Crown Lands Act 1989* 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. This involves the management of state-owned land, linking with other agencies, local government, the private sector and communities to provide social and economic outcomes for NSW.

Connection of the solar farm to the existing Beryl substation may require a transmission line to be established through Crown Land. This would require consent from the Department of Primary Industries Lands Division (DPI Lands). Consultation with DPI (Lands) is summarised in Section 5. The Minister will provide comment on the EIS, during the exhibition period.

4.3.9 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 SDD.

A search of the NSW Heritage Register on 15th November 2016 for the Mid Western LGA identified 14 listed items under the NSW Heritage Act and 485 items listed under the Mid- Western LEP and by state agencies. The closest listed heritage items are located within Gulgong, approximately 6km east of the proposal site. The onsite inspection identified a number of old structures that would potentially have historic significance. These include a dilapidated huts structure and the lane way that runs east west across the site. At least two dilapidated structures onsite would require removal. The proposed potential impact on historic heritage is addressed in Section 8.5.

4.3.10 Mining Act 1992

The main objective of the *Mining Act 1992* 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 (Department of Industry 2016) found the site to have one mineral title (EL8160), however this title expired 29 August 2016. First Solar Pty Ltd has consulted with the mineral title landowner and adjacent quarry operators, refer to Section 5.1.3

4.3.11 Water Management Act 2000

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

qualities of waterways and their in-stream uses, as well as to provide for the protection of catchment conditions.

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. There are two WSPs that relevant to the proposal site.

Regarding the proposal, there would be no requirement to modify existing entitlements or seek new entitlements under these plans. The proposal has minimal water requirements that would be satisfied by the purchasing of portable water and use of existing dams onsite for dust suppression during construction. Water would be sourced from a council standpipe if the onsite dam water diminishes. During operation, rainwater would be collected onsite or water would be purchased.

Works would occur within 40m of both watercourses that occur with the proposal site, this is defined as waterfront land under the WM Act. However, a controlled activity approval is not required for SSD under Section 89J of the EP&A Act. Potential impacts on waterways are addressed in Section 8.2.

4.3.12 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) when a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.

Under section 48 of the POEO Act, premises-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). Clause 17 of Schedule 1 of the POEO Act concerns electricity generation works, however does not include solar power. Therefore, the Beryl SF would not be a scheduled activity under this Act. Accordingly, an EPL is not required under the POEO Act.

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 in Section 8.6 of the EIS.

4.3.13 Native Vegetation Act 2003

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

An authorisation to clear native vegetation is not required for SSD under section 89J of the EP&A Act. Native vegetation clearing is summarised in Section 7.1. The biodiversity assessment is appended in full in Appendix D.

4.3.14 Threatened Species Conservation Act 1995

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

The potential to impact threatened species, populations and ecological communities listed under this act has been considered in a specialist biodiversity assessment, summarised in Section 7.1 and appended in full in Appendix D of this EIS. The format of the assessment is consistent with the newly developed Framework for Biodiversity Assessment, developed for major proposals. Under Section 79B(2A) of the EP&A Act, concurrence under the TSC Act is not required for SSD.

4.3.15 Fisheries Management Act 1994 (FM Act)

The 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 Beryl SF is within the Lower Murrumbidgee catchment. There are no watercourses within or in close proximity of the development envelope deemed to be Key Fish Habitat under the Act. 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.

4.3.16 National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act 1974*, 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.

It should be noted that 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 and native fauna and flora are discussed in Section 7.1 and 7.2 of this report.

4.3.17 Noxious Weeds Act 1993 (NW Act)

This Act aims to control noxious weeds in NSW. Part 3 of this Act outlines the obligations of a public authority to control noxious weeds.

One noxious weed was found onsite, St John's wort (*hypericum perforatum*). Refer to Section 7.1 and Appendix D for management.

4.4 COMMONWEALTH LEGISLATION

4.4.1 Environmental Protection and Biodiversity Conservation Act 1999

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 Minister.

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

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

A search for MNES and other matters protected by the EPBC Act was carried for the proposal site using the Commonwealth online Environmental Reporting Tool (report created 30 October 2016). A summary of the findings is provided in the tables below.

Table 4-2 Summary of Matters of National Environmental Significance.

Matters of National Environmental Significance	No.
World Heritage Properties	0
National Heritage Places	0
Wetlands of International Significance	4
Great Barrier Reef Marine Park	0
Commonwealth Marine Areas	0
Threatened Ecological Communities	6
Threatened Species	29
Migratory Species	8

Table 4-3 Summary of other matters protected by the EPBC Act.

Other Matters Protected by the EPBC Act	No.
Commonwealth Lands	3
Commonwealth Heritage Places	0
Listed Marine Species	14
Whales and Other Cetaceans	0
Critical Habitats	0
Commonwealth Reserves	0

Table 4-4 Summary extra information.

Extra Information	No.
State and Territory Reserves	1
Regional Forest Agreements	0
Invasive Species	28
Nationally Important Wetlands	0
Key Ecological Features (Marine)	0

The EPBC protected matters report identified the following MNES to have potential to occur within the proposal site:

- Wetlands of international importance
- Threatened ecological communities
- Threatened species
- Migratory species

- Commonwealth land
- Listed marine species

The potential for these MNES to occur at the site are discussed below. Refer to the Biodiversity Assessment (Appendix D) for a more detailed assessment of the proposal in relation to the identified MNES.

Wetlands of International Importance

Four wetlands of international importance were returned from the protected matters report. The nearest of these (between 200-300km from search area) is the Macquarie Marshes. All other wetlands returned from the search are over 700km away. The Macquarie Marshes occurs approximately 212km north west of the proposal site.

Threatened Ecological Communities

Four threatened ecological communities were returned from the protected matters report.

The majority of the site is derived from a community of conservation significance: White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is listed under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Cwth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The community remains present across some of the site in varying levels of condition

Threatened species

Twenty-nine threatened species were returned from the protected matters report. Of these, none are considered to have the potential to utilise the habitats at the proposal site:

Migratory species

Eight listed migratory species were returned from the protected matters report. None of these species are considered likely to occur at the site on a regular basis or rely on the habitats present.

Commonwealth land

The proposal would not impact on Commonwealth Land.

Listed Marine species

Fourteen listed marine species were returned from the protected matters report. None of these species are considered likely to occur at the site due to distance from marine environments and any migratory species would not occupy the site on a regular basis or rely on the habitats present.

4.4.2 Native Title Act 1993

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

People who hold native title have a right to continue to practise their law and customs over traditional lands and waters while respecting other Australian laws. This could include visiting to protect important places, making decisions about the future use of the land or waters, and hunting, gathering and collecting

bush medicines. Further, when a native title claimant application is registered by the National Native Title Tribunal, the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a proposal on the area claimed.

Native title may exist in areas such as:

- Vacant Crown land.
- Some national parks, forests and public reserves.
- Some types of pastoral 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 6 February 2017 for the Mid-Western Regional LGA found no registered native titles relevant to the proposal site.

4.4.3 Renewable Energy (Electricity) Act 2000

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

- To encourage the additional generation of electricity from renewable sources.
- 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 Beryl SF would need to be accredited as a Renewable Energy Generator to create Renewable Energy Certificates.

4.5 OTHER RELEVANT POLICIES AND MATTERS

4.5.1 Ecological 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 Beryl SF and this EIS have considered each principle.

- a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
 - i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
 - ii. an assessment of the risk-weighted consequences of various options.

The precautionary principle has been adopted in the assessment of 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.

- 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 Beryl 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 Beryl 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 solar farm 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 Beryl 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. A life Cycle Analysis has been completed for the proposal.

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

4.6 SUMMARY OF LICENSES AND APPROVALS

Table 4-5 Summary of licenses and approvals required for Beryl SF.

Legal Instrument	License or Approval
EP&A Act 1979 - Part 4	• Development consent required.
Crown Lands Act	• Licence for access across Crown Land, clearing vegetation, construction of an electricity transmission line and registration of an easement.
Roads Act 1993	• Section 138 approval for work within a public road reserve, Beryl 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 25 January 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. 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.

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 <i>Environmental Planning and Assessment Regulation 2000</i> . The EIS must include the following:	
- a full description of the development, including: - details of construction, operation and decommissioning; - a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of separate approvals process); - a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development;	- The proposal is described in Section 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 Section 6.
a strategic justification of the development focusing on site selection and the suitability of the proposed site;	the proposal justification is provided in Section 2.
- an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: - a description of the existing environment likely to be affected by the development; - an assessment of the likely impacts of all stages of the development which is commensurate with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; - a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and	- Site context is provided in Section 3.2. Existing environment of the site is described in Section 7 and 8. - 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

Issue summary	Addressed in this EIS
o a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	the level of impact, detailed impact assessment, mitigation and monitoring are included in Section 7 and 8. Draft management plans or management outlines have been included for: - o Proposed visual screening (Appendix F) - o Noise management (Appendix G.2)
• 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.
• the reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development.	• The conclusion in Section 10 includes a summary of the key benefits and reasons why the proposal should be approved.
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 <i>Environmental Planning and Assessment Regulation 2000</i>); and • the consent in writing of the owner of the land (as required in clause 49(1)(b) of the <i>Environmental Planning and Assessment Regulation 2000</i>).	• The capital investment report has been provided separately. • Landowners consent has been provided separately.
The EIS must address the following specific issues:	
• Biodiversity – including an assessment of the likely biodiversity impacts of the development, including but not limited to the impacts on Box Gum Woodland endangered ecological community, <i>Euphrasia arguta</i>, <i>Prasophyllum sp. Wybong</i>, Bluegrass <i>Dichanthium setosum</i>, Pink Donkey Orchid <i>Diuris tricolor</i>, Regent Honeyeater <i>Anthochaera phrygia</i>, Swift Parrot <i>Lathamus discolor</i>, and Silky Swainson-pea <i>Swainsona sericea</i>, having regard to the <i>NSW Biodiversity Offsets Policy for Major Projects</i>, and in accordance with the <i>Framework for Biodiversity Assessment (FBA)</i>, unless otherwise agreed by the Department;	• An FBA assessment has been completed and is summarised in Section 7.1 and provided in full 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 8.5.

Issue summary	Addressed in this EIS
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;	- An assessment of land use impacts is detailed in Section 8.4. - A soil survey report is included as Appendix H.
Visual – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners;	- A visual assessment has been completed and is summarised in Section 7.3. - Proposed perimeter planting is detailed as a recommendation of the visual assessment. It includes a requirement to consult with the most affected land owners in finalising the treatment. - 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 these landowners.
Noise – including an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Industrial Noise Policy</i> (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 G.2.
Transport – including an assessment of the site access route (including Castlereagh Highway and Beryl Road), site access point, rail safety issues 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 8.3.
- Water – including: - an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses (including Cudegong River and Wialdra Creek), wetlands, riparian land, groundwater dependent ecosystems, and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights,	- An assessment of water impacts are detailed in Section 8.2. - A description of erosion and sediment measures are detailed in Sections 8.1 and 8.2.

Issue summary	Addressed in this EIS
- 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);	
• Hazards and electromagnetic Interference – an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-ionizing Radiation Protection (ICNIRP) <i>Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields</i>.	• An assessment of hazards and electromagnetic interference impacts is detailed in Section 8.9 and 8.10.
• 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.
• 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 5.4.
• In particular, you must undertake detailed consultation with affected landowners surrounding the development and Mid-Western 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.	• A table of issues raised is provided in Section 5.4.

5.1.2 Relevant guidelines

The following guidelines 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)	NA

	Guideline	How guideline has been addressed?
	Policy and Guidelines for Fish Habitat Conservation and Management (DPI)	NA
Heritage	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)	Consultation approach Section 5.2.
	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)	NA
Land	Primefact 1063: Infrastructure proposals on rural land (DPI)	NA
	Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA)	Community consultation, Section 5.4. Visual assessment method, Section 7.3.
	<i>Local Land Services Act 2013</i>	NA
	Australian Soil and Land Survey Handbook (CSIRO)	Section 8.1.
	Guidelines for Surveying Soil and Land Resources (CSIRO)	
	The land and soil capability assessment scheme: second approximation (OEH)	NA
Noise	NSW Industrial Noise Policy (EPA)	Section 7.4
	Interim Construction Noise Guideline (EPA)	
	NSW Road Noise Policy (EPA)	
Transport	Guide to Traffic Generating Development (RTA)	Section 8.3
	Road Design Guide (RMS) & relevant Austroads Standards	
	Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development	NA
Water	Managing Urban Stormwater: Soils & Construction (Landcom)	Section 8.2
	Floodplain Development Manual (OEH)	NA
	Guidelines for Controlled Activities on Waterfront Land (DPI Water)	NA
	Water Sharing Plans (DPI Water)	Section 8.2
	Floodplain Management Plan (DPI Water)	Section 8.2

	Guideline	How guideline has been addressed?
	Guidelines for Watercourse Crossings on Waterfront Land (DPI Water)	NA
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
Environmental Planning Instruments	State Environmental Planning Policy (State and Regional Development) 2011	Section 4
	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	
	Mid-Western Regional Local Environmental Plan 2012	

5.1.3 Agencies additional comments

The SEARs require that, in preparing the EIS for the development, relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners be consulted.

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 • Traffic volumes • Travel routes for traffic • Description of over size and over mass vehicles and materials to be transported • Details of access requirements • Need and proposed road improvements • Consideration of local climate conditions in regards to road safety. • 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)	The traffic assessment was completed from desktop assessment and site inspection and is included at Section 8.3. 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 Mid-Western Regional Council.
Office of Environment and Heritage (OEH)	Matters raised in Department's addendum to the SEARs included impacts on biodiversity, Aboriginal Cultural Heritage, historic heritage, water, soils and flooding.	
	• Biodiversity and offsetting: - o Biodiversity impacts to be assessed and documented in accordance with the Framework for Biodiversity Assessment. - o Impacts on Box Gum Woodland endangered ecological community, <i>Euphrasia arguta</i>, <i>Prasophyllum</i> sp. <i>Wybong</i>, Bluegrass (<i>Dichanthium setosum</i>), Regent Honeyeater (<i>Anthochaera phrygia</i>) and Swift Parrot (<i>Lathamus discolor</i>), will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment. • Aboriginal cultural heritage - o Identify and describe the Aboriginal cultural heritage values that exist across	The biodiversity assessment and offsetting has used the FBA for major projects, as required, summarised in Section 7.1. The Aboriginal heritage assessment has used the <i>Guide to Investigating, assessment and reporting on</i>

Agency	Issue raised	How issue has been addressed
	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 OEH.	<i>Aboriginal Cultural Heritage in NSW</i> and consultation guidelines <i>Aboriginal cultural heritage consultation requirements for proponents 2010</i> as required, summarised in Section 7.2.
	• Historic heritage - o A heritage assessment including but not limited to an assessment of impacts to <i>State and local heritage</i> 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: ▪ outline the proposed mitigation and management measures ▪ be undertaken by a suitably qualified heritage consultant(s) ▪ include a statement of heritage impact for all heritage items (including significance assessment), ▪ consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and ▪ where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.	The heritage assessment was desktop, informed by a site inspection. No listed heritage items would be affected by the proposal. Refer to Section 8.5.
	• Water and soils: - o Must map the following features relevant to water and soils including: ▪ Acid sulfate soils	The soil and water assessments were desktop, informed by a site inspection. Surface and ground water resources are detailed in Section 8.2. Acid sulphate soils are

Agency	Issue raised	How issue has been addressed
	▪ Rivers, streams, wetlands, estuaries ▪ Groundwater. ▪ Groundwater dependent ecosystems. ▪ Proposed intake and discharge locations. ○ Must describe background conditions for any water resource likely to be affected by the development. ○ Must assess the impacts of the development on water quality. ○ Must assess the impact of the development on hydrology.	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 a 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 ○ Must map the following features relevant to flooding including: ▪ Flood prone land. ▪ Flood planning area, the area below the flood planning level. ▪ Hydraulic categorisation (floodways and flood storage areas). ○ Must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event. ○ Must model the effect of the proposed development (including fill) on the flood behaviour. ○ Must assess the impacts on the proposed development on flood behaviour.	The flooding assessment was desktop, informed by a site inspection. Flooding risks are assessed in Section 8.2. Maps of relevant flooding features are provided.
Department of Primary Industries (DPI)	Matters raised in Department's addendum to the SEARs included impacts on land and water. • Land should include a requirement for the proponent to develop Rehabilitation and Decommissioning/Closure Plans that outline rehabilitation objectives and strategies.	Soil properties and key risks of construction are well understood and documented in Section 8.1. 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

Agency	Issue raised	How issue has been addressed
		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 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.
	- Water should include - A detailed description of the proposed management of watercourses on site. - Estimated volume of water required for dust suppression and construction purposes and the source of this water.	The water assessment and quantities required are detailed in Section 8.2.
Division of Resources and Energy	Matters raised in Department's addendum to the SEARs included impacts on mineral titles. - Recommends the requirement for demonstrated, authentic consultation with mineral resource stakeholders including the Geological Survey of NSW, adjacent mineral title holders and quarry operators. - Must consider the potential impact of the project, including associated ancillary infrastructure, on any mineral resources, both within and adjacent to the project area. - Indicate, on a map or other visual means, the following: - the extent of the Project area, - the location of affected minerals titles (adjacent and adjoining),	Consultation undertaken is outlined in Section 5.4. Potential impact on mineral resources and map of features is provided in Section 8.4. Mitigation measures include ongoing consultation with the Stakeholders.

Agency	Issue raised	How issue has been addressed
	- o transmission and (project) related infrastructure, - o any transmission corridors, and - o any other relevant information. • An assessment regarding the potential impacts of the project, including electricity transmission infrastructure, on any significant mineral resources. • The proponent must liaise with the Division regarding the location of proposed electricity transmission infrastructure. • Provide evidence of any associated stakeholder consultation documents and, where required detail the ongoing engagement strategy in the form of management plans	
Mid-Western Regional Council	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 project description (Section 3) and further in Section 8.3. A Road Dilapidation Report and audit have been included as mitigation measures.
	• Community Consultation	Consultation undertaken is addressed in Section 5.4.

5.2 CONSULTATION REGARDING THE PROPOSED SUBDIVISION OF LAND

The proposed development involves the subdivision of land that initially was thought would be dealt with separately, and at the local level via a development application. However, after review of the local instrument and in consultation with Mid-Western Regional Council, it was determined that there were no provisions within the Mid-Western Regional Council Local Environmental Plan (LEP) 2012 or State Environmental Planning Policy Infrastructure (ISEPP) that would permit approval of the subdivision at the local level.

Given the proposed development would be deemed a State Significant Development, the direction of the Department of Planning and Environment was sought, requesting that the proposed subdivision of land be assessed as part of the overall development.

A telephone conference was held on Friday 3 February 2017. In attendance was the Project Manager (First Solar), consulting town planner (NGH Environmental) and representatives from the Department of Planning and Environment.

The Department advised that they could include the subdivision in their assessment however, requested evidence from the Mid-Western Regional Council that there would be no objection to the proposal during

the notification period and that evidence of Council's concurrence would be required prior to the assessment of the proposed development.

On 2 March 2017, a formal submission was made to the Mid-Western Regional Council requesting Council. The submission outlined the State Significant Development and justified the merits of the proposed subdivision against the Mid-Western Regional Local Environmental Plan and the State Environmental Planning Policy (Rural Lands) 2008. Council responded to the submission by letter raising no objection to the proposed subdivision (refer Section 4.3.6)

5.3 ABORIGINAL COMMUNITY CONSULTATION

The consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the *National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010* following the consultation steps outlined in the 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 Mudgee LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspaper, the Mudgee Guardian on the 18th of November 2016 seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by OEH in correspondence to NGH Environmental. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, four groups contacted the consultant to register their interest in the proposal. The groups who registered interest were Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation.

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

Stage 2. On the 19th of December 2016, an Assessment Methodology document for the Beryl Solar Farm was sent to the four registered parties as noted above and the Mudgee LALC as required by OEH. 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. Comments were received from Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation.

The main points raised in the comments received from the Wellington Valley Wiradjuri Aboriginal Corporation on the methodology were in relation to:

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

The main points raised in the comments received from the Warrabinga Native Tittle Claimants Aboriginal Corporation on the methodology were requests for further information on:

- The proposal, specifically the proposed earthworks;
- Landforms;
- The closest site to the project area; and
- Previous surveys.

These comments were addressed by NGH in reply letters sent to the Wellington Valley Wiradjuri Aboriginal Corporation on the 30th of January 2017 and the Warrabinga Native Tittle Claimants Aboriginal Corporation on the 9th of February 2017. No further correspondence was received regarding the letters from NGH Environmental that addressed the comments on the methodology from either group. No response or registration of interest in the project was received from the Mudgee LALC.

The Wellington Valley Wiradjuri Aboriginal Corporation has requested that any information they provided in regards to the project area was not shared. Therefore, the letters received as noted above have not been included in this report or appendix. As a similar courtesy, we have not included the response received from the Warrabinga Native Tittle Claimants Aboriginal Corporation.

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.

Cultural information about to the project area was received from the Wellington Valley Wiradjuri Aboriginal Corporation however they have requested that the information provided is not shared. Therefore, the cultural information received has not been included in this report.

No other response regarding cultural information was received.

At this stage, the fieldwork was organised and all four registered parties were asked to participate in one of the two days of fieldwork. The fieldwork was carried out in late February 2017 with a representative from all four of the registered parties participating for a day of the survey.

Stage 4 In March 2017 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal (this document) was forwarded to Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabinga Native Tittle Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document.

5.4 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).

5.4.1 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 Beryl 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.1.

The aim of the CCP is to identify methods to inform the community about the Beryl 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.

5.4.2 Visual impact assessment requirements

Community consultation specific to the assessment of visual impacts for the proposal was required in order to:

- Understand how the community values the existing visual amenity in the study area.
- Document the perceptions of the community to the proposed development.

As part of the community engagement for the proposal, respondents were surveyed on their views regarding solar farm development and local visual amenity. Specific questions relating to visual impacts were included in a feedback form distributed, via:

- The project website.
- Direct meetings and mail outs to near neighbours.

These questions related to:

- Local values, including views.
- Identification of views or landscape characteristics in the region and local area important to respondents.
- Perceptions and concerns about solar farm development.

The feedback form questions are included in the CCP (refer Appendix C). The results (summarised below in Section 5.4.4) were used to inform the visual impact assessment (refer Appendix F and Section 7.3).

5.4.3 Community consultation activities to date

The following community consultation has been undertaken with regards to the proposal:

- Direct engagement with nearby neighbours through face to face meetings on 7 November 2016.
- The proposal was presented to Mid Western Regional Council planning staff on 7 November 2016. Emails were also sent to the Chamber of Commerce and Mayor on 30 January 2017. A follow up presentation was presented at a council meeting on the 15 February 2017.

- Mail out to all residents within 2km of the proposal site, notifying them of the proposal on 8 December 2016.
- Project update and feedback form mailed out to adjacent neighbours, near neighbours (residents of Beryl locality), local businesses, special interest groups and the Gulgong Chamber of Commerce 3rd February.
- Advertisement in Mudgee Guardian outlining proposal and receipt of SEARs on the 14th and 21st of February 2017
- Community Open Day held by First Solar at the CWA Hall on 23rd February 2017.
- Direct engagement with nearby neighbours through face to face meetings on 23rd February 2017
- Direct engagement with nearby neighbours through face to face meetings on 22nd March 2017
- Development of a project website to provide information and updates (<http://www.firstsolar.com/Resources/Projects/Beryl%20Solar%20Farm>)
- Establishment of dedicated email address for feedback (berylsolarfarm@firstsolar.com).

5.4.4 Results of community consultation

The community consultation process was initiated on the 7 November 2016 by Tom Best, First Solar Australia Pty Ltd with face to face meetings undertaken with 10 neighbours near to the proposed solar farm site. Information regarding the potential project and First Solar was provided to residents and they were invited to provide feedback about the proposal. Feedback received by neighbours at this time included:

- That they were supportive of the project and would like to be kept informed on the planning approval progress.
- Two neighbours requested information on the exact location of the proposal.
- One neighbour was pro development as long as existing services, such as mobile phone reception, were not affected by the proposal.

A community mail out was sent to all residents within two kilometres of the proposed site, local business and community groups on the 8 December 2016. A dedicated website was also established for the Beryl SF to provide reliability and transparency of information. A feedback form and email address were provided to 44 households and 44 businesses enabling residents to comment directly on the proposal.

Feedback from residents included the following:

- Residents were generally supportive and showed interest in the consultation process.
- One resident raised concerns regarding the impacts of glare and heat of the proposal on his property.

Six local businesses provided feedback to First Solar:

- All expressed support and the positive economic benefits to the local community.
- A local mining operator had concerns regarding land conflict with the site.
- A local quarry raised concerns about traffic impacts on their operations.
- One electrical contractor expressed interest to work on the project.

Tom Best (First Solar Australia Pty Ltd) met with Mid Western Council representatives, Lindsey Dunstan and Drew Roberts on the 7 November 2016 and presented the Beryl SF proposal to the Council on the 15 February 2017. Feedback received included:

- Council members were supportive of the proposal as it will provide good use of low level farming land in the area and benefits the local community. Council appreciated the early consultation process (7 November 2016).
- Concerns were raised regarding:
 - planning development application on the parcel of land zoned R5;
 - the land around the existing house being rezoned as a new lot being below the minimum land size for land zoned RU1.
- Confirmation was given that the subdivision memo, to be circulated, would be supported by Mid Western Council (15 February 2017).

The Community Open Day, on the 23 February 2017, at the CWA Hall had 22 people attend. This included residents, local business owners, council members and associated landowners. Feedback included:

- Residents were very supportive of the project.
- Positive feedback regarding the creation of jobs, economic flow on effects to local businesses and benefits to the community were expressed.
- Visual screening was discussed and residents showed their support and wanted to be kept informed.
- Two residents raised concerns regarding impacts on access roads, namely Beryl Road and Perseverance Lane, and the effects of increased traffic on local infrastructure.
- Resident on the Southern side raised concerns regarding the potential impact to the value of adjacent land. This land is primarily used for grazing and cropping.

First Solar Australia Pty Ltd received four completed community feedback forms. The four residents lived five kilometres or less from the proposed site. Important local values to the respondents included to be living in a close community with a country lifestyle; enjoying the peace and quiet. Visual landscape values considered important included the farming landscape; views of trees, sky, hills, large paddocks and cattle.

Key concerns raised by members of the community were traffic impacts, potential decline in land value, visual impacts and the clarity of the planning approval process. 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.

5.4.5 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.

6 SCOPING

6.1 FATAL FLAWS ANALYSIS AND CONSTRAINTS MAPPING

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

Low, moderate and high environmental constraints were defined with reference to the 'developability' of the site. Where uncertainty exists, a higher constraint rating was applied. A preliminary constraints map was developed to guide further detailed investigations and ultimately the site infrastructure layout.

The constraints map was further refined during the preparation of the Scoping Report and following the detailed field investigations and further desktop assessments as part of the EIS. This allowed further refinements of the concept design to avoid potential environmental constraints. The final constraints map is provided in Figure 6-1 and provides the updated environmental constraints mapping for the proposal site (and key surrounding features). This includes:

- Conservation significant vegetation and threatened species
- Waterways
- Nearby residences
- Travelling Stock Reserve
- Aboriginal Heritage sites



Figure 6-1 Consolidated site constraints map

6.2 RISK ASSESSMENT

The Fatal Flaws Analysis and Scoping Report identified the key environmental issues likely to be associated with the Beryl SF. A risk assessment was undertaken to characterise the likely adverse environmental risks 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, relative to the degree of environmental risk they represented.

The environmental impact assessment below addresses all impacts likely to be attributed to the proposal (including the solar farm, access roads 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
 - 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.

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

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

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

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
8.1	Soils	Minor	Likely	High
8.2	Hydrology, water use and water quality (surface and ground water)	Minor	Possible	Medium
8.3	Traffic, transport and road safety	Moderate	Possible	High
8.4	Land use including mineral resources	Minor	Possible	Medium
8.5	Historic heritage	Minor	Possible	Medium
8.6	Resource use and waste generation	Minor	Possible	Medium
8.7	Socioeconomic and community	Minor	Possible	Medium
8.8	Climate and air quality	Minor	Possible	Medium
8.9	Magnetic fields	Minor	Unlikely	Low
8.10	Bush fire risk	Minor	Unlikely	Low

7 ENVIRONMENTAL IMPACT ASSESSMENT: KEY ISSUES

7.1 BIODIVERSITY (FLORA AND FAUNA)

7.1.1 Approach

A Biodiversity Assessment Report (BAR) has been prepared by NGH Environmental on behalf of First Solar (Australia) Pty Ltd. It is appended in full (Appendix D) and summarised in this section.

The aim of the BAR is to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) and to address the requirements of the Framework for Biodiversity Assessment (FBA), developed for Major Projects as part of the Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to assess impacts and provide offset guidance for Major Projects. This report follows the BAR format required by the FBA.

Comprehensive mapping and field surveys were completed in accordance with the requirements in the FBA and BioBanking Credit Calculator (BCC). BCC plot data were collected in November 2016 for five homogenous vegetation zones that were mapped for the site.

Targeted flora and fauna field surveys were undertaken in early November 2016 to ensure that the majority of species likely to occur within the development site could be detected, and in accordance with the threatened species survey timing matrix produced by the BCC. The survey timing was appropriate to all flora and fauna returned by the BCC with the exception of two flora species; *Prasophyllum* sp. 'Wybong' and *Acacia ausfeldii*. The BCC identified October as the end of the survey period for these species. Targeted surveys for these species were undertaken at the beginning (first week) of November. OEH were consulted regarding the timing of the surveys for these species and advised that the November timing was considered suitable by the OEH (Steven Cox, OEH, pers. comm. 05/03/17).

Survey effort included:

Targeted searches for threatened flora

Targeted searches were conducted in parts of the study area considered potentially suitable for:

- Ausfeld's Wattle (*Acacia ausfeldii*)
- *Euphrasia arguta*
- Pine Donkey Orchid (*Diuris tricolor*)
- *Prasophyllum* sp. 'Wybong'
- Silky Swainson-pea (*Swainsona sericea*)

The survey areas included patches of remnant woodland with areas of suitable ground cover containing a representation of native flora. The majority of the study area, comprising improved pasture and intensively grazed pastures in low condition, was not targeted. The searches were conducted by systematically traversing the woodland areas with linear transects approximately 10 m apart.

Fauna habitat assessment

An assessment of habitat types available and their quality and suitability as threatened species habitat was conducted across the project area. Factors such as arboreal resources, ground-layer resources, vegetation structure/types, as well as connectivity and disturbance were noted. All trees within the project area were inspected for hollows and general habitat values, including signs of use by fauna such as the presence of scratches/scats. An opportunistic record of fauna species observed during the fauna assessments was also taken.

Brush-tailed Phascogale

Nocturnal spotlighting surveys were carried out on foot with two spotlights, (including one 50W and one 100W) and included a total of 2.5 hours of spotlighting within the treed areas of the site.

Koala

During the fauna habitat assessment, described above and which included an inspection of all trees within the development envelope, including an inspection of trees for signs of fauna use, such as the presence of scratch marks or scats on or at the base of trees. Additionally, the 2.5 hours of nocturnal spotlighting surveys described above for the Brush-tailed Phascogale, also targeted the Koala.

Pink-tailed Legless Lizard

During the site habitat assessment, a small area of approximately 2 ha of scattered surface rocks was noted in the eastern portion of the site. Active searches for the species was undertaken by turning over these rocks (where possible, based on overall size and degree of embeddedness), and inspecting beneath them for signs of the species. This included either direct observations of individuals, or skin sloughs left behind by individuals. Approximately 50 rocks were turned over for this inspection (which represents about the total number of potentially suitable rocks able to be effectively turned over within the area).

Regent Honeyeater

Eight diurnal bird surveys (comprising primarily 30 minute surveys each) were undertaken across the site, for a combined total of 4 hours. In addition to this, 2 x 15 minute avifaunal surveys (on the morning and evening of 2/11/2016) were conducted within clumps of trees at survey site 3a, involving a general meander through this area. An additional 105 minute survey and 60 minute survey was conducted across/throughout the area identified as survey site 3b on the mornings of 3/11/2016 and 4/11/2016 respectively. These avifaunal surveys gave a total survey effort of 7.25 hours.

The surveys were conducted at both dawn and dusk when the Regent Honeyeater is most active. The survey locations were selected to cover available/potential Regent Honeyeater habitat within the project area, which was found to be restricted to woodland patches as well as isolated trees in paddocks. In addition to this, opportunistic records of all bird species observed during fauna assessments, vegetation surveys and hollow-bearing tree assessments, were also recorded.

Squirrel Glider

The survey methods for this species included the nocturnal spotlighting surveys as described above for the Brush-tailed Phascogale, which included a total of 2.5 hours of nocturnal surveys over 2 nights. This level of

survey effort is generally in keeping with the NSW *Threatened Species Survey and Assessment Guidelines* (DEC, 2004) which requires 2 x 1 hour of spotlighting up to 200ha of stratification unit on two separate nights. The woodland (treed parts of the site) comprise about 32 ha, and were subject to more than 2 hours of spotlighting over two nights.

7.1.2 Results

Previous surveys conducted in the local area

It is unclear whether dedicated biodiversity surveys have been previously undertaken within the locality, however evidence from the Atlas of Living Australia indicates that occasional opportunistic surveys are undertaken and the results provided to the relevant government agencies. None of the species targeted above have been previously recorded within the development envelope.

Landscape attributes

The dominant IBRA subregion affected by the proposal is the Inland Slopes Subregion of the South-Western Slopes Bioregion.

Five Mitchell Landscapes occur within the development site; Talbragar – Upper Macquarie Terrace Sand, Dubbo Basalts, Gulgong Ranges, Cope Hills Granite and Macquarie – Turon Gorges. The dominant Mitchell Landscape affected by the proposal is the Talbragar – Upper Macquarie Terrace Sand Landscape.

A site based assessment was completed in the BCC, in accordance with Appendix 4 of the FBA (as the proposal is non-linear). The total area of native vegetation mapped within the outer assessment circle of 2000 ha is 508.39 ha. This reflects the high amount of land cultivation and development surrounding the site.

No rivers or permanent streams are present within the site. Two small ephemeral drainage lines are located within the north-eastern and south-western portions of the site. The former is a predominantly 2nd order stream draining north into Wialdra Creek (approx. 1.35 km north of the site boundary), and the latter is a 1st order stream draining west into Cudgegong River (approx. 900 m west of the site boundary). Both of these drainage lines were predominantly dry at the time of the survey.

There are numerous man-made dams occurring within the project area and on immediately surrounding lands. These artificial wetlands may provide potential habitat for waterbirds and amphibians, although in general, the habitat value of these dams is considered to be of low quality due to sparse aquatic vegetation and often turbid water quality.

The closest Wetlands of International Importance (Ramsar Wetlands) to the project area are the Macquarie Marshes, situated approximately 250 km northwest of the site.

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

The BCC returned a landscape value score of 14.20.

Field survey results

PLANT COMMUNITY TYPE

One Plant Community Type (PCT) was identified in the development site; *Rough-barked Apple – red gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions* (PCT281).

Cleared areas that were dominated by non-indigenous vegetation are not considered to provide habitat for native species and thus were not included in the BCC calculations.

Within the project area, PCT 281 occurs as small patches of good condition woodland in the western and central parts of the site, and areas of low condition woodland across the majority of the central parts of the site. Low condition derived grasslands occur across the majority of the central and north-eastern parts of the site and mixed condition derived ephemeral wetland vegetation also occurs across the other parts of the north-eastern portion of the site. The low condition derived grasslands and mixed condition derived ephemeral wetland vegetation are also considered part of PCT 281 as they are derived from this woodland community, even though these areas are generally devoid of trees, and have a proportionately low percentage of native groundcover. These low condition areas represent highly degraded pasture, and it is considered likely that most of these areas have been cultivated and possibly cropped in the past. The distribution of PCT 281 at the site is mapped on Figure 7-1. Figure 1-1

White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as an EEC under the TSC Act and is listed as a CEEC under the EPBC Act. PCT 281 forms part of this community.

The community occurs across the majority of the western half of the site, and includes areas of moderate to good and low condition woodland (identified as Zones 1, 2 and 3). These areas of the TSC-listed EEC are characterised by areas where the overstorey (treed) vegetation is at the benchmark cover value and with some native groundcover (rated as moderate/good condition), as well as areas where there is overstorey (treed) vegetation at or above 25% of the lower benchmark cover value but has groundcover vegetation dominated by exotics. A total of 17.13 ha of this EEC occurs within the development footprint.

The low condition and highly modified derived grasslands (Zones 4 and 5) do not meet the criteria for the EEC or CEEC.

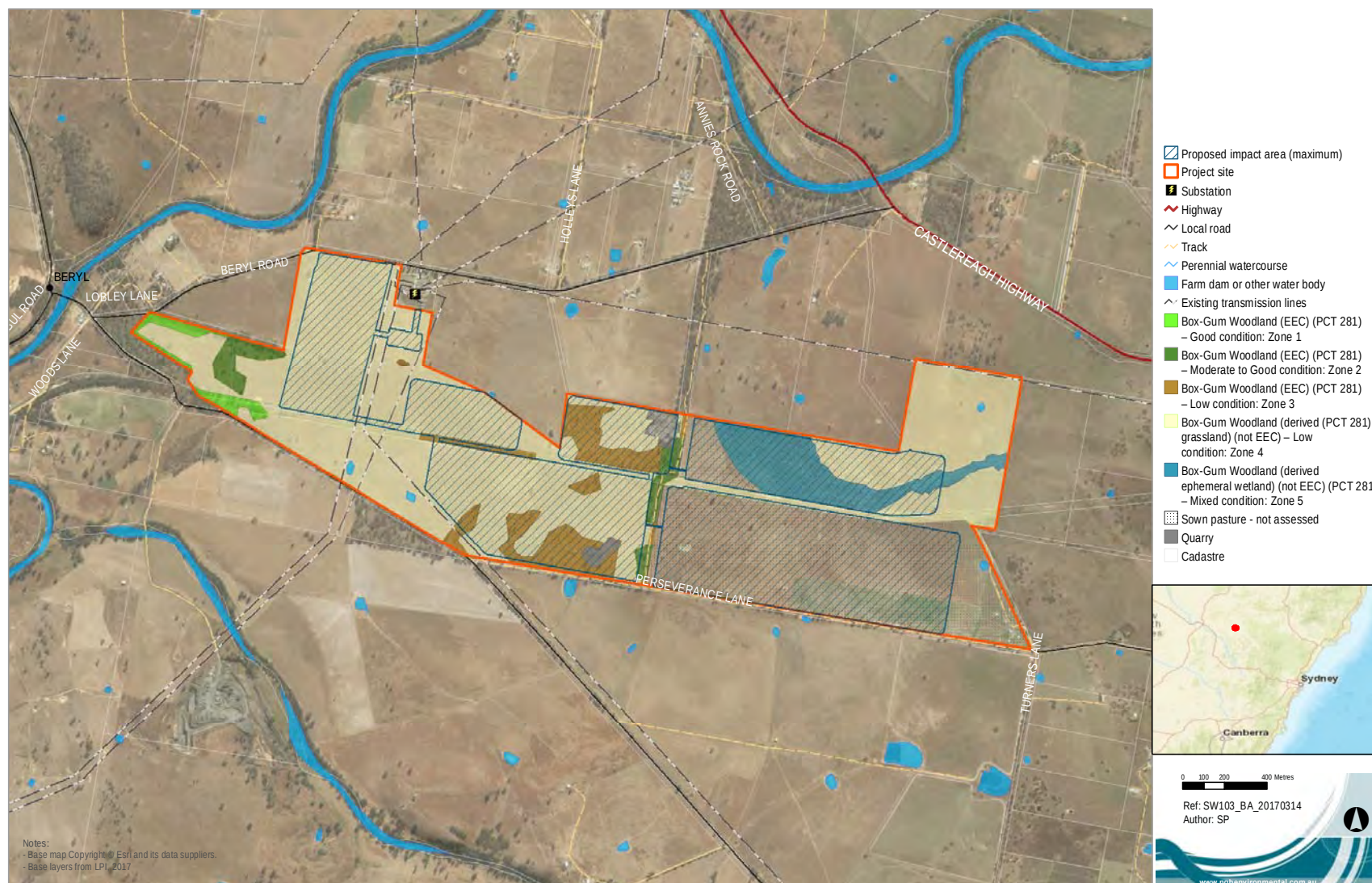


Figure 7-1 Distribution of PCT's



Figure 7-2 Distribution of EEC and EEC condition



Figure 7-3 Example of moderate/good condition Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions in the project area



Figure 7-4 An example of exotic-dominated vegetation within the project area

THREATNED SPECIES

Three threatened species listed under the NSW TSC Act were detected during the survey, including:

- Dusky Woodswallow *Artamus cyanopterus cyanopterus* – Vulnerable (TSC Act)
- Silky Swainson-pea *Swainsona sericea* – Vulnerable (TSC Act)
- Pine Donkey Orchid *Diuris tricolor* – Vulnerable (TSC Act)

The Silky Swainson-pea and Pine Donkey Orchid are species credit species, whilst the Dusky Woodswallow is neither an ecosystem or species credit species.

Biobanking Credit Calculator results

Applying the above information to the BCC assessment, the following data were entered into the BCC and returned the site value scores and areas of impact detailed in Table 7-1 below. It is noted that Zone 4 and 5 do not comprise an EEC or threatened species habitat and impacts to these zones do not generate credits under the FBA. No areas of habitat for species credit species would be impacted by the proposal.

Table 7-1 Vegetation zones for the development site

Zone ID	Vegetation zones	Condition class	EEC status (NSW TSC Act)	Area (ha) within development footprint	Survey effort (number of plots completed)	Site value score (current)
1	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - good	Yes	0	2	66.67
2	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - Good	Yes	0.99	3	67.33
3	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Low	Yes	16.14	3	47.33
4	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Low	No	95.04	3 (+2)	10

Zone ID	Vegetation zones	Condition class	EEC status (NSW TSC Act)	Area (ha) within development footprint	Survey effort (number of plots completed)	Site value score (current)
5	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - good	No	17.89	3	20.67

The outcome of the FBA BCC assessment is that a total of 684 ecosystem credits have been generated for the development site (BCC Major Project 0035/2017/4165MP Version 1). The BCC full credit report is included within the BAR, Appendix D.

ECOSYSTEM CREDITS

- PCT 281 - Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions – 684 Credits

SPECIES CREDITS

No species credits are generated by the proposal

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.

7.1.3 Commonwealth Matters of National Environmental Significance (MNES)

An EPBC protected matters report was undertaken on the 12 October 2016 (10km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. The MNES relevant to the biodiversity assessment are summarised below.

WETLANDS OF INTERNATIONAL IMPORTANCE

Four wetlands of international importance were returned from the protected matters report. The nearest of these (approximately 250 km from the development site) is the Macquarie Marshes. All other wetlands returned from the search are over 500 km away. There is no apparent connectivity between the development site and the Macquarie Marshes.

THREATENED ECOLOGICAL COMMUNITIES

Four 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 CEEC occurs within the development site. Based on the EPBC listing criteria, 4.43 ha of the CEEC occurs west of the development footprint (equivalent to Zone 1). It would not be impacted by the development.

The other three EEC's are not present within or near the proposal site.

THREATENED SPECIES

Twenty-nine threatened species were returned from the protected matters report. None of the listed species are considered to have the potential to utilise the habitats at the development site, based on either or both an assessment of the habitat conditions present at the site, or a lack of existing records in the database within close proximity (i.e. less than 15 km) to the site.

MIGRATORY SPECIES

Eight listed migratory species were returned from the protected matters report. None of these species are considered likely to occur at the site on a regular basis or rely on the habitats present.

7.1.4 Potential impacts

Avoidance measures

A preliminary constraints analysis was conducted by NGH Environmental (2016) which informed the site layout design. This analysis included identification of low, moderate and high environmental constraints, as summarised below. From this assessment, a development footprint was established which was designed to minimise impacts on the Zone 1 EEC/CEEC vegetation in the far-west of the project site, including avoidance of the small woodland patches in the west of the site which have the potential to support listed threatened species such as the Silky Swainson-pea and Pine Donkey Orchid.

After the first calculation of offset requirements, the layout was further scrutinised in terms of 'credit drivers'. The layout was further adapted:

- To remove all impacts on Zone 1 EEC/CEEC vegetation
- To reduce impacts on Zone 2 and 3 EEC, where they occur near the north-south lane way in the centre of the site. A 30 m buffer either side of the fenced lane way was mapped and the development footprint excluded from this buffer.

The array has been designed to utilise the suitable flat clear land within the site. It is noted that the area within the north east of the site is not suitable for the deployment of PV as it is located on the southern face of a small hill and is further constrained by the rail corridor. The area of the site south of the existing Beryl substation contains numerous transmission lines and due to shading issues and the existing easements it is not considered suitable to construct a PV array within the remaining area.

The final design footprint allows for areas of better quality vegetation at the western corner of the project site (as well areas along the south-western boundary) to be avoided. These have been highlighted as potential offset / revegetation sites. They would contribute to local landscape connectivity.

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
 - Potential clearing of habitat outside of the development footprint

- o Injury and mortality to fauna during clearing of fauna habitat
- o Introduction and spread of noxious weeds and pathogens
- o Disturbance to fallen timber, dead wood and bush rock

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, weed and feral animal encroachment into areas adjacent to the site or the generation of excessive dust, light or noise and associated disturbance to fauna. Where not already included as soil and water mitigation commitments of the proposal, these issues are addressed in the mitigation measures below.

Operation

Direct impacts that must be managed during operation include:

- Collision risk to birds and microbats to exterior barbed-wire fencing
- Shading by solar array infrastructure. The consequences of this impact may include:
 - o Ongoing prevention of flora regeneration
 - o Unstable ground surfaces and sedimentation of downstream habitats

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.

7.1.5 Safeguards and mitigation measures

The safeguards provided in the BAR are restated below and would be implemented to minimise and manage risks to biodiversity values. Soil and water measures that would also act to management impacts on adjacent habitats are included in those sections and not duplicated below.

Table 7-2 Safeguards and mitigation measures for biodiversity impacts

C: Construction, O: Operation, D: Decommissioning

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 hollow-dependant fauna including the Superb Parrot as well as the Large-eared Pit Bat and Corben's Long-eared Bat, which whilst considered unlikely to occur within the site, nevertheless may have some small potential as occurring within the site from time to time. The nominated clearing period above will also help to avoid the core hibernation period for the two bat species. • 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 (including EEC)	C		

Safeguards and Mitigation Measures	C	O	D
- 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. Where possible, fallen timber with hollows is to be collected and placed into adjacent suitable habitats outside the development footprint. - o The relocation of displaced fauna during clearing - o Weed management, particularly noxious weeds - o Pathogen management - o Unexpected threatened species finds - o Rehabilitation/stabilisation of disturbed areas.			
• Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree that originates from outside of the development site. • 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		D
• Use non barbed-wire on exterior fencing where possible.		O	
• A groundcover management plan would be developed and implemented to ensure the existing ground cover is maintained beneath the array during operation of the solar farm. The plan would be developed with reference to soil testing. Highly managed grazing may be used to maintain the height of ground cover during operation.		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.		O	
• Avoid night works as much as possible, and avoid altogether where in close proximity to woodland habitats on adjacent properties.	C		D
• Ensure lights (during nightworks and operation) are directed away from vegetation and adjacent habitats.	C	O	D
• Weed and hygiene protocols will be prepared and implemented.		O	
• Awareness training (fauna collision risks) during site inductions and enforcement of site speed limits.		O	
• Feral species to be monitored and a management plan to be prepared and implemented to reduce feral species abundance.	C	O	
• Implement plan which ensures that fauna movement still possible around perimeter of development site.	C	O	
• A Biodiversity Offset Strategy (BOS) would be developed and implemented to retire the credits generated by the proposal, in	C	O	

Safeguards and Mitigation Measures	C	O	D
accordance with the NSW Biodiversity Offsets Policy for Major Proposals.			

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), and
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (OEH 2010b) produced by the NSW Office of Environment and Heritage (OEH)

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, four groups contacted the consultant to register their interest in the proposal. The groups who registered interest were Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabing Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation. 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 one of the two days of fieldwork. The fieldwork was carried out in late February 2017 with a representative from all four of the registered parties participating for a day of survey.

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 and adjacent to the proposal area. The closest AHIMS site to the project area was recorded as an open artefact site (AHIMS # 36-2-0016) located approximately 500m north of the assessment area.

Assessment of Aboriginal site models for the region suggest 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 100-400 m 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 intention for the heritage survey was to cover as much of the ground surface as possible, given that the project was going to disturb approximately 206ha, within the 332ha proposal site. Survey transects were undertaken on foot across the project area to achieve maximum coverage. All mature trees within or adjacent to the development footprint were also inspected for evidence of Aboriginal scarring. Visibility within the project area was variable with visibility ranging from 80% in exposures to less than 5%. The average effective visibility was 15% but overall was quite good.

Between the survey participants, over the course of the field survey, approximately, 100km of transects were walked across the proposed solar farm development area. Allowing for an effective view width of 5m each person, this equates to a surface area examined of 46ha. However, allowing for the visibility restrictions, the effective survey coverage was reduced to 6.9 ha, or 3.3% of the project area. The effective survey coverage for the area outside the development plan was lower at 1.9 ha or 1.5%.

Despite the variable visibility encountered during the survey, there were six stone artefacts found across the proposal area that were recorded as five site occurrences. The archaeological features have been recorded as an artefact scatter (Beryl Solar Farm AS1) and four isolated finds (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3 and Beryl Solar Farm IF 4).

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 of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the solar farm and powerline easement areas.

The models of site location for the area have been shown to be accurate, with the current survey confirming the predicted distribution and nature of archaeological material with the sites located within 100-400m to a water source, even in areas highly disturbed by farming activities.

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

7.2.4 Potential impacts

The proposal involves the construction of a solar farm and includes connection to the nearby substation with an above ground powerline on Lot 21/DP 1173059 that will extend to the existing Beryl substation on Lot 1/ DP 523876. The development will result in disturbance of almost 206ha of the 332ha property within Lot 20/DP 1173059 and Lot 1/DP 1012926. 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.

Table 7-3 Identified risk to known sites

Site name	Site integrity	Type of harm	Degree of harm	Consequence of harm	Recommendation
Beryl Solar Farm IF 1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 2	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 3	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 4	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm AS1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage objects prior to development of project.

The impact to the scientific values if the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1 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.

The Beryl 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.

7.2.5 Safeguards and mitigation measures

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

Table 7-4 Safeguards and mitigation measures for Aboriginal heritage

C: Construction, O: Operation, D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
If complete avoidance of the five recorded sites within the proposal area (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1) is not possible, the artefacts 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	C		

Safeguards and Mitigation Measures	C	O	D
registered Aboriginal parties. A new site card/s will need to be completed once the sites are moved to record their new location on the AHIMS database.			
Once the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1 are salvaged, the proposed work can proceed with caution within the development footprint.	C		
First Solar should prepare an Unexpected Finds Protocol (UFP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm. The UFP will outline the procedure to deal with construction activity. Preparation of the UFP should be undertaken in consultation with the registered Aboriginal parties	C		
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 Beryl 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.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints (including glare and reflectivity).

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

7.3.1 Approach

The VIA includes the following components:

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

The impact assessment methodology used in this VIA is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d). The

BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the proposal. Mitigation measures are considered to be required for areas with a high visual impact; for medium and low impacts, the contrast is considered acceptable and mitigation is not required.

For the purpose of the assessment, a height of 3m was used to model onsite infrastructure to the proposal boundary extents. This is a realistic approximation of the height of panels and inverter containers, which may actually be 2.3m and 3.4m, respectively. It is conservative as panels may not be distributed to the site boundaries and the model does not take into account screening such as vegetation or infrastructure. On this basis is considered a 'worst case' model. The full methodology is provided in Appendix F.

7.3.2 Results

Existing environment

The proposed Beryl Solar Farm location is located on the edge of a rural residential area, in an area of moderate scenic quality and in close proximity (<1km) of a number of residences. Thirty-one residences have been counted from aerial imagery within 1 km of the site. Sixty-nine residences have been counted within 5km of the site¹.

The visual outlook around Beryl is typical of many places of rural NSW. It is characterised by mainly cleared low land areas, dissected by creeks and rivers, where riparian corridors are largely retained. Surrounding forested hills and ranges rise up to contain the low lands, occurring as disconnected remnants to the north, west and south.

The Beryl locality's visual landscape is dominated by large parcels of cleared agricultural land with scattered trees; extensive grazing of horses and cattle is the predominant agricultural activity. Large lot rural residences as well as clusters of smaller lot residential subdivisions occur. Sheds, tanks and farm machinery contribute to the rural character. House and garden plantings around houses contribute to the residential character. The proposed solar farm site is currently worked agricultural land (grazing).

The Beryl locality contains no look outs, promoted scenic areas or formalised recreational infrastructure however, notable features that are likely to be valued for their visual character include:

- Views of the surrounding forested ranges and hill tops, hemming in the fertile alluvial landscape; occurring as disconnected remnants to the north, west and south of the proposed solar farm site, between 1 and 8km from the proposed solar farm site.
- Riparian corridors such as Wialdra Creek and Cudgegong River, including timber truss bridges and providing river access in a number of locations.
- Yarrobil National Park, accessed off Spring Ridge Road. The Yarrobil National Park is approximately 8km from the site.
- The historic property of Guntawang, including race track and stables, accessed off Goolma Road, approximately 3km from the proposed solar farm site.

Nearby, Gulgong's historic township offers:

¹ This is considered an estimate as errors can occur; small houses may be overlooked and sheds may be incorrectly counted as residences.

- Formalised parks and lookout areas (including Flirtation Hill, which looks in the direction of the proposed solar farm site).
- Historic buildings.
- Scenic residential areas.

Refer to Figure 7-5.



Figure 7-5 Scenic vistas in the study area

Left to right from top: Views of the surrounding forested ranges and hill tops, Riparian corridors and creek access, Gulgong's historic township, Yarrobil National Park.

Values of the local community to the proposal

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.

- Surrounding landowners are generally supportive of the project.
- Residents in the locality were generally supportive and showed interest in the consultation process.
- One resident raised concerns regarding the impacts of glare and heat of the proposal on his property.
- Visual screening as a means to minimise views of infrastructure was discussed at the open house event.
- One resident raised concerns regarding the potential impact to the value of adjacent land (currently used for grazing and cropping).

Important local values to the respondents of the feedback forms included:

- To be living in a close community
- Country lifestyle
- The peace and quiet.

The visual landscape values considered important to respondents included:

- The farming landscape
- Views of elements including trees, sky, hills, large paddocks and cattle.

One of the key concerns raised by members of the community was potential for visual impacts.

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 16km of the proposed solar farm site:

- Agricultural (most commonly, grazing lands).
- Native vegetation remnants (includes roadside corridors, riparian areas and surrounding ranges).
- Rural residential (mostly large RU1 Primary Production lots but including some smaller R5 Village lots to the north and west of the site).
- Urban (Gulgong town centre and residential areas).

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

Landscape Character Unit - Agricultural

Scenic quality is moderate. Natural landscape elements (ranges and alluvial flats) have visually pleasing elements and contrast. View locations are varied, given the short sightlines and framing influence of local topography and remnant vegetation. However, built elements are clearly production related and include low density supporting infrastructure; linear fences, powerlines, roads and agricultural buildings and rural houses.

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



Landscape Character Unit – Native vegetation remnants

Scenic quality is low. Forms are generally uniform, lacking variety, but are organic rather than straight, and of low elevation and provide a pleasing visual contrast to the agricultural LCU. Colour variation is low. The extent of the remnants acts to reduce sight lines and view extent, framing shorter duration views.

This LCU is common in the study area.



Landscape Character Unit – Rural residential

Scenic quality is considered moderate. These areas have variety in colour and form. Built elements and landscaping contribute to the character type.

This LCU is not common in the study area.



Landscape Character Unit – Urban

Scenic quality is considered high. These areas have variety in colour and form. They contribute to a unique historic character type. Elements include recreational aspects; parks and gardens. The character is important in defining the town and contributes to its local economy.

This LCU is not common in the study area.



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 an appendix of the Visual Assessment) assumes the proposal could be modelled as a 3m high rectangular block. This is realistic approximation of the height of panels and inverter containers, which may actually be 2.3m and 3.4m, respectively. Topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours. The ZVI does not take into account screening such as vegetation or infrastructure and on this basis is considered a 'worst case' model.

The predicted sensitivity of each viewpoint was then be determined, considering its proximity to the proposed solar farm site and factors such as use, scenic quality and regional significance. Figure 7-6 illustrates the locations of these representative viewpoints with reference to the proposal site and Table 7-6 provides details of representative viewpoints. Criteria for proximity and sensitivity are provided in the full visual assessment, Appendix F.

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

- Generally, within the Agricultural LCU, whether viewed from pastures, roadside or residences, these viewpoints were assessed to be of low sensitivity. These are low use roads in a production dominated landscape. View extents are often limited or broken up by existing native vegetation remnants and house plantings. Sensitivity to contrast is expected to be low. The exception to this may be elevated residences that are oriented to take in the pastoral view.
- Where viewpoints within the Native vegetation remnants LCU have a recreational component, such as creek access or lookouts, or where residences occur, a moderate sensitivity has been assigned. In other areas, these are considered low sensitivity, reflecting low use and a low level of 'uniqueness'. Further, view extents are often limited or broken up by existing native vegetation in these areas.
- Generally, rural residential viewpoints have been assigned a moderate sensitivity. In areas where a village character is developing, they are considered to have some local significance.

- Residential and recreational viewpoints in urban areas were assigned high sensitivity. These are located in high use areas and the unique historic character of the Gulgong township has local significance.

The sensitivity of each viewpoint is tabulated below.

Table 7-5 Representative viewpoints, proximity, scenic quality and resulting sensitivity

ID	LCU	View location	Proximity	Scenic quality	Sensitivity
1	Agricultural	Road	Foreground	Moderate	Low
2	Agricultural	Residential	Middle ground	Moderate	Low
3	Agricultural	Road	Foreground	Moderate	Low
4	Agricultural	Residential	Middle ground	Moderate	Low
5	Agricultural	Road	Middle ground	Moderate	Low
6	Agricultural	Road	Middle ground	Moderate	Low
7	Agricultural	Road	Middle ground	Moderate	Low
8	Remnant	Creek	Foreground	Low	Moderate
9	Remnant	Residential	Middle ground	Low	Moderate
10	Remnant	Road	Foreground	Low	Low
11	Remnant	Road	Foreground	Low	Low
12	Remnant	Road	Foreground	Low	Low
13	Remnant	Road	Middle ground	Low	Low
14	Remnant	Recreation	Middle ground	Low	Moderate
15	Rural residential	Road	Foreground	Moderate	Moderate
16	Rural residential	Residential	Middle ground	Moderate	Moderate
17	Rural residential	Residential	Foreground	Moderate	Moderate
18	Rural residential	Residential	Foreground	Moderate	Moderate
19	Rural residential	Residential	Foreground	Moderate	Moderate
20	Rural residential	Road	Foreground	Moderate	Moderate
21	Urban	Recreational	Middle ground	High	High
22	Urban	Residential	Middle ground	High	High

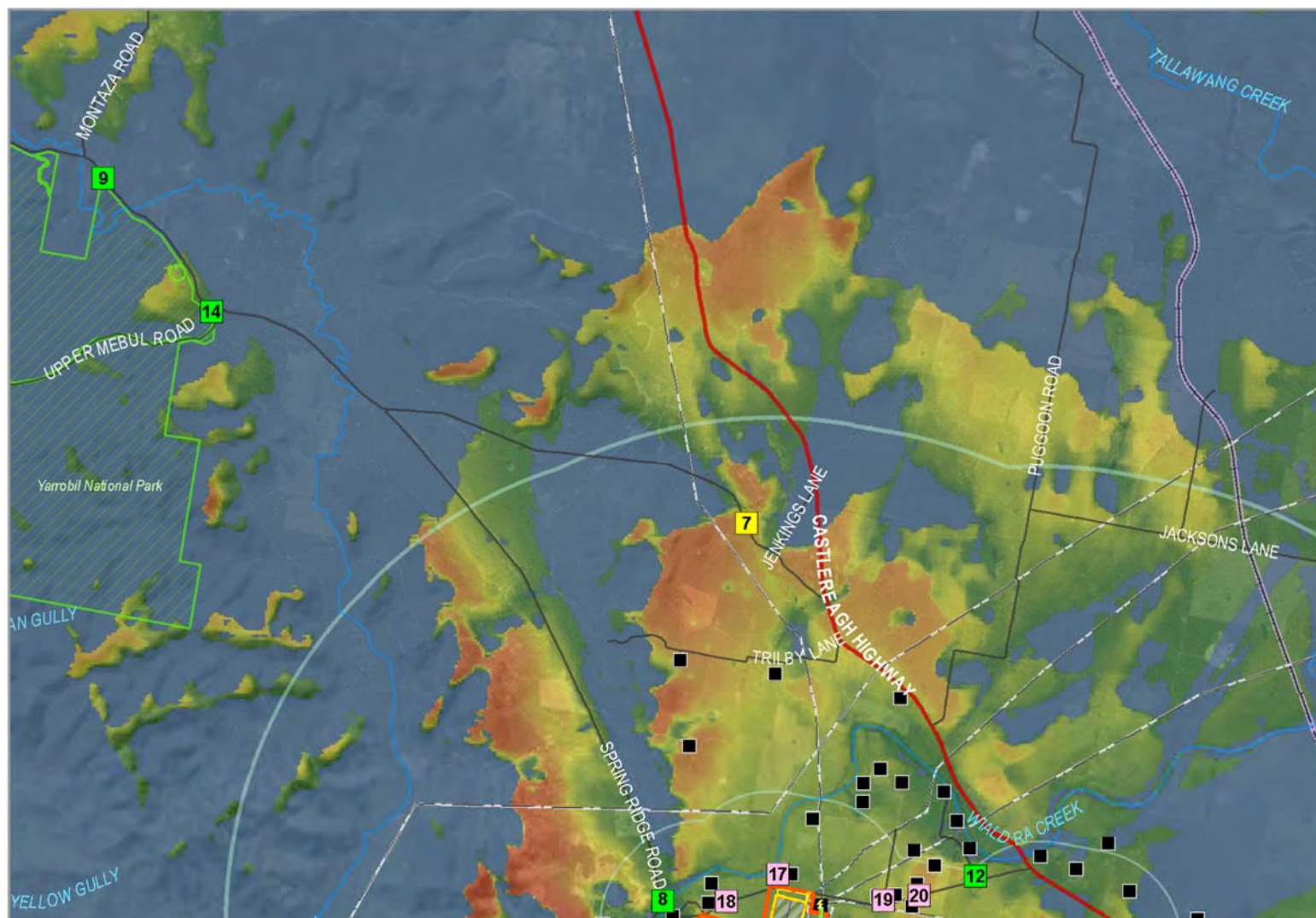


Figure 7-6 Location of representative viewpoints and array infrastructure ZVI (fore and midground view)

7.3.3 Potential impacts

The visual impact assessment was undertaken considering the:

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

Evaluation criteria

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

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

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

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

For high impact viewpoints, mitigation must be considered.

The table below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating (medium). Viewpoints assessed to have a low impact (negligible or not perceived and considered acceptable) are excluded below but provided in full, Appendix F.

Representative photos (including panoramas for selected locations) of the existing views are provided below. In the panoramas below, the visual extent of the 'worst case infrastructure layout'² is shown as follows:

- Green is the estimated visible extent of arrays, excluding shielding by trees/infrastructure: this is the extent of the array most likely to be observable.
- Yellow areas are likely to be shielded by trees/infrastructure: infrastructure in this area is unlikely to be visible.
- Red is the estimated extent of the solar farm site boundary within the view field.

² This is the infrastructure footprint prior to reducing the western extent of the array. The panorama extents were based on the earlier layout and are in this case conservative; actual view extents would be less from some locations.

Table 7-6 Visual impact at representative viewpoints with reference to the Beryl Solar Farm, in order of highest impact

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
17	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to existing vegetation. Views would be broken up to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
18	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to the location of existing vegetation and placement of infrastructure. Views would be screened to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's north-east corner would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
19	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited by topography and existed vegetation. Views would be screened to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
20	Rural residential	Road	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure from the closest receiver at this location (which backs onto the solar site) may be expansive. Views would be broken up to a minor extent by existing buildings and vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise views further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
1	Agricultural	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working in paddocks) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. No mitigation required



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
11	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working on properties) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. No mitigation required



Visual impact assessment at representative viewpoints

The highest predicted impacts were identified for four rural residential viewpoints, one agricultural viewpoint and one remnant viewpoint. All are located in the foreground proximity; within 1km of the proposed solar farm site.

Table 7-7 Highest visual impact: summary

ID	LCU	Viewpoint	Visual impact
17	Rural residential	Residential	Medium
18	Rural residential	Residential	Medium
19	Rural residential	Residential	Medium
20	Rural residential	Road	Medium
1	Agricultural	Road	Medium
11	Remnant	Road	Medium

In all cases, these locations have expansive views of the proposed infrastructure and, while the landscapes can absorb some change and the contrast is considered acceptable, some further screening could be effective in further 'breaking up' views of the infrastructure. This would assist to protect the dominant visual features, which include native vegetation and planted landscaping. This is particularly warranted where residences and residential access ways are affected; viewpoints 17, 18, 19 and 20.

In all cases, the contrast of the proposed infrastructure is considered acceptable, but mitigation is recommended. Proposed onsite screening locations are provided in Appendix F specifically aiming to address impacts from these locations.

Generally, the visibility of low lying infrastructure (less than 3m) is low. This is on account the generally flat terrain, meaning that the view diminishes rapidly with distance from the site. It is noted however, that local rises in some cases assist to screen the site (receivers to the north-east and south) and in some cases may expand the view of the site (elevated receivers to the north, north of Wialda Creek, looking down on the site). Generally, the visibility is further by existing roadside vegetation and native vegetation remnants, including the riparian corridors that surround the site to the north, west and south. Impacts in all other locations have been assessed as low and acceptable. No mitigation has been recommended for these locations.

CUMULATIVE IMPACTS

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

Construction

During construction, the additional haulage traffic impact creates the greatest potential for cumulative visual impacts. The Castlereagh Highway is a high use road corridor and likely to carry a substantial proportion of heavy and oversized vehicles. The visual impact of increased traffic movements to the site would be predominantly limited to construction (approximately 12 months).

Operation

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.

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.

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

7.3.4 Safeguards 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 Beryl 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 7-8 Safeguards and mitigation measures for visual impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
- If feasible, underground rather than overhead power lines would be considered. - If 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: - Buildings will non-reflective and in eucalypt green, beige or muted brown. - Pole mounts will be non-reflective. - Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.	Design stage		
- Dust would be controlled in response to visual cues. - Parking areas, material stock piles and other construction activities would be located as far as practical from nearby residences or screened (by existing vegetation or constructed screens) for the period of construction.	C		

Safeguards and mitigation measures	C	O	D
- 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).			
A Visual Impact Management Plan would address the 'as built' visual impacts of the proposed solar farm. The plan would include: - Onsite vegetation screening, guided by the proposed screening, provided in Appendix D of the VIA report Appendix F. - Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas). - Verification of predicted and actual impacts. This would improve the reliability of the measures and provide a trigger to undertake additional mitigation if required. (Guidance regarding these measures is provided in Appendix D of the VIA report Appendix F).		O	

7.4 NOISE IMPACTS

7.4.1 Approach

A Construction and Operational Noise and Vibration Assessment for the proposed Beryl SF was undertaken by Renzo Tonin and Associates. The full report is provided in Appendix G.1 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 six kilometres west of Gulgong. The surrounding land use is agriculture based with residences existing on large rural properties that undertake grazing and

cropping activities. Noise sources include traffic and agricultural activities such as the operation of large harvesters, tractors, haulage trucks, irrigation pumps, quad bikes and 4WD vehicles.

Figure 7-7 illustrates the locations of the nearest receivers to the proposal site, with the nearest residential dwelling being approximately 135m north of the project area (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. For this project, background noise was determined by long-term noise monitoring.

Noise Monitoring was undertaken at the third closest receiver (R2, Monitored at L1 on Figure 7-7). Long term (unattended) noise monitoring was carried out at L1 between Thursday 17th and Monday 21st November 2016. The results are included in Table 7-9.

Table 7-9 Results of background noise monitoring and noise management levels

Monitoring location	L _{A90} Background Noise Levels			L _{A90} Ambient noise level		
	Day	Evening	Night	Day	Evening	Night
L1 – 5 Holleys Lane Gulgong	28	30	29	45	51	49

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.

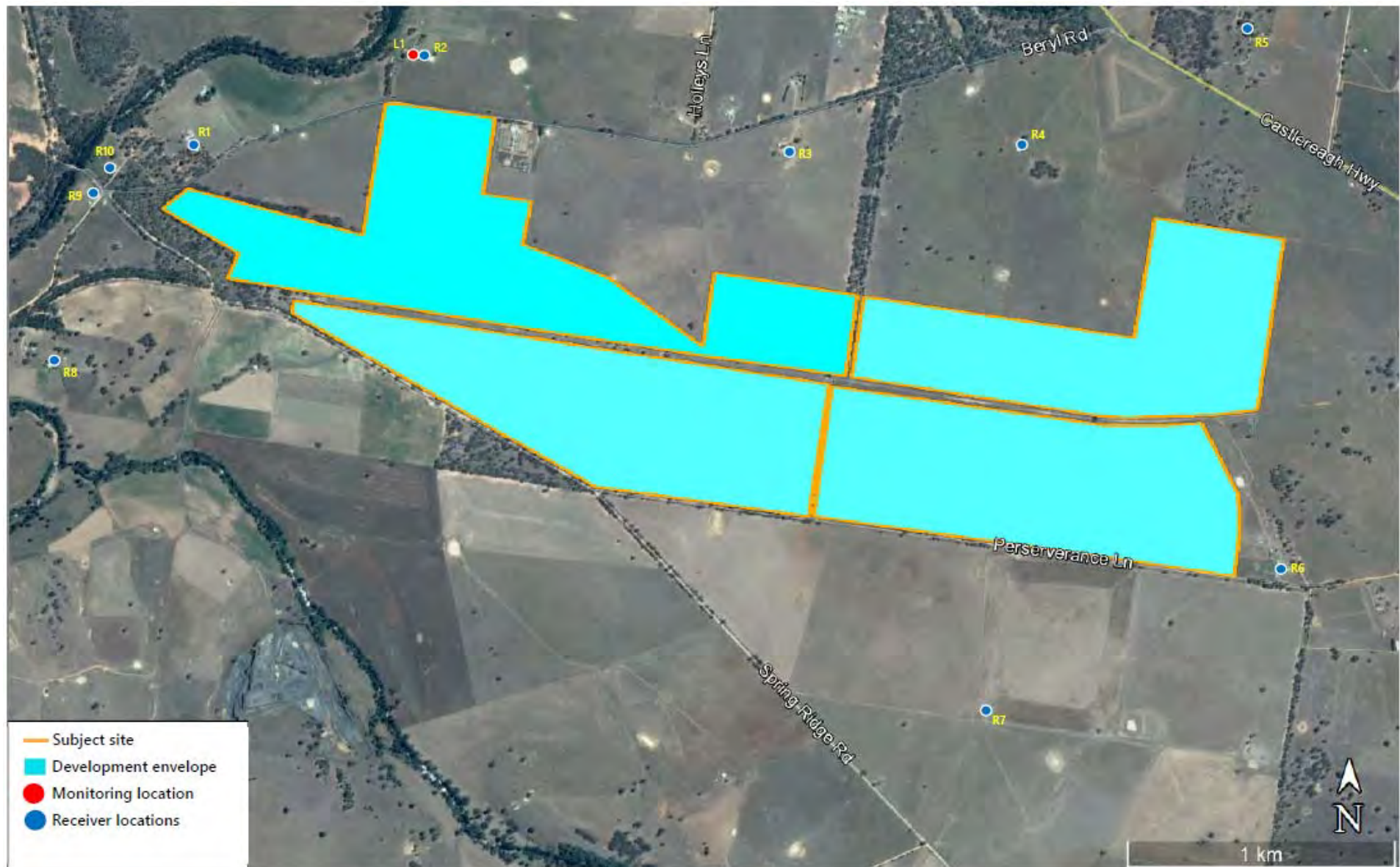


Figure 7-7 Residential receivers and noise monitoring locations adjacent to the proposal site

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.

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers (Table 7-10). The Rating Background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measures 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 7-10 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 RBL + 10dB(A) Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected RBL + 5dB(A)

Noise Management Levels

Table 7-10 identifies the adopted construction noise management levels (NMLs) for the nearest noise sensitive receivers (refer to Figure 7-7). The NMLs for the receivers' locations are derived from the RBLs represented by the background noise levels measures at the monitoring location (Table 7-9) and NSW ICNG (DECC 2009) criteria (Table 7-10). Furthermore, during standard construction hours, a highly affected noise objective of 75 dB(A) applies to all receivers.

Table 7-11 Construction Noise Management Levels at Residential Receivers

Location description	Day L_{A90} Background Noise Level (RBL)	Day Noise Management L_{A90} (15min)
All residential receivers	30 ¹	40

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

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 7-12.

Table 7-12 Construction equipment sound power levels

Equipment used	L _{Aeq} Sound power levels (dBA)	No. Items required
Small pile driving rig	3	114
Crane	1	110
Drum Roller	1	109
Padfoot roller	1	109
Wheeled loader	1	109
Dump truck	2	108
30t Excavator	4	107
Grader	2	107
Chain trencher	1	104
Water truck	2	104
Telehandler	2	98
Forklift	2	90

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 the prediction of the total noise from a site.

The noise prediction models take into account:

- Location of noise sources and receiver locations
- Height of sources and receivers
- Separation distances between sources and receivers
- Ground type between sources and receivers
- Attenuation from barriers (natural and purpose built).

Table 7-13 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 noisiest plants operating concurrently.

Table 7-13 Predicted $L_{Aeq\ 15\ min}$ construction noise levels at receiver locations

Receiver location (refer to Figure X)	Noise management level ¹	Predicted Construction Noise Level, $L_{Aeq\ (15\ min)}^2$	Comply? (Yes/No)
R1	40	<20-52	No
R2		<20-50	No
R3		<20-40	Yes
R4		<20-39	Yes
R5		<20-36	Yes
R6		<20-50	No
R7		<20-38	Yes
R8		<20-36	Yes
R9		<20-46	No
R10		<20-47	No

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 noisiest construction plant and equipment operating concurrently.

Based on the construction noise level presented in the table above, the construction management levels at Receivers R1, R2, R6, R9 and R10 may be exceeded when construction works are conducted at closest proximity to the receivers. It is noted construction 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. Table 7-14 outlines possible noise reductions using some recommended control methods (refer to Appendix G.1 for more detailed list). Included in Appendix G.2 is a draft Construction Noise Management Plan, to assist in managing noise exceedances during construction.

Table 7-14 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

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
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 Beryl SF is outlined in Table 7-15.

Table 7-15 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 shown in Table 7-15 is shown in Table 7-16.

Table 7-16 Applicable operational noise criteria

Receiver	Intrusiveness criteria		Recommended LAeq Amenity Noise level		
	Period	LAeq (15 minute) (dBA)	Time of day	Acceptable	Maximum
All receivers	Day	30 + 5 = 35	Day ¹	50	55
	Evening	30 + 5 = 35	Evening ²	45	50
	Night	30 + 5 = 35	Night ³	40	45

- 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.

When comparing the amenity and the intrusiveness criteria, it can be seen that the intrusiveness criteria is more stringent for day, evening and night periods. As such, intrusiveness criteria is the only criteria that was considered in the operational noise assessment.

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 7-17.

Table 7-17 Sleep Disturbance Criteria dB(A)

Receiver	Sleep Disturbance Criteria	Sleep Disturbance Criteria specific to proposal, L_{amax}
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 3,600 tracking motors to drive up to 950,000 solar panels.
- Operation of up to 66 inverters
- Three staff members onsite daily with the use of a light vehicle

The predicted power levels of these operation activities are outlined in Table 7-18.

Table 7-18 Typical operational plant and equipment and sound power levels for the proposal

Plant description	L_{Aeq} Sound power levels (dBA)
Tracker Motor (up to 3,600 in total)	78 (each)
Ingeteam 1640TL B630 Inverters (up to 66 in total)	88 (each)
Light vehicle (3 in total)	88 (each)

Operational noise assessment

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 was used. The modelling calculates the contribution of each noise source at each specified receptor point and allows 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 10 m 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 7-19 presents the predicted noise levels for the 'worst case scenario' based on concurrent operation all plant and equipment shown in Table 7-12.

Table 7-19 Predicted $L_{Aeq\ 15min}$ Operational Noise Levels at Receiver Locations, dB(A)

Receiver location	Intrusiveness criteria	Predicted Operational Noise Levels, L_{Aeq} (15 min)			Comply? (Yes/No)
		Calm and isothermal conditions	Slight to gentle breeze	Moderate temperature inversion ¹	
R1	35	26	30	30	Yes
R2		27	32	32	Yes
R3		27	32	32	Yes
R4		26	31	31	Yes
R5		<20	25	25	Yes
R6		26	31	31	Yes
R7		26	32	32	Yes
R8		<20	24	24	Yes
R9		21	26	26	Yes
R10		22	27	27	Yes

Based on the predicted operational noise levels presented in the table above, predicted noise levels at the nearest receivers comply with the nominated criteria under all scenarios and meteorological conditions. The predicted operational noise levels will additionally be 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 receivers are in excess of 100m from the subject site. Also, there are no high vibration producing plant items to be used, therefore 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 EPAs Assessing Vibration: A technical Guideline (DECC 2006). Based on the proposed plant items to be used during construction (Table 7-12), vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 7-20.

Table 7-20 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	135m	Residential	Very low risk of adverse comment	Not required
R2	330m	Residential	Very low risk of adverse comment	Not required
R3	465m	Residential	Very low risk of adverse comment	Not required
R4	1,120m	Residential	Very low risk of adverse comment	Not required
R5	1,470m	Residential	Very low risk of adverse comment	Not required
R6	290m	Residential	Very low risk of adverse comment	Not required
R7	1,220m	Residential	Very low risk of adverse comment	Not required
R8	710m	Residential	Very low risk of adverse comment	Not required
R9	495m	Residential	Very low risk of adverse comment	Not required
R10	470m	Residential	Very low risk of adverse comment	Not required

The potential for adverse comments to vibration impacts during the construction works was determined to be very low due to the large distances between the receiver locations and the type of construction activities. 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, the road traffic noise assessment is only considered for the construction stage, to provide 'worst case' assessment. Vehicle movements during operation of the solar farm would be minimal.

Noise impacts from the potential increase in traffic on the surrounding road network due to the construction is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out criteria to be applied to types of road and land uses.

Vehicle access to the subject site will be via Beryl Road.

Table 7-21 Summary of estimated construction traffic volumes during peak.

Vehicle type	Trips per day
Cars / light vehicles (proposal management, construction staff etc.)	300
Trucks/ heavy vehicles	Up to 100

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

Table 7-22 Predicted road traffic noise contribution levels along public roads, dB(A).

Receiver	Criteria	Speed (km/h)	Distance to Road	Predicted Noise Level	Comply? (Yes/No)
Residences on Beryl Road	$L_{Aeq}(15 \text{ hour})$ 60 dB(A)	80	20m	35 dB(A)	Yes

From Table 7-22 it can be seen that road traffic noise level contributions from the truck movements associated with the construction works are at least 7dB(A) below the applicable noise criteria. Therefore, traffic noise during 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 7-23 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		
Preparation of a Construction Noise Management Plan. A draft plan is included in Appendix G.2.	C		
- Additionally, during construction: - Use less noisy plant and equipment, where feasible and reasonable. - Plant and equipment should be properly maintained. - Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended. - Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.	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 Develop and implement a noise complaint process. Each complaint would 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. Keep people informed of progress. The person selected to liaise with the community should be adequately trained and experienced in such matters.			

8 ASSESSMENT OF ADDITIONAL ISSUES

8.1 SOILS

8.1.1 Existing environment

Topography geology and soils

The topography of the proposal site is generally flat to gently undulating and sits at an elevation of between 410 and 435 metres above sea level (ASL). The site includes the following topographic features:

- The north-eastern part of the site rises to a small crest (approximately 455m ASL) which is located just north of the northern boundary.
- A rocky knoll is located in the central southern part of the site and appears to have once been subjected to quarrying operations.
- A raised embankment runs through the proposal site in an east-west direction.
- Some parts of the site are low lying and waterways exist close to the site on three boundaries.

The Cobbora 1:100,000 Geological Sheet (Meakin *et al.* 1999) indicates that the proposal site contains geology from the Cenozoic era, including:

- Undifferentiated unconsolidated quartz and quartz-lithic gravel, sand, silt and clay (Cza); and
- Tholeiite, alkali basalt, basanite, nephelinite, limburgite, trachyte, rare obsidian (Tb).

Four soil landscapes occur within the proposal site (Murphy and Lawrie 1998), all of which have moderate to very high erosion hazard when disturbed. The location and limitations of these soil landscapes are described in Table 8-1.

Table 8-1 Soil landscapes at the proposal site

Soil Landscape	Location	Limitations
Nanima 'na'	North East area of the site	Moderate fertility, friable surface soils, steep slopes, rock outcrop, moderate to high available water holding capacity, very high erosion hazard under cultivation, moderate to high shrink-swell potential, aggregated clays may leak in earthworks.
Craigmore 'cm'	South east area of the site	Moderate to high fertility, weakly structure surface soils, moderate to high available water holding capacity, moderate to high erosion hazard under cultivation.
Home Rule 'hr'	Western area of the site	Very low fertility, low available waterholding capacity, acidic surface soils, seasonal waterlogging, sodic subsoils in lower slopes, high permeability on mid to upper slopes, moderate to high erosion hazard under cultivation.
Mebul 'me'	Small area along south boundary in the western portion of the site	High erosion hazard under cultivation and low surface cover, high shrink-swell potential.

Most of the site is generally stable and well grassed. There are several areas of disturbed ground however, in the central part of the site that have been disturbed and contain areas of bare soil that would be at present risk of erosion.



Figure 8-1 Ground disturbance in the central northern part of the site



Figure 8-2 Mounds of soil and ground disturbance in the central northern part of the site.



Figure 8-3 Possible quarry area in the central southern part of the site

Potential contamination

A search of the NSW EPA Contaminated Land Register of notices (NSW Government 2017a) on 3 February 2017 identify one site within the Mid-Western LGA. The site is however located near Mudgee, over 27km from the proposal site. The proposal site does not appear on the List of NSW contaminated sites notified to the EPA, as of 3 February 2017.

There is a risk that contamination associated with agricultural and quarrying activities onsite and former railway line (e.g., use and storage of pesticides, buried rubbish) could be present on the site however, no evidence of contamination was observed during the site assessment, such as odours or colouring and this risk is considered very low.

There is no potential for acid sulphate soils due to the distance of the proposal site from the coast.

8.1.2 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. 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:

- 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).
- 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 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. There may be some earthworks within the raised embankment of the former railway line but this would be limited and would mostly constitute trenching works to install cables or a track construction works in which the general lay of the land would be followed.

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 disturbance (less than 1 hectare total) 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 stability. Cleaning vehicles and machinery as part of the soil and water management plan would reduce this risk.

The use of fuels and other chemicals onsite pose a risk of soil contamination in the event of a spill. Chemicals used onsite would include fuels, lubricants and (minimally) herbicides. Spills of these contaminants can alter soil health, affecting its ability to support plant growth. When mobilised, such as in a rain event or flooding, these substances may spread via watercourse onsite, affecting much larger areas of aquatic habitat such as Cudgegong River and Wialdra Creek. This risk is manageable.

It is possible that contamination associated with past agricultural and possible quarrying activities (e.g. 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 project. A contaminated soil protocol has been included to manage this risk should it occur.

Operation

Minimal operational impacts to soils would occur. Maintenance activities and vehicles would be largely confined to the formalised access tracks. There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides) requiring emergency protocols during operation of the solar farm.

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 amount 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.

Concentrated runoff from the impervious surfaces created by the solar panels could lead to increased soil erosion below the leading edge of the solar array modules during significant rain events and could be influenced by seasonal droughts. Further, if panels are located very close together, shading could reduce plant growth beneath the panels. Generally, however, the microclimate created under panels and the direction of water to the leading edge of panels is expected to lead to more not less grass growth at the leading edge. Moisture is expected to distribute evenly in this soil type. The cleaning of solar panels with water could also have similar impacts if water concentration was sufficient to cause erosion. The maintenance of ground cover (including monitoring through a formal groundcover management plan) would ensure a stable groundcover during the operation of the solar farm, minimising erosion and adverse water quality impacts. Soil testing would be undertaken to inform the groundcover management plan.

8.1.3 Safeguards and mitigation measures

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

Table 8-2 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.	Design stage		
- A soil and water management plan (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: - Carry out soil testing prior to any impacts, to inform any soil treatments and provide baseline information for the decommissioning rehabilitation. - Install, monitor and maintain erosion controls. - Ensure that machinery leaves the site in a clean condition to avoid tracking of sediment onto public roads which may cause risks to other road users through reduced road stability. - Manage topsoil: In all excavation activities, separate subsoils and topsoils and ensure that they are replaced in	C		D

Safeguards and Mitigation Measures	C	O	D
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 Ensure any discharge of water from the site is managed to ensure ANZECC (2000) water quality criteria are met. - 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.			
• A spill response plan would be developed as part of the overall risk management plan to prevent contaminants affecting adjacent surrounding environments. The plan would: - 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.	C	O	D
• 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

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

8.2.1 Existing environment

Surface water

The Beryl SF proposal site is located within the Central Tablelands Local Land Services Area (formerly Central West CMA). The site is located within the Macquarie catchment. Two waterways are located in close vicinity of the proposal site including Cudgegong River and Wialdra Creek (Figure 8-4).

- Cudgegong River is located between 164m and 823m from the western boundary of the proposal site. Cudgegong River flows in a south westerly direction.
- Wialdra Creek is a tributary of Cudgegong River, it is located approximately 1.2 km north of the proposal site boundary.

The closest Nationally Important Wetland and Ramsar Wetland to the proposal site is the Macquarie Marshes and Nature Reserve, which is over 200km north west of the site.

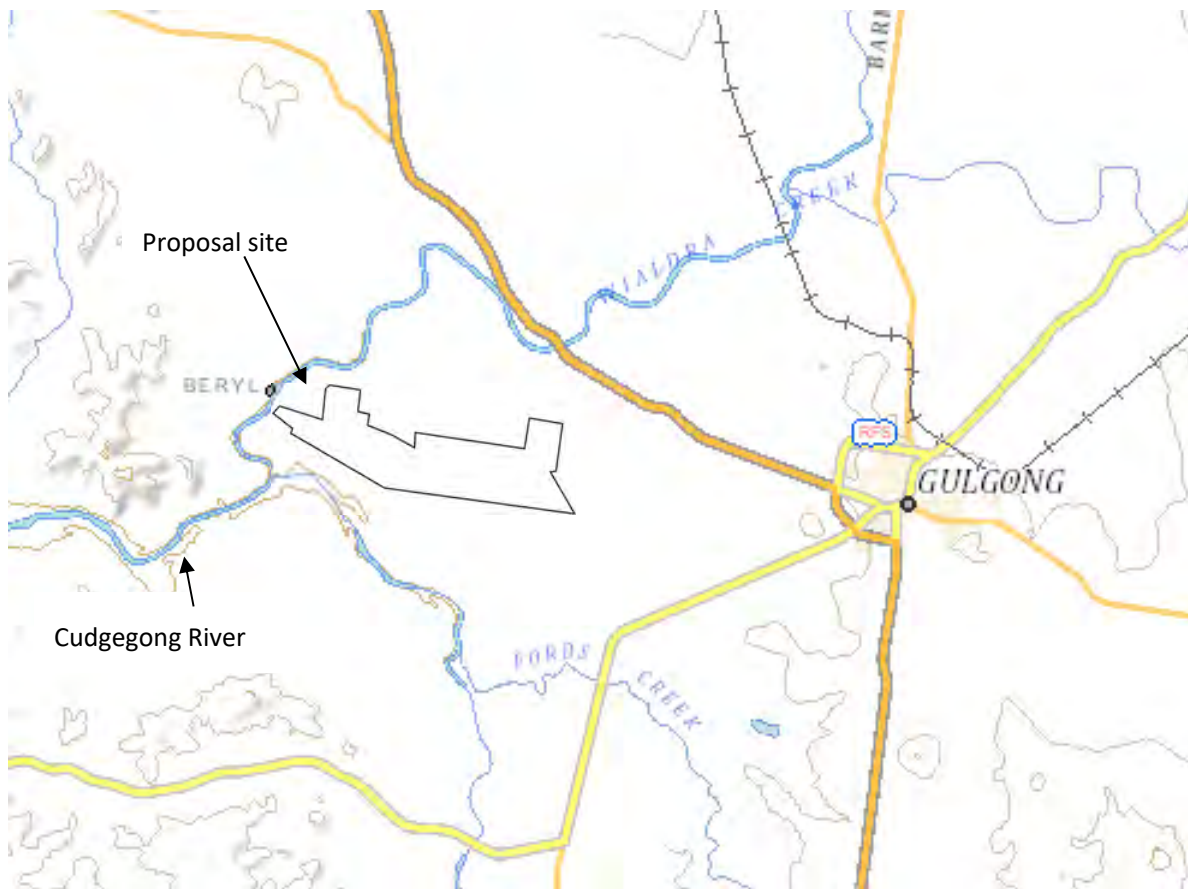


Figure 8-4 Waterways surrounding the proposal site (NSW Government, 2017).

Two waterways and eight wetlands/farm dams occur within the proposal site. One waterway located within the south western area of site, is an ephemeral tributary of the Cudgegong River. The waterway enters the Cudgegong River approximately 900m south west of the proposal site. The other waterway is located in the eastern area of the site. It is an ephemeral tributary of the Wialdra Creek, entering the creek 1.4km north of the proposal site. At the time of the site inspection these waterways were dry. There was no evidence of incised channels and no obvious creek bed; they were evident only as greener depressions in the pasture. These waterways are likely to have water present only after substantial rainfall. The water quality would be influenced by the surrounding land uses including cropping and grazing. It would therefore vary seasonally.

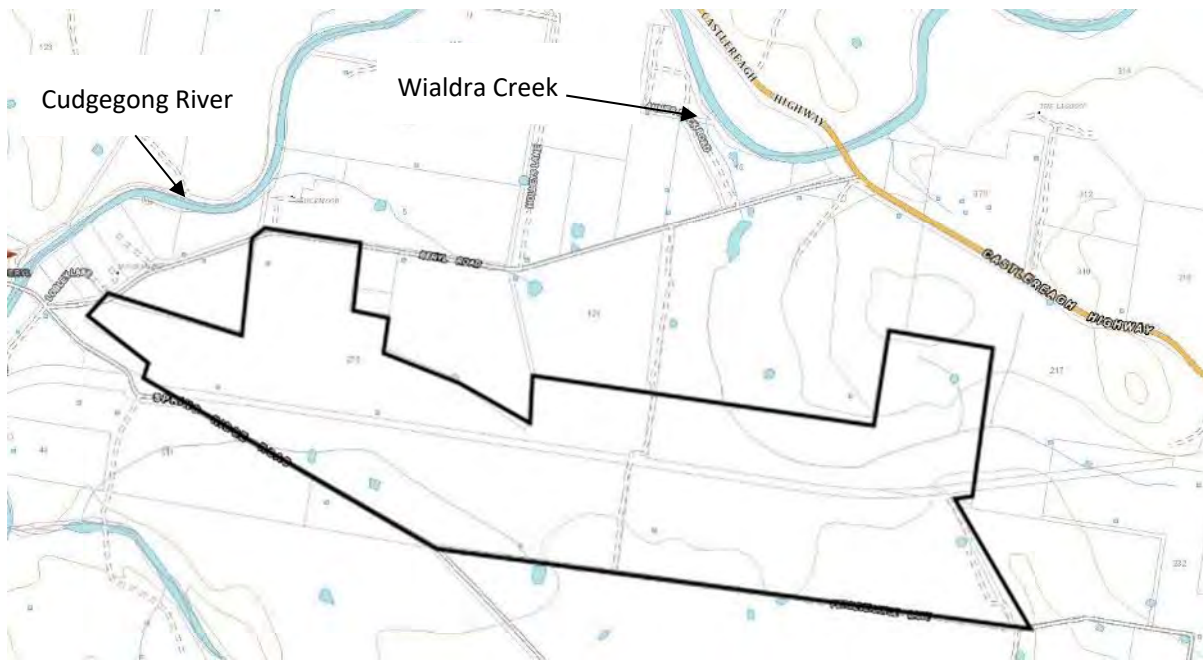


Figure 8-5 Waterways (blue) within proposal site (black outline) (NSW Government, 2017).



Figure 8-6 Man-made dam onsite.



Figure 8-7 Waterway onsite.

Surface hydrology and flooding

The site is generally low lying, with some localised rises. It occurs in close proximity to two perennial waterways, located along three of its boundaries. The site was identified as not part of the Flood Risk Precincts identified in the Mudgee Floodplain Management Study (Mudgee Shire Council 2002). There is no flood prone land mapping for the site as part of the Mid Western Regional Council LEP 2012.

The Australian flood risk portal (Geoscience Australia 2017) identifies one man made dam within the site at the northern boundary as water detected during 1% and 5% of observations (Figure 8-8).

The proposal site has the potential to be temporarily flooded during flood events of Wialdra Creek and Cudgegong River due to their close proximity. There are several culverts installed underneath the railway line embankment indicating water flow needed to be managed during the operation of the railway line. However, there is no available history of the site being flooded.

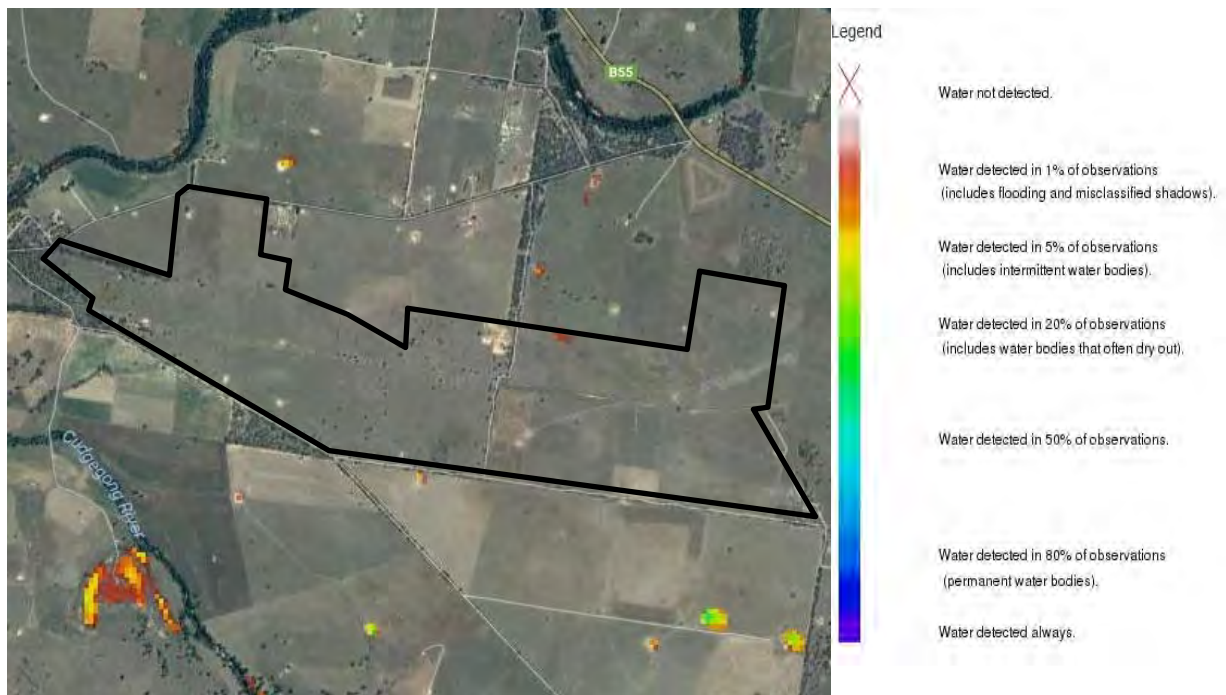


Figure 8-8 Flood Risk Information Map (Geoscience Australia 2017).

Groundwater

There are three bores located within 1km of the proposal site with recorded groundwater (Figure 8-9). All bores are private and installed for stock, irrigation and domestic purposes. The two bores east of the proposal site, GW057947 and GW803647, intercepted groundwater at 22m and 35m respectively. The bore west of the site, GW803200, adjacent to Cudegong River, has a standing water level at 4m below the ground surface (DPI, 2017). During the site inspection there was no evidence of high water tables and the watercourses onsite were also dry.

The Mid-Western Regional LEP 2012 identifies the Beryl SF site as groundwater vulnerable.

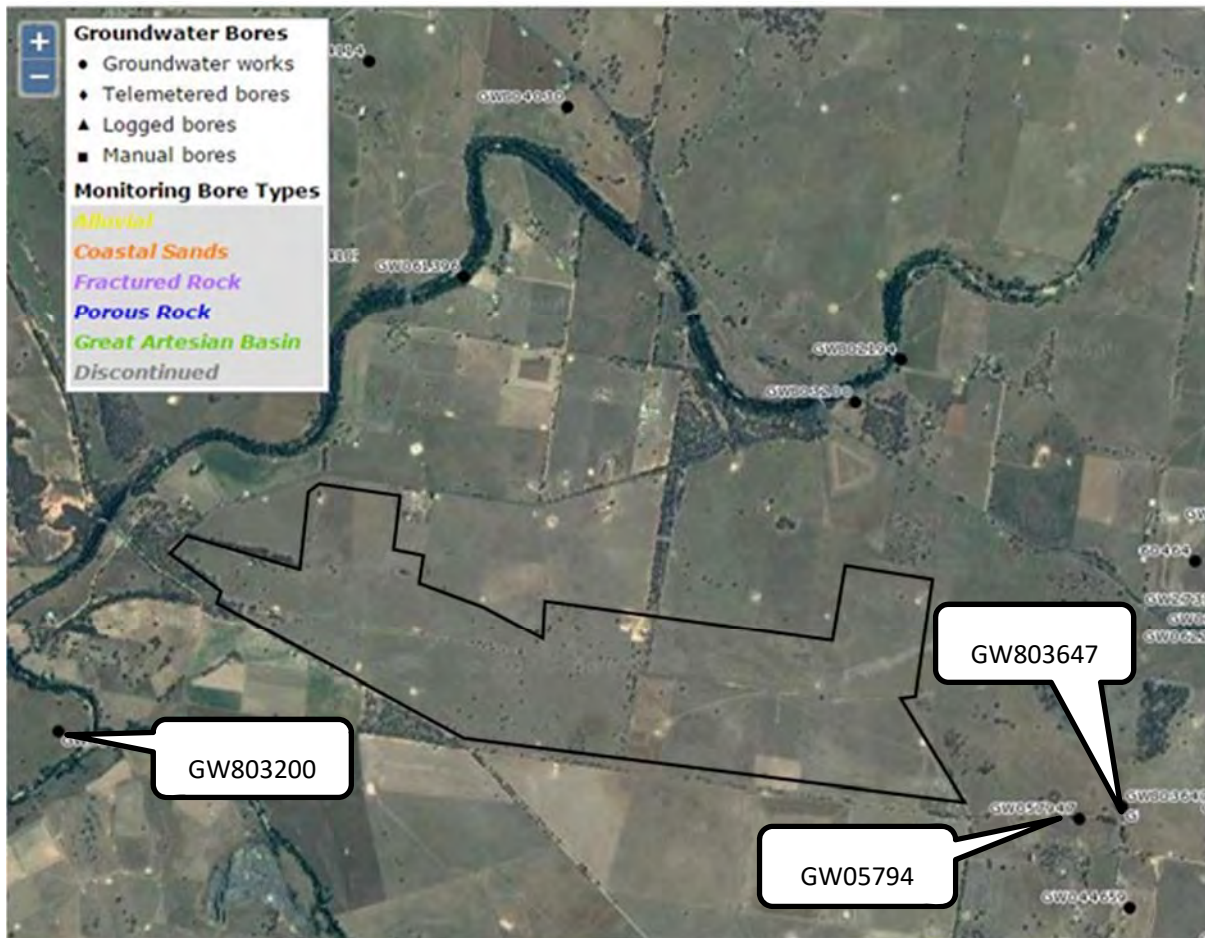


Figure 8-9 Groundwater bores within the vicinity of the proposal site (DPI, 2017).

Groundwater dependent ecosystems

Potential Groundwater Dependent Ecosystems (GDEs) within the vicinity of the proposal site are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2016) (refer Figure 8-10). The Atlas identified one vegetation GDE that is potentially reliant on subsurface groundwater outside the western portion of the proposal site. The vegetation is described as Blakely's Red Gum – Rough Barked Apple woodland on flats and alluvial terraces. This GDE has low to moderate potential for groundwater interaction. No GDEs are mapped for the proposal site.

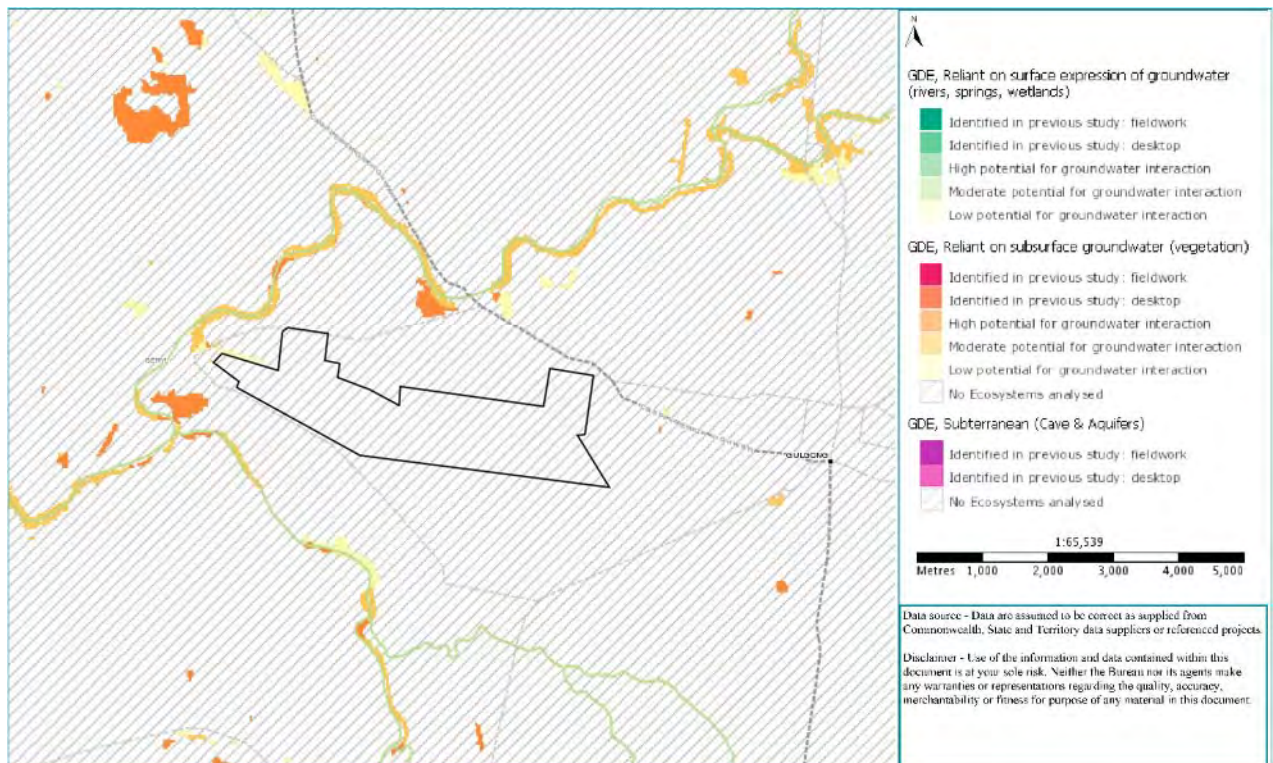


Figure 8-10 GDEs in regards to the proposal site, black (BOM 2016).

Water entitlement

The proposal site is located within the area of two water sharing plans within the Central Tablelands water management area. However, the proposal would not involve the extraction of water and therefore would not require any extraction licences.

8.2.2 Potential impacts

Construction and decommissioning

SURFACE WATER

The proposal involves a range of activities that would disturb soils and potentially lead to sediment laden runoff, affecting local water ways. These activities include:

- o 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.
- o Trenching for underground cable installation and transmission line
- o Pile driving/ screwing of module frames, transmission line poles and fencing poles.

Soil compaction would occur when hardstand areas and access tracks are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. The use of fuels and other chemicals (lubricants and herbicides), as well as concrete used for footings onsite during construction and decommissioning, pose a risk of surface water contamination in the event of a spill.

Surface water contamination risks for Cudgegong River and Wialdra Creek are considered low, due to the distance from the proposal site. However, there is an increased risk for surface water contamination and

mobilisation of a spill during rainfall events due to the onsite watercourses being tributaries of these waterways.

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– Soil. Additionally, impacts to local water quality can be minimised by ensuring erosion and sediment control plans include measures to ensure ANZECC water quality criteria are met prior to discharge of water offsite.

FLOODING AND HYDROLOGY

The proposal site has potential to be temporarily flooded during flood events of Cudgegong River and Wialdra Creek, due to their tributaries being located within the proposal site and the low relief of parts of the site. Temporary flooding has the potential to interfere with construction and poses a safety risk for workers onsite. Additionally, flooding has potential to impact the water quality of the site and downstream waterways if materials, equipment or fuels and other stored chemicals became mobile in floodwaters. A flood contingency plan would be developed to reduce the safety and potential water quality impacts. Additionally, mitigation measures would be implemented for the storing of fuels and chemicals onsite within the bunded areas.

The proposal would not involve any extensive earthworks or landform reshaping likely to affect hydrology with two exceptions:

- Limited benching to create the new substation pad.
- Existing disturbance areas near the quarry areas may be restored to a more natural surface landform in these two specific areas.

The two watercourses onsite would not be altered. Panels would be located over these watercourses but this is unlikely to change the hydrology of the watercourse or present any risk to bank stability (no incised channels exist in these well grassed drainage lines).

GROUNDWATER AND GROUNDWATER DEPENDENT ECOSYSTEMS

No Groundwater Dependent Ecosystems are known to occur within the proposal site. As the Proposal would not alter existing groundwater supplies within the solar farm site, it is considered that impacts to Groundwater Dependent Ecosystems (GDE) are not likely to result from the Proposal. Furthermore, the Proposal is not predicted to have any impact on any High Priority GDEs listed in the relevant WSPs given their distance from the proposal site.

Impacts to groundwater during construction, and decommissioning are unlikely to occur due to depth of groundwater. This is due to the standing water levels identified in the adjacent bores as greater than 4m deep in the western portion and greater than 20m in the eastern portion. 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.

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 2000kL 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 90kL per annum. The non-potable water would be trucked to the site on an 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

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 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- Soil).

FLOODING and HYDROLOGY

While the proposal would not increase flooding risks at the site or change the local hydrology, extensive flooding may pose:

- 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 1/100 year flood level and would be designed to withstand periods of local flooding. The proposed new substation would be located adjacent to an existing substation, so risks are considered low. No components are considered susceptible to becoming mobile and entering waterways.

All the potential pollutants stored onsite would be stored in accordance with HAZMAT requirements and bunded.

A flood contingency plan would be developed to manage the safety of workers and equipment in the event of extended flooding in the region.

GROUNDWATER

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 GDEs during the operation phase.

WATER USE

Water use volumes during operation would be 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.

8.2.3 Safeguards and mitigation measures

Table 8-3 Safeguards and mitigation measures for water quality impacts

C: Construction, O: Operation, D: Decommissioning

Safeguards and Mitigation Measures	C	O	D
Design of footings for electrical componentry and panel mounts will consider flood risk.	Design stage		
All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
All fuels, chemicals, and liquids would be stored at least 50m from any waterways or drainage lines and would be stored in an impervious bunded area.	C	O	D
Adequate incident management procedures will be incorporated into the Construction Environmental Management plan, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
Machinery would be checked regularly to ensure there is no oil, fuel or other liquids leaking from the machinery.	C		D
- A flood risk contingency plan would be prepared prior to construction and is to be implemented during construction, operation and decommission. The plan would: - Detail who would be responsible for monitoring the flood threat and how this is to be done. - A process for removing any necessary equipment and materials offsite and out of flood risk areas. - Consideration of site access in the event that some tracks become flooded - Establishment of an evacuation point	C	O	D

8.3 TRAFFIC, TRANSPORT AND ROAD SAFETY

8.3.1 Existing environment

The Beryl SF is bounded by three roads, including Beryl Road to the north, Spring Ridge Road along the south western boundary and Perseverance Lane along the southern boundary. Access to Beryl SF would be from the sealed Beryl Road, adjacent to the existing Beryl Substation. Spring Ridge Road and Perseverance Lane are unsealed and would not be used to access the Beryl SF. Perseverance Lane is currently in poor condition.

Beryl Road is a two lane, single carriageway sealed public road with a speed limit of 80 kilometres per hour. It is approximately 7m wide and maintained by Mid Western Regional Council. Beryl Road is accessed from Castlereagh Highway, approximately 6.2km north of Gulgong. It is approximately 4km long, ending at the junction with Spring Ridge Road. Along Beryl Road there are two unsealed roads that travel north of the road including Holleys Lane and Annies Rock Road, as well as five accesses into private properties.

The access into the Beryl SF proposal site off Beryl Road is an existing unsealed track. There are no turning lanes into the site. The access track is located 2.5km from the Castle Highway junction and 1.4km from the Spring Ridge Road junction. The access into the existing Beryl substation is 213m east of the proposed access track to Beryl SF. The closest resident driveway is located approximately 325m west of the site access.

Traffic along Beryl Road would currently include local residential traffic, local farm traffic and haulage trucks transporting materials from the nearby Beryl Quarry (located off Spring Ridge Road). There are no traffic counts available for Beryl Road, however it is expected to be low due to the low population density. Existing heavy vehicles numbers are expected to be higher than average for Beryl Road than other rural roads in the area due to the existing quarry located on Spring Ridge Road. It is likely that school buses operate along Beryl Road.

The Castlereagh Highway would be the major transport route for haulage and site vehicles during construction and operation of the project. The Castlereagh Highway is a two lane, single carriageway sealed public road with a speed limit of 100 kilometres per hour. The Castlereagh Highway has a total length of approximately 790 kilometres. Its northern terminus is located south of St George in southern Queensland. Its southern terminus is located near Lithgow in NSW. The highway is part of the 'Great Inland Way' linking Sydney and Cairns. In NSW, the Castlereagh Highway is maintained by Roads and Maritime Services. The closest counting average daily traffic along the Castlereagh Highway is located approximately 6km south east of the proposal site. In 2009 the average daily traffic was 613 vehicles travelling west which included 89% cars and 11% heavy vehicles (RMS 2009).

A railway line was historically located within the proposal site, however it is no longer operational and the majority of the infrastructure has been removed.

8.3.2 Potential impacts

Construction

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 project indicates that approximately 40 employees would be required during the first month rising to 150 employees during the peak construction period (approximately 6 months).

Preliminary plans for the site propose 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 150 construction personnel would be required onsite during the peak construction period. Assuming an uptake rate of 80% and a 20-person capacity, up to 6 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 8-4 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 4,150 heavy vehicles would be required. This averages to approximately 16 heavy vehicles per day for the construction period. The amount of deliveries per day would depend on the phase of works being undertaken. An increase amount of heavy vehicles is required for the delivery of modules and mounting frames, which would be delivered over a period of five months.

Table 8-4 Traffic volumes and requirements for Beryl SF.

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
Site set-up and de-mobilisation	Temporary office delivery and removal	Low loader	10
	Skip delivery and removal	Low loader	4
	Generator delivery and removal	Semi-trailer	4
	General deliveries	Semi-trailer	12
	Crane mobilisation and demobilisation	Crane	1
	Water tank delivery and removal	Truck	2
Roads and hardstands	Delivery of imported capping for roads, laydowns and crane hardstands	Truck and dog	390
	Plant delivery and removal: excavators, compactors, drill rig	Low loader	16
Generating equipment	Tool container delivery and removal	Low loader	2
	Module deliveries	Semi-trailer	1198
	Mounting structure and pile deliveries	Semi-trailer	2130
	Inverter station deliveries	Low loader	44
	DC cabling, trays and combiner boxes	Semi-trailer	50
AC cable installation	AC cable delivery	Semi-trailer	8
	Backfill material delivery	Dump Truck	72
	Plant delivery and removal: telescopic handler and excavator	Low loader	8
Overhead line	Conductor delivery	Semi-trailer	1
	Pole deliveries	RAV	2

Phase	Purpose	Vehicle type / trailer type	No. of one way vehicle movements
	Pole dressing delivery	Semi-trailer	2
	Plant delivery and removal: Telescopic handler and excavator	Low loader	8
Sub Station	Concrete deliveries	Concrete agitator	20
	Switchroom delivery	Low loader	4
	Operations and maintenance and workshop deliveries	Low loader	8
	Transformer delivery	RAV	2
	Electrical equipment deliveries	Semi-trailer	16
Other	Employee vehicle movements	Light vehicle	16000
	Monitoring equipment, fibre, SCADA Supervisory Control and Data Acquisition (SCADA) servers etc.	Truck	12
	Waste collection	Truck	104
	Consumables (oil, petrol etc.)	Truck	24
	Miscellaneous deliveries	Light vehicle (vans)	144
Total ¹			22294

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

Traffic impacts would largely be confined to standard hours of construction. 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.

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 collision risk relates primarily to traffic entering and exiting Beryl Road into the Beryl SF proposal site and Castlereagh 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. The intersection of the Beryl SF with Beryl Road would be upgraded to the appropriate standard to accommodate the increased traffic flows that would occur during construction and delivery vehicles. Although the final design has not yet been complete, the location and form of the main access road intersection with Beryl Road would provide adequate sightlines (approximately 350m) for vehicles entering and exiting the site. No upgrades are considered to be required to the Beryl Road and Castlereagh Highway intersection. Use of Spring Ridge Road and Perseverance Lane is not proposed.

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 Castlereagh Highway the impact is expected to be negligible due to the existing capacity of the road network. Along Beryl Road, heavy vehicles are common due to the existing quarry located on Spring Ridge Road, south of the proposal site. However, the proposed solar farm is likely to have a larger amount of heavy vehicles within short period time compared to the ongoing operation of a quarry due to the delivery of infrastructure. Additionally, with the increase amount of heavy vehicles on Beryl Road, there is an increased potential for damage to the road. A Road Dilapidation report would be undertaken prior to construction. An audit would be undertaken at the completion of construction to identify any road formation and/or pavement condition resulting from the construction of the solar farm. The proponent would consult with Mid-Western Regional Council regarding any damage and restoration requirements. All damage attributable to the project would be paid for by the proponent.

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 with the expectation of the 'throat' entrance to the site which will be sealed to a length of 40m.

ASSOCIATED NOISE AND DUST

The proposal may result in increased noise and dust, particularly on unsealed access roads and internal tracks. Impacts from dust generated from the proposed activity, including that associated with increased traffic, is considered in Section 8.8. During construction, water would be used to minimise dust generation along access tracks.

The DECCW (2011) *NSW Road Noise Policy* (NSW RNP) 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.1 and Section 7.4 of this EIS.

DISRUPTION TO EXISTING SERVICES

Local traffic in Gulgong would be minimally 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. The potential impacts to Gulgong and Castlereagh Highway would be insignificant in the context of existing traffic movements along these roads and due to the size of Gulgong being a regional centre for the locality.

Increased traffic along Castlereagh Highway and Beryl 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.

Haulage

While a detailed haulage program has not yet been developed, it is expected that the proposal's components are most likely to be delivered by road from either Sydney, Brisbane or Adelaide. The

proposed roads of these routes would have sufficient capacity to accommodate the haulage of components required for the construction of the solar farm and transmission 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 three 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. Access to the substation is off Beryl Road.

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.

8.3.3 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 8-5.

Table 8-5 Safeguards and mitigation measures for traffic, transport and road safety impacts

C: Construction, O: Operation, D: Decommissioning

Safeguards and mitigation measures	C	O	D
The proponent would consult with the Mid Western Regional Council regarding the proposed upgrading of the site access. The upgrade would be subject to detailed design, and must be designed and constructed to the standards specified by RTA Guidelines.	Design stage		
- A Haulage Plan would be developed with input from the roads authority, including but not limited to: - Assessment of road routes to minimise impacts on transport infrastructure. - Scheduling of deliveries of major components to minimise safety risks (on other local traffic). - Traffic controls (signage and speed restrictions etc.).	C		D
- A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Mid Western Regional Council and Roads and Maritime. The plan would include, but not be limited to: - Assessment of road condition prior to construction on all local roads that would be utilised.	C		D

Safeguards and mitigation measures	C	O	D
- o A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. - 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. - o Consideration of cumulative impacts. - 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.			
• A Road Dilapidation Report would be prepared and include audits of the road formation and/or pavement condition to be undertaken prior to construction and at the completion of construction, operation and decommissioning phases. The proponent would repair any damage resulting from proposal traffic (except that resulting from normal wear and tear) as required at the proponent's cost and in consultation with Mid Western Regional Council.	C	O	D

8.4 LAND USE IMPACTS (INCLUDING MINERAL RESOURCES)

8.4.1 Existing environment

The proposal site includes land that is zoned RU1 Primary Production and land zoned R5 Large Lot Residential under the Mid-Western Regional LEP. Electricity generating works are permitted with consent within the RU1 zone however Electricity generating works are prohibited in R5 zone.

Agriculture

The proposed solar farm site is currently worked agricultural land (grazed by cattle and sheep). The surrounding areas are dominated by large parcels of cleared agricultural land with scattered trees; extensive grazing of horses and cattle is the predominant agricultural activity. Few areas are cropped. Several horse studs are also located in the locality. The agricultural industry specifically sheep, beef cattle and grain farming is identified as 3.3 % of the main industries within the Gulgong locality (ABS 2011).

Residential areas

Large lot rural residences as well as clusters of smaller lot residential subdivisions occur. Sheds, tanks and farm machinery contribute to the rural character. House and garden plantings around houses contribute to the residential character in developing 'villages' of higher density on the Gulgong side (east) of the site.

One house is located within the north-eastern section of the proposal site and two dilapidated sheds are located onsite and would be removed.

Mineral resources

Within the Gulgong locality, coal mining is the main industry (16.6%) and main source of employment for the area (ABS 2011). A search of the Department of Industry (Resources and Energy) MinView found the site to have mineral titles, refer to Figure 8-11. However, the mineral title for the proposal site, EL8160, expired 29 August 2016.

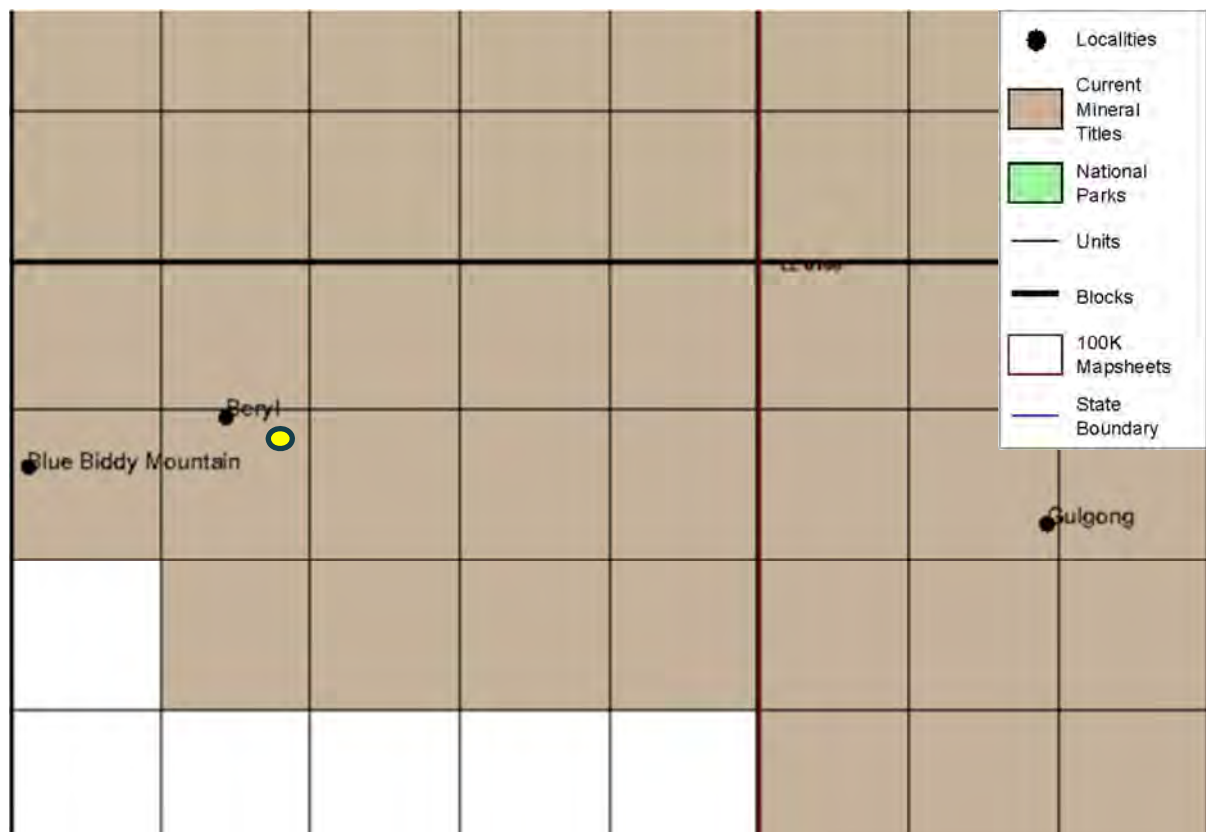


Figure 8-11 MinView (yellow circle indicates proposal site)

Beryl Quarry operates 1.2 kilometres south of the proposal site. The quarry is accessed from Spring Ridge Road and uses Beryl Road to access Castlereagh Highway. The haulage routes of this operation and the cumulative impacts of haulage traffic during construction of the solar farm is considered in Section 8.11. Small scale quarry operations have previously occurred within the south central portion of the proposal site.

Consultation with Beryl quarry and the proposal site mineral titleholder for the proposal site is outlined in Section 5.

Electricity

Three existing electricity transmission lines pass through the proposal site mostly in a north-south direction and in alignment with the existing Beryl substation. The existing Beryl Substation is directly adjacent to the proposal site within the north-western section.

Aviation

There are three airstrips located within 10km of the proposal site. The closest is 1.5km north east of the proposal site. These airstrips are small 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 common in the local area, although grazing properties would also have sections of pasture dedicated to more intensive feed production.

Other land uses nearby

The proposal site is located approximately 6km from Gulgong. Gulgong has a population of approximately 1,900 people. The main employment source in Gulgong is coal mining at 16.6% (ABS 2011). Services in Gulgong include banks, supermarkets, post office, real estate, trades people, machinery and farming services, accommodation, cafes and restaurants, fire station (Gulgong Chamber of Commerce 2016). It is a local service centre. Gulgong's main streets have a consistent historic character. Retail and residential building colours, materials and design reflect this. Gardens and public spaces are well maintained and attractive and it is likely a popular tourist destination and stop over point.

The Yarrobil National Park is approximately 6.2km north west of the site. No formalised picnic areas are in the park.

8.4.2 Potential impacts

Construction

From the commencement of construction, agricultural activities would cease in areas required for access and construction of the solar farm. 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; no large areas of reshaping or excavation are proposed. Therefore, post decommissioning, the land could return to existing agricultural use or an alternative use.

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.

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.

There would be no extraction of minerals onsite during the construction period. Due to the proposal being highly reversible, mineral exploration would not be sterilised in the long term, post decommissioning. Ongoing consultation would be undertaken with the proposal site mineral titleholder.

Residence located near to the site may experience noise, dust and traffic during construction. These are temporary and manageable impacts, addressed in Section 7.4, 8.3 and 8.8. No impacts on the use of any recreational areas would occur.

No land use conflicts are likely during construction.

Operation

During operation, the proposal site would change from agricultural land use to power generation. Grazing may occur as maintenance but would 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.

Once the panels are installed, the proposal would result in the development of a large proportion of the 332ha property, approximately 56% of the site. The transmission easement is mostly sited adjacent to existing transmission lines and easement associated with the Beryl 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 array site (225ha) for agricultural production during this period is not considered a significant economic loss in the locality. The loss is temporary. Agricultural use or an alternative land use, could be undertake at the end of the project's life, with minimal impact on land capability or productivity.

Operation of the solar farm would unlikely to impact on adjacent mineral extractive operations such as Beryl Quarry. All operation activities would be confined to the proposal site and there would small amount of workers (3 personnel) and associated vehicles. During operation, extractive activities onsite would not be able to occur, however quarrying no longer occurs onsite and the mineral title for the proposal site has expired.

The identified risk to aviation from the operation of the Beryl 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.
- 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 a 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)

Due to the proposal being highly reversible, mineral exploration would not be sterilised onsite in the long term, post decommissioning. Ongoing consultation would be undertaken with proposal site mineral titleholder. There would unlikely to any impacts to the surrounding mineral extractive activities during decommissioning.

There is unlikely to be any impacts on aviation during decommissioning of the proposal.

8.4.3 Safeguards and mitigation measures

Potential for land use impacts is proposed to be addressed via the mitigation measures in Table 8-6.

Table 8-6 Safeguards and mitigation measures for land use impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
• Consultation with proposal site mineral titleholder and Beryl Quarry regarding the proposal and potential impacts	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
• 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

Safeguards and mitigation measures	C	O	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		

8.5 HISTORIC HERITAGE

8.5.1 Approach

A desktop study was undertaken to identify any historic heritage (Non-indigenous) items or places in proximity to the study area, with a focus on the proposal site and surrounding landscape. Heritage databases searched as part of this assessment are:

- The 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 Mid Western Regional LEP 2012, for locally listed heritage items, that are within or adjacent to the proposal site.

8.5.2 Results

The results of the heritage searches listed above indicate that no known historic items or places occur on the site. A summary of the results of the heritage searches are illustrated in Table 8-7. Details of listed items are provided below.

Table 8-7 Summary of heritage listed items in the Mid Western LGA.

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
NSW State Heritage Register	14
NSW State Agency Heritage Register (section 170)	29
Mid Western Regional Local Environmental Plan (LEP) 2012	449

Australian Heritage Database

The Australian Heritage Database search was undertaken on the 8 February 2017. No known items listed under the National Heritage List were identified for the Mid Western Regional Council.

NSW State Heritage Inventory

The SHI database search was undertaken on the 8 February 2017. No known items listed under the World Heritage List were identified for the Mid Western Regional LGA.

There were 14 items listed under the NSW State Heritage Register and 29 items listed under the NSW State Agency Heritage Register (Section 170) for the Mid Western regional LGA. None of these items were identified onsite, with the closest item being over 3.5km north east of the proposal site (Gulgong Railway bridge over Wialdra Creek). A majority of the listed items buildings located with Gulgong, approximately 6km south east of the proposal site.

Mid Western Regional Local Environmental Plan 2012

The Mid Western LEP database search was conducted on the 8 February 2017. No local heritage items have been recorded onsite. The closest listed items are located in Gulgong, approximately 6km south east of the proposal site.

Unlisted heritage items

Although no listed items were identified within the site, it is acknowledged that there may be unlisted items of historic significance on the subject site. A site inspection identified a number of structures across the site.

The items identified include the following.

- Small concrete and corrugated iron shed with associated post and rail yards and concrete race.
- Small concrete and fibro sheeting structure.
- Machinery including crusher, conveyor and drilling equipment as well as other materials associated with the former basalt quarry operation.
- Disused farm equipment including tractors, balers, headers, ploughs, vehicles and other miscellaneous items
- The former railway corridor.



Shed and yards



Small concrete and fibro structure



Crusher and conveyor at the basalt quarry



Farm equipment

The farm structures and the farm machinery are currently outside the development footprint and therefore are unlikely to be impacted at all by the proposal.

A raised embankment running east west through the centre of the site indicates the location of the Sandy Hollow-Mary Vale railway line. The railway line was intended to link Newcastle with Dubbo and western NSW and was in planning since the mid 1800s, although the agreement to commence construction didn't eventuate until 1925. Actual construction didn't commence until 1936 but with the onset of World War 2, progress was slow and then ceased. It was restarted again in 1946 but priorities changed and in 1950 it was officially halted, with approximately 85% of work completed (Wangmann 2013).

Within the site, it is not clear if the railway line infrastructure was removed and taken elsewhere, as many sections were, or was never constructed.



Railway culvert in place



Railway embankment with culvert

8.5.3 Heritage Assessment

The historic items located during the field inspection did not appear to be particularly old or rare. The material used in the construction of the structures were concrete, fibro, milled timber and corrugated iron, all common materials. The fence railings in the yards may have been older than the shed but there was nothing in their presence or construction that appeared to be significant. These farm related structures, including the farm machinery are considered common within a working farm environment.

The Gulgong district was first settled by Europeans in the 1820s with the gold rush of the 1870s the catalyst for rapid growth. After the goldrush died in the early 1880s and the miners left, the district turned to wheat and wool as the basis for its economy. The items identified during the field inspection are considered to be from the mid to late 1900s and are unlikely to relate to earlier periods of European settlement. Most of the items are in poor condition and dilapidated and have not been in use for some time.

8.5.4 Potential impacts

Several heritage listed items were identified during the desktop study as outlined above but none of these items are in proximity to the proposal site. The items identified within the site are noted as typical of a rural landscape that has probably been farmed since the 1880s, although the items identified are all from the more recent period and are typical of a working farm.

The proposal is not considered likely to have a significant impact in accordance with the NSW *Heritage Act 1977*, the EP&A Act, or the EPBC Act, in terms of heritage.

The development proposal includes the use of the earthen railway alignment as a thoroughfare to link vehicle access between the arrays north and south of the railway line. This would require the construction of vehicle crossings in two locations across the railway line. Underground cables linking the arrays would also be installed in these locations. The alignment is currently used as a farm track and is relatively intact. There are some sections that may need stabilization due to slight erosion. Any impacts to the railway line caused by the vehicle crossing works and cabling works would be managed by through mitigation measures in the CEMP.

8.5.5 Safeguards and mitigation measures

The Gulgong Historical Society and Gulgong Pioneer Museum aim to collect, preserve and provide access to an array of historical objects including machinery. It is recommended that if the items are to be removed an opportunity be provided to the Historical Society and Museum to inspect the objects at the property for possible inclusion in the collection.

A protocol for unexpected finds would be developed for the proposal, as detailed below.

Table 8-8 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
If any old farm machinery is to be removed, contact the Gulgong Historical Society to enquire about their interest in acquiring any items.	C		
Maintain the railway embankment formation as much as possible.	C	O	D

8.6 RESOURCE USE AND WASTE GENERATION

8.6.1 Existing environment

Resource use

Key resources and estimated quantities (pending the completion of the detailed proposal design) required to construct the proposed solar farm are listed in Table 8-9.

Table 8-9 Resource requirements for the proposed Beryl SF.

Resource	Quantity
Gravel (access tracks)	3,900 m ³
Sand (bedding for cables)	1400 m ³
Concrete	30m2
Metal (components for mounting system, inverters and delivery system containers,)	3900t
Glass for panels	130t
Water during construction	4500mL

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 8.2 of this REF.

Lifecycle analysis

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates 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 Programme. 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 Beryl 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 Beryl SF Project.
- Potential to reuse and recycle component parts.

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

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.

OPERATION

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 Beryl SF.

DECOMMISSIONING

Decommissioning of the site would involve the recycling or reuse of materials including:

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.
- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Items that cannot be recycled or reused, 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 8.2.

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 proposal is considered highly reversible in its ability to return to the site to the pre-existing land use capability or alternative land uses. 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.

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.

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 8-10.

Table 8-10 Safeguards and mitigation measures for resource use and waste generation

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: - Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. - Quantification and classification of all waste streams. - Provision for recycling management onsite. - Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). - Tracking of all waste leaving the site. - Disposal of waste at facilities permitted to accept the waste. - Requirements for hauling waste (such as covered loads).	C	O	D
Septic system is installed and operated according to the Mid Western Regional Council regulations.	C	O	

8.7 COMMUNITY AND SOCIOECONOMIC

8.7.1 Background

Socio-economic profile

MID-WESTERN REGIONAL LOCAL GOVERNMENT AREA

The Mid-Western LGA had a population of 24,017 in 2014 (ABS 2016). It covers an area of approximately 9000km² (Mid-Western Regional Council 2015). The area's population has steadily been increasing from 23,020 recorded on the 2011 Census, an increase of almost 5% (ABS 2011a). The median age of the locality is 41 years of age; this is comparable to the Australian average of 37.3 years of age (ABS 2016). The 2011 census records indicate that 3.9% of the population is from Aboriginal and Torres Strait Islander origin and 14.5% of the population was born overseas (ABS 2011a).

The main local industries for employment within the Mid-Western LGA is mining (13.8% in 2011a), followed by the retail trade at 11.3%; agriculture, forestry and fishing industry with 9.5% employed and health care and social assistance at 9.2% (ABS 2011a). The region is also renowned for its vineyards, wineries, wilderness areas and historic villages (Mid-Western Regional Council 2015, Destination NSW 2016a). The regional council is anticipating significant population growth in the area over the next five years due to the recent and ongoing expansions in the coal mining industry (Mid-Western Regional Council 2015).

The Mid-Western Regional Council (2015) states that advantages to living in this region include:

- A diverse and growing economic base;
- centrally located to regional centres;
- strong transport links (air and bus services daily);
- a skilled workforce,
- strong business service sector
- thriving tourism and arts/cultural industries.

Some of the community facilities and economic features of the Mid-Western LGA include:

- Health facilities include: Mudgee Hospital, Rylstone Hospital, The Carmel Croan Community centre (this includes community transport, meals on wheels, respite care and cultural services), doctors, aged care facilities, (Mid-Western Regional Council 2015).
- Recreation and sporting facilities include: Glen Willow Regional Sports Complex, various showgrounds, three swimming pools, pony clubs, horse clubs, poultry club, woodworkers group, pottery groups and various art and craft groups (Mid-Western Regional Council 2015).
- Community facilities include: Mudgee Town Hall, three libraries, various halls and community buildings, airport (five km from Mudgee), rotary club and aero club (Mid-Western Regional Council 2015).
- The MWRC maintains 55 parks, gardens and sporting fields, 11 cemeteries, numerous playgrounds, parks and reserves (Mid-Western Regional Council 2015).
- Active business organisations in the LGA include: Cudgegong business group, Gulgong Chamber of Commerce, Mudgee Chamber of Commerce, Mudgee Fine Foods Inc. and Mudgee grape growers' association Inc. (Mid-Western Regional Council 2015).
- Events in the region include the Rylstone Street Feast, Mudgee fine foods farmers market (monthly), Black tie at Burnbrae and the Huntington Estate Music festival (Destinations NSW 2016a).
- Environmental attractions include: Putta Bucca Wetlands, Capertee National Park, Wollemi National Park, Coorongoora National Park, Munghorn Cap Nature Reserve, Goulburn River National Park and Coolah Tops National Park, Ferntree Gully and Windamere Dam (Destinations NSW 2016a).

Mid-Westerns Region Community Plan (Mid Western Regional Council 2013) sets out the community's vision for the future. Consultation undertaken for the plan found the community values the areas 'country feel' with its historic linkages. Results of the community consultation also identified the following values:

- Maintaining and improving the road networks.
- Strong focus on health services and facilities.
- Emphasis on youth services.
- Development of additional pre-school and education facilities.
- Working towards achieving a balance between our natural environmental and our economic drivers.

A number of the measures proposed in the Plan (Mid Western Regional Council 2013) to meet the community's vision for the future would be assisted by the proposed Beryl SF. These include:

- An increase in the use of alternative energy sources.
- An increase in the number of jobs in the region.

- An increase in the number of residents.
- Increased economic activity in the region.

GULGONG

Gulgong is the closest large township, to the locality of Beryl, and is 6km from the proposed site and approximately 350km from Sydney (Destinations NSW 2016b). The population of Gulgong was 2,383 in the 2011 Census (ABS 2011b). This comprises of a high 4.9% Aboriginal and Torres Strait Islander people, compared to the Australian average of 2.5% (ABS 2011b). The median age is 39, comparable to the Australian median of 37 (ABS 2011b). In Gulgong 12.8% of the population was born overseas, with the most common countries of birth being England (2.2%) or New Zealand (0.8%) (ABS 2011b).

The main local industry for employment in Gulgong is the coal mining industry (ABS 2011b). Full time employment, recorded at the 2011 census, was 56.6%, this is comparative to the Australian rate of the time of 59.7%; with the unemployment rate high at 6.5%, compared to the Australian average of 5.6% (ABS 2011b). The median age for full time employment in Gulgong is 42 (ABS 2011b). The main industries are coal mining at 16.6%; followed by school education at 6.6%, supermarket and grocery stores 4.2% and sheep, beef cattle and grain farming at 3.3% (ABS 2011b). The median weekly income for residents of Gulgong was \$412 in 2011 (ABS 2011b).

This area of rural NSW is rich in European heritage and was settled in the 1860's during the Australian gold rush (Destination NSW 2016b). Gulgong was the first town to be featured on the original ten-dollar note (Destinations NSW 2016b). There are currently 130 buildings, within the town of Gulgong, listed under National Trust classification many still have the original verandahs and iron-lace balconies (Destinations NSW 2016b). Today the town is renowned for its arts and crafts and is world famous for its clay/pottery (Mid-Western regional council 2015, Destinations NSW 2016b).

- Tourism attractions include the Pioneer Museum, Henry Lawson centre, The Prince of Wales opera house (oldest operating opera house in the southern hemisphere) and the Gulgong Symbol trail; a secret code of symbols used in the gold rush to communicate the 'lie of the land' (Destinations NSW 2016b).
- Events include: the annual Henry Lawson Festival, Gulgong Folk Festival; celebrating 30 years in 2016, Gulgong Gold Chinese festival, Community fun day and camel races, Gulgong annual eisteddfod and the triannual clay festival - Clay Gulgong (Destinations NSW 2016).
- Recreational and sporting facilities include: Billy Dunn Oval, Victoria Oval, swimming pool, turf club, golf club and dance academy (Destinations NSW 2016b).
- Community facilities and clubs include: a memorial hall, branch library, cemetery, Gulgong musical and dramatic society (MADS), craft club, RSL club and youth council (Destinations NSW 2016b, Gulgong Chamber of Commerce 2016).
- Health services include: Wenonah lodge aged care facility and Gulgong health services (Service NSW 2016).
- Services include: banks, supermarkets, post office, real estate, trades people, machinery and farming services, accommodation, cafes and restaurants, fire station (Gulgong Chamber of Commerce 2016).
- Education facilities include: Gulgong pre-school, Gulgong public school, Gulgong high School, All Hallows Catholic Primary School and the Red Hill environmental Centre (Service NSW 2016).
- Churches – St Luke's Anglican, St John's Catholic, Uniting and Presbyterian (Destinations NSW 2016a).

BERYL

Beryl is a small rural locality approximately 9km North-West from Gulgong. The proposed solar farm is approximately 4km South of Beryl. The locality of Beryl is accessed from the Castlereagh Highway; it's residents are dispersed, and live on large rural properties. There was no data available from the Australian Bureau of Statistics (ABS) on population, businesses or number of dwellings in the Beryl locality.

Attitudes to renewable energy proposals

A high percentage (77%) of Australians believe that large scale solar farms could supply a significant source of Australia's energy requirements (IPSOS 2015). Attitudes in Australia are greatly divided about the visual impacts of large scale solar farms; 30% agree and 26% disagree that large-scale wind farms have a negative visual impact (IPSOS 2015). Approaches to improving community understanding of the visual impacts of large scale installations include:

- Provision of images (from many angles) of large scale solar facilities, particularly in the early phases of a proposal (IPSOS 2015).
- Understanding the similarities between highly supported domestic scale installations and large scale facilities (IPSOS 2015).
- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for (IPSOS 2015).
- Understanding of what steps are needed to prepare the proposed land for the installation and how the condition of the land after decommissioning (IPSOS 2015).

This EIS and the CCP addresses 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 (IPSOS 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 phases would cause much activity, whilst other phases 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 (IPSOS 2015). In 2012-13 it was estimated that only 13% of all electricity generated within Australia came from renewable energy sources (IPSOS 2015); in 2015 this had increased to 14.6% (Clean Energy Council 2015). In 2015, eight solar farms were completed in Australia (Clean Energy Council 2015). This included Nyngan (102 MW) and Broken Hill (53MW) solar farms; two of the three largest in Australia, with the Moree 56 MW solar farm completed in 2016 (Clean Energy Council 2015). In September 2016, another 12 large-scale solar farms were announced in Australia with a proposed cost of \$1,056.4 million (ARENA 2016). This is set to increase in the future as Australia averages the highest average solar radiation potential per square metre in the world (IPSOS 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).

Employment in the sector is considered a positive driver; the Australian Bureau of statistics estimated that 14,020 people were employed in the renewable sector in the 2014-15 financial year (Clean Energy Council

2015). Additionally, there local economic benefits. 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.

Community feedback on this proposal

Section 5.4.3 of this EIS details the specific consultation and feedback received so far for the proposed Beryl SF. In summary, positive feedback received by neighbours to date has included shows of support, specifically with regard to positive economic benefits to the local community. This has included the local Mid Western Regional Council.

Concerns have also been voiced, regarding potential impacts on existing services, such as mobile phone reception, the traffic network, potential for glare and heat at adjacent properties, potential land use conflict with the site.

- A local quarry raised concerns about traffic impacts on their operations.
- One electrical contractor expressed interest to work on the project.

Tom Best (First Solar Australia Pty Ltd) met with Mid Western Council representatives, Lindsey Dunstan and Drew Roberts on the 7 November 2016 and presented the Beryl SF proposal to the Council on the 15 February 2017. Feedback received included:

- Council members were supportive of the proposal as it will provide good use of low level farming land in the area and benefits the local community. Council appreciated the early consultation process (7 November 2016).
- Concerns were raised regarding:
 - planning development application on the parcel of land zoned R5;
 - the land around the existing house being rezoned as a new lot being below the minimum land size for land zoned RU1.
- Confirmation was given that the subdivision memo, to be circulated, would be supported by Mid Western Council (15 February 2017).

The Community Open Day, on the 23 February 2017, at the CWA Hall had 22 people attend. This included residents, local business owners, council members and associated landowners. Feedback included:

- Residents were very supportive of the project.
- Positive feedback regarding the creation of jobs, economic flow on effects to local businesses and benefits to the community were expressed.
- Visual screening was discussed and residents showed their support and wanted to be kept informed.
- Two residents raised concerns regarding impacts on access roads, namely Beryl Road and Perseverance Lane, and the effects of increased traffic on local infrastructure.
- Resident on the Southern side raised concerns regarding the potential impact to the value of adjacent land. This land is primarily used for grazing and cropping.

First Solar Australia Pty Ltd received four completed community feedback forms. The four residents lived five kilometres or less from the proposed site. Important local values to the respondents included to be living in a close community with a country lifestyle; enjoying the peace and quiet. Visual landscape values considered important included the farming landscape; views of trees, sky, hills, large paddocks and cattle.

Key concerns raised by members of the community were traffic impacts, potential decline in land value, visual impacts and the clarity of the planning approval process. 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.

8.7.2 Potential impacts

Construction

The Beryl SF would be a new type of infrastructure in the area and 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. Some people are adverse to changing the rural landscape and would consider the development to be in conflict with the existing environment and scenic values. Other community members may view the development as an opportunity for jobs and economic stimulus within the region and sign of protecting the environment through the generation of renewable energy.

The site would be visible to the public during construction, for traffic travelling along the Beryl Road, Spring Ridge Road and Perseverance Lane. 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. As discussed above, the Beryl SF would assist in addressing some of the measures outlined in the Mid-Westerns Region Community Plan to meet the community's future vision of the region. Specifically, during construction would represent a direct economic benefit to the region. The construction of the proposal would utilise up to 150 staff at peak construction. Many of these would be drawn from the local area. 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 Beryl SF.

Additional workers moving to the area temporarily may stimulate local economic activity. Accommodation and retail services 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 8.3). Mitigation strategies to address these impacts centre on consultation with the community, so that benefits can be maximised and conflicts resolved where possible.

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.

The operation of the Beryl SF would also assist with meeting the proposed Mid Western Regional community's vision for the future of using alternative energy sources within the area (Mid Western Regional Council 2013).

Considering the local economy includes agriculture, it is relevant to note that the soil capabilities at the site limit intensive agriculture (refer to Section 8.4). The installation of solar array modules, that involve little

soil disturbance and provide an alternative income stream for large agricultural properties, can be seen as an important local economic benefit. Further, 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.

Minimal adverse social-impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be at low levels. 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 8-11 Safeguards and mitigation measures for Community and Socioeconomic impacts.

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
- The Community Consultation Plan will continue to be implemented, including but not limited to implementing protocols to: - Keep the community updated about the progress of the proposal and proposal benefits. - Inform relevant stakeholders of potential impacts (haulage, noise etc.). - Respond to any complaints received.	C		
Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
Liaise with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
Liaise with local tourism industry representatives to manage potential timing conflicts with local events.	C		D

8.8 CLIMATE AND AIR QUALITY

8.8.1 Existing environment

Air quality

The proposal site is located in the Mid Western LGA, Central Tablelands NSW. The closest climate data for the region is from the Gulgong Post Office weather station (BOM 2017). The area experiences hot summers and mild winters. The hottest months of the year are December through to February. The coldest months

of the year are June, July and August (BOM 2017). The average rainfall is 653.0mm; with the majority of rainfall occurring in the summer months. Annual wind speed averages for the area is 6.9km/h at 9am and 9.9km/h at 3pm. In the morning the average highest winds are experienced October, November and January. While at 3pm the average highest winds are experienced August to December (BOM 2017).

Air quality for the Mid Western 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 2015) identified six facilities within the Mid Western LGA that are required to record emissions. The facilities include three coals mines, two lime manufactures and one quarry. The closest facility is the Beryl Quarry, approximately 1.2km south of the proposal site.

Approximately 60 residences are located within 2km of the proposal site, one being an involved landholder. The closest non-involved receiver is approximately 135m west of the proposal site. A second residence is located 330m north west of the proposal site access. Topography of the proposal site is flat. Vegetation or screening is present along the western and southern boundaries. There is limited screening along the northern and eastern boundaries.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases in the atmosphere. Climate change proposals 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).

It is now generally accepted that the release of certain gases, including most notably carbon dioxide, contribute to global climate change. These gases are collectively referred to as 'greenhouse gases' (GHGs). Construction and maintenance activities where plant and equipment uses diesel, gasoline and other hydrocarbons, result in GHG emissions and are likely to contribute to climate change. The construction, operation and decommission of the proposed solar farm assessed in this EIS would produce minimal CO₂ emissions when compared to conventional coal and gas fired powered stations; refer to Table 8-12.

Table 8-12 Comparison of CO₂ equivalent emissions produced per kilowatt hour

Generation method	Emissions produced (grams CO ₂ equivalent per kWh)	Source
PV solar farm	19-59	Wright and Hearps (2010)
Coal-fired power station	800-1000	Wright and Hearps (2010)
Combined cycle gas turbine	400	Alsema <i>et al.</i> (2006)

On an annual basis, the proposed Beryl SF would provide enough clean, renewable energy to meet the demand of approximately 28,000 NSW homes based on average energy consumption, while displacing approximately 183,000 metric tons of carbon dioxide – the equivalent of taking about 49,000 cars off the road.

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/m² are also specified.

8.8.3 Potential impacts

Construction and decommissioning

Air quality can be affected by dust caused by soil disturbance and emissions from vehicles and machinery. These impacts can be a nuisance to nearby receivers i.e. residences, farm workers and road users. At worst they can interfere with plant growth, degrade ecosystems, represent human health risks and contribute to GHG emissions and anthropogenic climate change. In Australia's rural agricultural landscape dust and dirt are a major influence on air quality. Within the Mid Western Regional LGA the operation of mines and quarries would also be a potential influence on air quality within the LGA.

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles travelling along unsealed access roads during construction and decommissioning of the project. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving, or lead to adverse health impacts where severe or prolonged.

Earthworks associated with construction would be relatively minor and mostly involve trenching for cables, construction of access tracks and construction of footings for inverters, substation and buildings. Poles for the module frames would either be pile driven or screwed. The impact area for the piles would be less than 1% of the site area.

The majority of emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force, and haulage traffic delivering construction components.

The closest non-involved receiver is approximately 142m west of the proposal site. Earthworks would also occur adjacent to Beryl Road near to the existing Beryl substation, and along Perservence Lane in the south of the proposal site. Vegetation is present along the western and southern boundaries of the proposal site. This vegetation screening would reduce the potential impact of dust on the closest receiver to west and traffic along Perservence Lane. In dry and windy conditions, it is likely that a portion of Beryl Road at the site access and adjacent to the existing Beryl Substation would be impacted by dust. There is currently no screening at that location. However, the proposed works involve minimal earth-moving, and mostly piling equipment would be used, thus reducing the amount of dust produced.

With the minor earthworks proposed and implementation of mitigation measures, air quality issues for sensitive receivers would be considered manageable. Due to the distance of other residential dwellings, dust and emissions would be expected to attenuate in a very limited distance from the site. Substantive air quality impacts are not anticipated for these dwellings.

There is potential for a cumulative impact on air quality with the existing quarry operations, 1.2km south east of the site. Also, the quarry haulage route includes Beryl Road. Due to the distance from the proposal site, the cumulative impact is expected to be not significant, particularly with the implementation of mitigation measures. Cumulative impacts are discussed further in Section 8.11.

Mitigation strategies include a formal community consultation and engagement process, and complaints management system, whereby the sources of complaints are promptly identified and addressed, and

appropriate application of a suite of dust and emission reduction measures. The construction of the proposal is not anticipated to have a significant impact on air quality. Identified impacts are highly manageable.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase. Traffic requirements would be similar in type but of shorter duration than that required for the construction phase.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the solar farm. Haulage traffic and plant and equipment would generate emissions, however, the short duration of the work and the scale of the solar farm proposed suggests this contribution would be negligible in a local or regional context.

Operation

The production of solar energy during the operation of the proposal would generate negligible air quality impacts and emissions.

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 (Section 8.1) and planting of the site would provide screening to Beryl 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 the minimal impacts on air quality during operation, the cumulative impact is expected to be not significant. Cumulative impacts are discussed further in Section 8.11.

8.8.4 Safeguards and mitigation measure

Air quality impacts would be addressed via the mitigation strategies in Table 8-13.

Table 8-13 Safeguards and mitigation measures for climate and air quality impacts

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
Development of a complaints procedure to promptly identify and respond to complaints.	C	O	D
Develop protocols to minimise vehicle and construction equipment emissions for inclusion in the construction and operational environmental management plans. This would include but not limited to Australian standards and the POEO Act.	C	O	D
Protocols would be developed minimise dust levels generated during construction (eg. water carts or similar in response to visual cues).	C		D

8.9 MAGNETIC FIELDS

8.9.1 Existing environment

Electromagnetic fields (EMFs) consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunder storms and Earth's magnetic field (WHO 2012).

Electric fields are produced by voltage and magnetic fields by current. When electricity flows, EMFs exist close to the lines and wires that carry electricity and close to electrical devices and appliances (WHO 2007). Electric and magnetic field strengths reduce rapidly with distance from the source, and while electric fields are shielded to some extent by building materials, magnetic fields are not.

Fields of different frequencies interact with the body in different ways. EMF field sources to which people may be exposed are predominately 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).

As electricity use has become an everyday part of life, concerns have been raised about the potential for exposure to EMFs to adversely affect human health. Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO undated). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Proposal 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 Beryl SF and along the transmission line.

Whether exposure to ELF magnetic fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA 2015) advises that 'the scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found near transmission lines is a hazard to human health', and that 'current science would suggest that if any risk exists, it is small'.

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 8-14.

Table 8-14 ICNIRP reference levels (ICNIRP 2010)

Exposure characteristics	Electric field strength (kVolts per metre - kV/m)	Magnetic flux density (microteslas - μ T)
Occupational	10	1000
General public	5	200

The proposal includes four main components that could generate EMFs:

- an overhead or underground 66kV transmission line;
- underground 22-33kV cables;
- Up to 40 Inverters up to 2.5MW
- a 66kV substation and;
- 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.

Transmission line and substation

Figure 8-12 displays the typical electric fields emitted from different voltage overhead powerlines. The proposal site has existing 132kV and 66kV powerlines. The proposal would include the construction of a new 66kV transmission line either overhead or underground. The existing and proposed overhead powerlines are less than the recommended 5kV/m and 10kV/m limits. Underground transmission lines do not produce external electric fields due to shielding from effects of the soil.

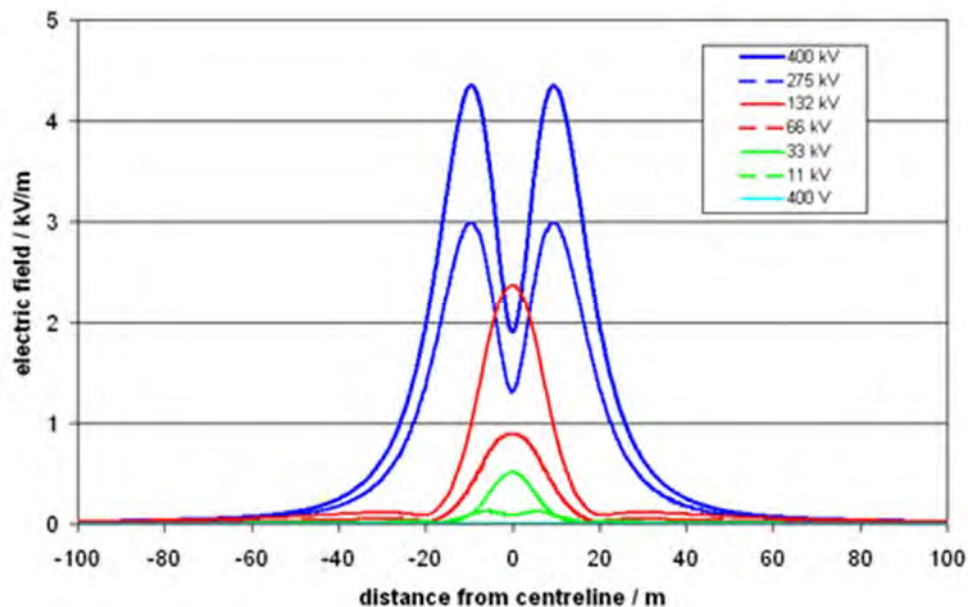


Figure 8-12 Typical electric fields from overhead powerlines (EMFs.info 2017).

Figure 8-13 and Table 8-15 shows 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 200 μ T and 1000 μ T limits, even if directly underneath the powerline.

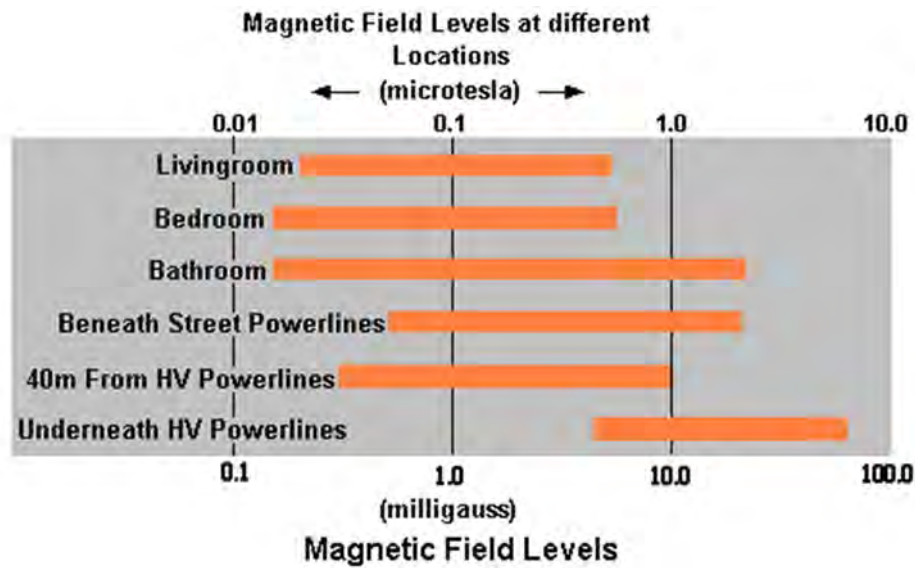


Figure 8-13 Magnetic field levels at different locations (ARPANSA 2015).

Table 8-15 Typical magnetic fields from overhead powerlines.

Source	Location of measurement	Range of measurement	
		(mG)	(μT) ³
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

Cabling

Underground 33kV cabling does not produce external electric fields due to shielding from effects of the soil, however magnetic fields still occur. EMFs.info (2016) provides some typical magnetic field data for a single 33kV underground cable at 0.5m depth. It can be seen that magnetic field would be under the recommended limits of 200 μT and 1000 μT.

Table 8-16 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

Inverters

Up to 40 inverter stations containing inverter, transformer, HV switchgear and communication and ancillary equipment would be installed across the site. The inverter stations would have a total output of 2.5MW. The inverters would have an AC power frequency of 50 Hz and fall into the Extremely Low

³ Converted from mG where 1 mG = 0.1 μT.

Frequency (ELF) range of 0-300 Hz. Within this range, the EMFs are not considered to be a hazard to human health.

Arrays

Research into electric and magnetic fields undertaken at utility scale photovoltaic installations in California⁴ by Chang and Jennings (1994), indicated that magnetic fields (the EMF type of greatest public concern) was significantly less for solar arrays than for household applications. Chang and Jennings (1994) found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

8.9.2 Potential impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the proposal. Site staff would be exposed over intermittent periods during works at and around the existing 132kV and 66kV transmission lines that occur onsite and 132kV substation adjacent to the proposal site. The maximum magnetic and electric fields of the existing transmission lines and substation are well under the recommended limits for public and occupational exposure. Given the voltage that workers would be exposed to, and the intermittent nature of exposure, the effects are likely to be negligible.

Operation

During operation, EMF sources would include the 22-33kV underground cables, 66kV transmission line, inverter stations, array and substation.

Electric fields can be reduced with distance from operating electrical equipment and by shielding, while magnetic fields are reduced more effectively with distance. Using the Principle of Prudent Avoidance to design and site this infrastructure, the exposure to EMFs can be minimised and potential for adverse health impacts avoided.

The site is surrounded by agricultural land and public access would be further restricted by site fencing around the solar array and substation. EMFs from the solar farm are likely to be indistinguishable from background levels at the boundary fence. The underground 22-33kV cabling would not produce external electric fields due to shielding from soil, and its magnetic fields would be under the recommended limits for public and occupational exposure.

Staff exposure to EMFs from the proposed and existing transmission lines would be intermittent during site access and maintenance activities, and again EMF levels produced would be well within the recommended occupational exposure limits.

The EMFs produced by the proposed inverters and array are not considered to be a hazard to human health due the low voltage and magnetic fields significantly than household applications.

The onsite substation would also be located within fenced proposal site. While there are number of EMF sources within a substation, design procedures relating to equipment selection, layout, electrical connection techniques and compound size, would ensure the EMFs produced by the equipment within the station would also be typically indistinguishable from background levels beyond the substation fence. The

⁴ Note the U.S.A electricity supply operates at 60 Hz frequency

substation design would be similar to other designs used throughout Australia that have had EMF measurements taken to ensure levels within the compound are within recommended occupational exposure limits for staff.

Using the Principle of Prudent Avoidance to design and site this infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

8.9.3 Safeguards and mitigation measures

Table 8-17 Safeguards and mitigation measures for magnetic fields.

C: Construction; O: Operation; D: Decommissioning

Safeguards and mitigation measures	C	O	D
All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
Transmission lines would be located as far as practical from residences, farm sheds, and yards to reduce the potential for exposure to EMFs.	C		
Design of electrical infrastructure would minimise EMFs.	C		

8.10 BUSH FIRE RISK

8.10.1 Existing environment

The study area is generally low relief and the majority of the proposal site has been cleared of overstorey vegetation. Localised native vegetation remnants occur in the locality, specifically linear roadside vegetation and along waterways. Patches of open woodland also occur within paddocks. The study area is dominated by cropping land.

The proposal site is currently used for grazing and therefore understorey bush fire fuel loads vary from season to season. In terms of existing bush fire hazards onsite, there are vegetation corridors along the western and southern boundaries of the property. As well as a corridor within the centre of the proposal site traversing north to south. These remanent patches onsite are part of larger patches that link to vegetation along Cudgegong River and Wialdra Creek. There are three existing powerlines (66 and 132kV) intersecting the site, mostly in a north-south direction and in alignment with the existing Beryl Substation. The existing Beryl Substation is directly adjacent to the proposal site within the north western section. There is no bushfire prone land mapping available for the proposal site.

The local bush fire danger period occurs between October and March. The Cudgegong Bush Fire Management Plan states typical climatic conditions for the area is varied with warm to temperate conditions in the western and northern areas and temperate to cool at higher elevations predominantly in the central and eastern portions with predominantly summer rainfall (CBFMC 2010). The catalyst for weather conditions favourable for bush fires in the area are south westerly and north-westerly winds accompanied by moderate to high temperatures and moderate levels relative humidity (CBFMC 2010).

Periods of higher temperatures and lower humidity lasting several days occur during the fire season along with frequent dry lightning storms. The harvest period of November to mid-December is considered a prime risk period due to machinery in crops and generally high activity in the rural sector.

Water resources available on-site include two waterways and eight wetlands/farm dams. One waterway is located within the south western area of site and the other waterway transverses the eastern area of the site. A number of tracks are located on the proposal site, including underneath powerlines, accessing dams and running down the centre of the site in a west and east direction. The site has good access from Beryl Road.

In terms of receivers and assets at risk from bush fire, 60 residences are located within 2km of the site. Additionally, a quarry 1.2km south of the proposal site, farm sheds, watering points, council infrastructure and equipment are common in the local area.

8.10.2 Potential impacts

Construction and decommissioning

Activities associated with proposal construction that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol powered tools.
- Hot works including welding and soldering activities.
- Operating a petrol, LPG or diesel powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the sparse and fragmented nature of the woodland and forest remnants flanking the proposal site, it is considered unlikely that in combination with appropriate mitigation strategies, the proposal would pose a significant bush fire risk. Bush fire hazards associated with the activities listed above are considered highly manageable and would be minimised through the implementation of fire and bush fire 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.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction and operation activities (below), any bush fire risk associated with decommissioning of the proposal would be highly manageable.

Operation

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).

The overhead transmission line portions would be managed by maintaining appropriate vegetation clearance limits and reducing the potential ignition risks.

Bush fire risks during operation of the solar farm and connection infrastructure is considered highly manageable.

8.10.3 Safeguards and mitigation measures

Fire risks would be addressed as part of the proposal through the development and implementation of a Bush Fire Management Plan, covering construction and operational phases, as detailed in Table 8-18.

C: Construction; O: Operation; D: Decommissioning

Table 8-18 Safeguards and mitigation measures for bush fire risk.

Safeguards and mitigation measures	C	O	D
- Develop a Bush Fire Management Plan to include but not be limited to: - Management of activities with a risk of fire ignition. - Management of fuel loads onsite. - Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. This includes access to the onsite dam if required for fire emergency situations. - The below requirements of <i>Planning for Bush Fire Protection 2006</i> - - Identifying asset protection zones - Providing adequate egress/access to the site - Emergency evacuation measures - Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.	C	O	D

8.11 CUMULATIVE IMPACTS

8.11.1 Existing environment

Adverse cumulative impacts occur when the infrastructure or activities at the proposal site exacerbate the negative impacts of other infrastructure or activities occurring nearby. Cumulative impacts can occur concurrently or sequentially.

In terms of cumulative impacts, the most relevant interaction for the Beryl SF is the existing Beryl Quarry, located 1.2km south the of proposal site. The quarry's haulage route includes Beryl Road. Additionally, the Beryl SF would be adjacent to an existing substation, and the site has three 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.

8.11.2 Potential impacts

Construction

During construction, the additional traffic impact is likely the greatest potential for cumulative impact in regards to potential dust, noise and visual impacts for receivers along Beryl Road. There would be an increase in the amount of heavy vehicles along Beryl Road with the construction of Beryl SF and operation of the Beryl Quarry. Visually the receiver along Beryl Road would also see an increase in vehicles parked on the proposal site, approximately 60 vehicles. The potential impact from increased traffic and traffic movements to the site would be predominantly limited to construction (approximately 12 months).

It is unlikely there would be cumulative impact of onsite noise and air quality from concurrently operation of the quarry and construction of the Beryl SF, due to the distance between the sites and low density of receivers in the area.

Operation

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.

There is unlikely to be any potential cumulative impacts with the concurrently operation of Beryl Quarry and Beryl SF.

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.

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

8.11.3 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 Beryl 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, consisting of a CEMP, an Operation Environmental Management Plan and a Decommissioning Environmental Management Plan. These plans would be prepared sequentially, prior to each stage of works.

These plans would detail the environmental management responsibilities of specific staff roles, reporting requirements, monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training, complaint response procedures and adaptive management mechanisms to encourage continuous improvement.

9.2 MITIGATION MEASURES

Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Table 9-1 Summary of mitigation measures

Construction (C), Operation, (O), Decommissioning (D)

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 hollow-dependant fauna including the Superb Parrot as well as the Large-eared Pit Bat and Corben's Long-eared Bat, which whilst considered unlikely to occur within the site, nevertheless may have some small potential as occurring within the site from time to time. The nominated clearing period above will also help to avoid the core hibernation period for the two bat species. - 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: - Protection of native vegetation to be retained (including EEC) - Best practice removal and disposal of vegetation - Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. Where possible, fallen timber with hollows is to be collected and placed into adjacent suitable habitats outside the development footprint. - The relocation of displaced fauna during clearing	C		

Safeguards and mitigation measures	C	O	D
- o Weed management, particularly noxious weeds - o Pathogen management - o Unexpected threatened species finds - o Rehabilitation/stabilisation of disturbed areas			
• Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree that originates from outside of the development site. • 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		D
• Use non barbed-wire on exterior fencing where possible.		O	
• A groundcover management plan would be developed and implemented to ensure the existing ground cover is maintained beneath the array during operation of the solar farm. The plan would be developed with reference to soil testing. Highly managed grazing may be used to maintain the height of ground cover during operation.		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.		O	
• Avoid night works as much as possible, and avoid altogether where in close proximity to woodland habitats on adjacent properties.	C		D
• Ensure lights (during nightworks and operation) are directed away from vegetation and adjacent habitats.	C	O	D
• Weed and hygiene protocols will be prepared and implemented.		O	
• Awareness training (fauna collision risks) during site inductions and enforcement of site speed limits.		O	
• Feral species to be monitored and a management plan to be prepared and implemented to reduce feral species abundance.	C	O	
• Implement plan which ensures that fauna movement still possible around perimeter of development site.	C	O	
• A Biodiversity Offset Strategy (BOS) would be developed and implemented to retire the credits generated by the proposal, in accordance with the NSW Biodiversity Offsets Policy for Major Proposals.	C	O	
• If complete avoidance of the five recorded sites within the proposal area (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar	C		

Safeguards and mitigation measures	C	O	D
Farm AS 1) is not possible, the artefacts 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.			
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 sites are moved to record their new location on the AHIMS database.	C		
Once the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1 are salvaged, the proposed work can proceed with caution within the development footprint.	C		
First Solar should prepare an Unexpected Finds Protocol (UFP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm. The UFP will outline the procedure to deal with construction activity. Preparation of the UFP should be undertaken in consultation with the registered Aboriginal parties	C		
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
- If feasible, underground rather than overhead power lines would be considered. - If 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: - Buildings will non-reflective and in eucalypt green, beige or muted brown. - Pole mounts will be non-reflective. - Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.	Design stage		

Safeguards and mitigation measures	C	O	D
- Dust would be controlled in response to visual cues. - Parking areas, material stock piles and other construction activities would be located as far as practical from nearby residences or screened (by existing vegetation or constructed screens) for the period of construction. - 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		
A Visual Impact Management Plan would address the 'as built' visual impacts of the proposed solar farm. The plan would include: - Onsite vegetation screening, guided by the proposed screening, provided in Appendix D of the VIA report Appendix F. - Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas). - Verification of predicted and actual impacts. This would improve the reliability of the measures and provide a trigger to undertake additional mitigation if required. (Guidance regarding these measures is provided in Appendix D of the VIA report Appendix F).		O	
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		
Preparation of a Construction Noise Management Plan. A draft plan is included in Appendix G.2.	C		
- Additionally, during construction: - Use less noisy plant and equipment, where feasible and reasonable. - Plant and equipment should be properly maintained.	C		

Safeguards and mitigation measures	C	O	D
- 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. • Develop and implement a noise complaint process. Each complaint would 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. Keep people informed of progress. The person selected to liaise with the community should be adequately trained and experienced in such matters.			
• The array would be designed to allow sufficient space between panels to establish and maintain ground cover beneath the panels.	Design stage		
• A soil and water management plan (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 Ensure any discharge of water from the site is managed to ensure ANZECC (2000) water quality criteria are met.	C		D

Safeguards and mitigation measures	C	O	D
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.			
- A spill response plan would be developed as part of the overall risk management plan to prevent contaminants affecting adjacent surrounding environments. The plan would: - Manage the storage of any potential contaminants onsite. - Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation. - Ensure that machinery arrives on site in a clean, washed condition, free of fluid leaks.	C	O	D
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
Design of footings for electrical componentry and panel mounts will consider flood risk.	Design stage		
All staff would be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
All fuels, chemicals, and liquids would be stored at least 50m from any waterways or drainage lines and would be stored in an impervious bunded area.	C	O	D
Adequate incident management procedures will be incorporated into the Construction Environmental Management plan, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 Protection of the Environment Operations Act).	C	O	D
The refuelling of plant and maintenance would be undertaken in impervious bunded areas on hardstand areas only.	C	O	D
Machinery would be checked regularly to ensure there is no oil, fuel or other liquids leaking from the machinery.	C		D
- A flood risk contingency plan would be prepared prior to construction and is to be implemented during construction, operation and decommission. The plan would: - Detail who would be responsible for monitoring the flood threat and how this is to be done. - A process for removing any necessary equipment and materials offsite and out of flood risk areas. - Consideration of site access in the event that some tracks become flooded	C	O	D

Safeguards and mitigation measures	C	O	D
o Establishment of an evacuation point			
• The proponent would consult with the Mid Western Regional Council regarding the proposed upgrading of the site access. The upgrade would be subject to detailed design, and must be designed and constructed to the standards specified by RTA 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 Traffic controls (signage and speed restrictions etc.).	C		D
• A Traffic Management Plan would be developed as part of the CEMP and DEMP, in consultation with the Mid Western Regional Council and Roads and Maritime. The plan would include, but not be limited to: - o Assessment of road condition prior to construction on all local roads that would be utilised. - o A program for monitoring road condition, to repair damage exacerbated by the construction and decommissioning traffic. - 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. - o Consideration of cumulative impacts. - 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. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures.	C		D
• A Road Dilapidation Report would be prepared and include audits of the road formation and/or pavement condition to be undertaken prior to construction and at the completion of construction, operation and decommissioning phases. The proponent would repair any damage resulting from proposal traffic (except that resulting from normal wear and tear) as required at the proponent's cost and in consultation with Mid Western Regional Council.	C	O	D
• Consultation with proposal site mineral titleholder and Beryl Quarry regarding the proposal and potential impacts	C	O	D

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
- A Rehabilitation Plan would be prepared to ensure the array site is returned to its 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: - Australian Soil and Land Survey Handbook (CSIRO 2009) - Guidelines for Surveying Soil and Land Resources (CSIRO 2008) - The land and soil capability assessment scheme: second approximation (OEH 2012)			D
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		
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
If any old farm machinery is to be removed, contact the Gulgong Historical Society to enquire about their interest in acquiring any items.	C		
Maintain the railway embankment formation as much as possible.	C	O	D
- A Waste Management Plan (WMP) would be developed to minimise wastes. It would include but not be limited to: - Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. - Quantification and classification of all waste streams. - Provision for recycling management onsite. - Provision of toilet facilities for onsite workers and identify that sullage would be disposed of (i.e., pump out to local sewage treatment plant). - Tracking of all waste leaving the site. - Disposal of waste at facilities permitted to accept the waste. - Requirements for hauling waste (such as covered loads).	C	O	D
Septic system is installed and operated according to the Mid Western Regional Council regulations.	C	O	

Safeguards and mitigation measures	C	O	D
- The Community Consultation Plan will continue to be implemented, including but not limited to implementing protocols to: - Keep the community updated about the progress of the proposal and proposal benefits. - Inform relevant stakeholders of potential impacts (haulage, noise etc.). - Respond to any complaints received.	C		
Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C		
Liaise with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
Liaise with local tourism industry representatives to manage potential timing conflicts with local events.	C		D
Development of a complaints procedure to promptly identify and respond to complaints.	C	O	D
Develop protocols to minimise vehicle and construction equipment emissions for inclusion in the construction and operational environmental management plans. This would include but not limited to Australian standards and the POEO Act.	C	O	D
Protocols would be developed minimise dust levels generated during construction (eg. water carts or similar in response to visual cues).	C		D
All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required.	C		
Transmission lines would be located as far as practical from residences, farm sheds, and yards to reduce the potential for exposure to EMFs.	C		
Design of electrical infrastructure would minimise EMFs.	C		
- Develop a Bush Fire Management Plan to include but not be limited to: - Management of activities with a risk of fire ignition. - Management of fuel loads onsite. - Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. This includes access to the onsite dam if required for fire emergency situations. - The below requirements of <i>Planning for Bush Fire Protection 2006</i> -	C	O	D

Safeguards and mitigation measures	C	O	D
▪ Identifying asset protection zones ▪ Providing adequate egress/access to the site ▪ Emergency evacuation measures o Operational procedures relating to mitigation and suppression of bush fire relevant to the solar farm.			

10 CONCLUSION

The proposed Beryl SF would be located approximately 6km west of Gulgong. The site is accessed directly off Beryl Road. The proposal would connect to the existing Beryl substation, which is immediately adjacent to the north west section of the proposal site.

The proposed solar farm would produce up to 95MW of electricity that will be fed into the National Electricity Market. 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 proposed Beryl SF would provide the following benefits:

- Reduce greenhouse gas emissions required to meet Australia's energy demands.
- Assist in the transition towards cleaner electricity generation.
- Directly contribute to helping in meeting the RET.
- Create significant economic benefits to the region, through the creation of direct and indirect jobs, supporting small business and by developing skills in a growing industry. 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.
- Embed electricity generation, to supply into the Australian grid closer to the consumption centres.

Key environmental risks have been investigated through specialist investigations and specific management strategies now form commitments of the proposal. Key commitments include:

- Biodiversity impacts:
 - A Flora and Fauna Management Plan (FFMP) would be developed and implemented to manage direct and indirect impacts on native vegetation and habitat values. This would include hollow bearing tree felling protocols, weed and pathogen management.
 - A Groundcover Management Plan would be developed and monitored to ensure the existing ground cover is maintained beneath the array during the operation of the solar farm.
 - A Biodiversity Offset Strategy (BOS) would be developed and implemented to retire the credits generated by the proposal, in accordance with the NSW Biodiversity Offsets Policy for Major Proposals.
- Aboriginal heritage impacts:
 - An Unexpected Finds Protocol (UFP) would be prepared to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm. The UFP will outline the procedure to deal with construction activity.
- Visual impact:
 - Design measures (materials selection and colour) would be undertaken to reduce glint and minimise the contrast of the infrastructure where possible.
 - Screening vegetation would be planted to break up views of infrastructure in specific locations.
- Noise impacts:
 - A Construction Noise Management Plan would be finalised and implemented to manage exceedances during the construction phase.

A suite of additional management measures has been developed to address other environmental impacts and risks. These include:

- Traffic:
 - A Traffic Management Plan would be developed in consultation with the Mid Western Regional Council and Roads and Maritime, to manage construction and decommissioning impacts.
 - A Road Dilapidation Report would be prepared to ensure the proponent would repair any damage resulting from proposal traffic.
- Land capability:
 - A Rehabilitation Plan would be prepared to ensure the array site is returned to its pre solar farm land capability. The plan would be developed with reference to baseline soil testing and with input from an Agronomist to ensure the site is left stabilised, under a cover crop or other suitable ground cover.
- Community:
 - The Community Consultation Plan will continue to be implemented to keep the community updated about the progress of the proposal and proposal benefits, inform relevant stakeholders of potential impacts (haulage, noise etc.) and respond to any complaints received during construction and operation.
 - The proponent would liaise with local industry and commercial representatives to maximise the use of local contractors, manufacturing facilities, materials and to manage accommodation options for construction staff.
- Bushfire
 - A Bush Fire Management Plan would be developed to manage fire risks and responses during construction, operation and decommissioning.

The impacts and risks identified are considered manageable with the effective implementation of the measures stipulated in this EIS. The proposal is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous land capability. The proposal would make a long-term contribution to meeting energy demands of Australians, using renewable sources that would offset emissions generated through the burning of fossil fuels. Impacts are considered justifiable and acceptable.

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APPENDIX A SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS



Our ref: SSD 8183

Mr Tom Best
First Solar (Australia) Pty Ltd
Level 3, 16 Spring Street
SYDNEY NSW 2000

Dear Mr Best

**Beryl Solar (SSD 8183)
Environmental Assessment Requirements**

I have attached the Environmental Assessment Requirements for the preparation of an Environmental Impact Statement (EIS) for the Beryl Solar Farm.

The requirements are based on the information you have provided to date, and have been prepared in consultation with the relevant government agencies. The agencies comments are attached for your information (see Attachment 2).

Please note that the Department may alter these requirements at any time, and that you must consult further with the Department if you do not lodge a development application and EIS for the project within the next two years.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will also require approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment and Energy in Canberra (02 6274 1111 or www.environment.gov.au).

Please contact the Department at least two weeks before you plan to submit the development application and EIS for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1AA, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the required number of copies of the EIS.

It is important for you to recognise that the Department will review the EIS for the project before putting it on public exhibition. If it fails to adequately address these requirements, you will be required to submit an amended EIS.

Yours sincerely

25/1/17

Clay Preshaw
**A/Director
Resource Assessments**
(as nominee of the Secretary)

Environmental Assessment Requirements

State Significant Development

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

Application Number	SSD 8183
Proposal	Beryl Solar which includes: • the construction and operation of a solar photovoltaic (PV) generation facility with an estimated capacity of 95 MW; and • associated infrastructure, including a grid connection.
Location	Beryl Road, Beryl (Mid-Western Regional Council)
Applicant	First Solar (Australia) Pty Ltd
Date of Issue	25 January 2017
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i>. In particular, the EIS must include: • a full description of the development, including: – details of construction, operation and decommissioning; – a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); – a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development; • a strategic justification of the development focusing on site selection and the suitability of the proposed site; • an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development; – an assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; – a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development; • a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and • the reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the <i>Environmental Planning and Assessment Regulation 2000</i>, 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 <i>Environmental Planning and Assessment Regulation 2000</i>); and

	the consent in writing of the owner of the land (as required in clause 49(1)(b) of the <i>Environmental Planning and Assessment Regulation 2000</i>).
Specific Issues	The EIS must address the following specific issues: Biodiversity – including an assessment of the likely biodiversity impacts of the development, (including but not limited to the impacts on Box Gum Woodland endangered ecological community, <i>Euphrasia arguta</i>, <i>Prasophyllum sp. Wybong</i>, Bluegrass (<i>Dichanthium setosum</i>), Pink Donkey Orchid (<i>Diuris tricolor</i>), Regent Honeyeater (<i>Anthochaera phrygia</i>), Swift Parrot (<i>Lathamus discolor</i>), and Silky Swainson-pea (<i>Swainsona sericea</i>)), having regard to the <i>NSW Biodiversity Offsets Policy for Major Projects</i>, and in accordance with the <i>Framework for Biodiversity Assessment</i>, unless otherwise agreed by the Department; 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; 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; Visual – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners; Noise – including an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Industrial Noise Policy</i> (INP), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria; Transport – including an assessment of the site access route (including Castlereagh Highway and Beryl Road), site access point, rail safety issues 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); Water – including: - an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses (including the Cudgegong River and Wialdra Creek), wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; - details of water supply arrangements; and - a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom 2004); Hazards and Electromagnetic Interference – an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) <i>Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields</i>. Socio-Economic – including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.

Consultation	In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Mid-Western 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.
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Environmental Planning Instruments, Policies, Guidelines & Plans

Biodiversity

[Framework for Biodiversity Assessment \(OEH\)](#)
[NSW Biodiversity Offsets Policy for Major Projects \(OEH\)](#)
[Threatened Species Assessment Guidelines - Assessment of Significance \(OEH\)](#)
[Biosecurity Act 2015](#)
[Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings \(DPI\)](#)
[Policy and Guidelines for Fish Habitat Conservation and Management \(DPI\)](#)

Heritage

[Aboriginal Cultural Heritage Consultation Requirements for Proponents \(OEH\)](#)
[Code of Practice for Archaeological Investigations of Objects in NSW \(OEH\)](#)
[Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW \(OEH\).](#)
[NSW Heritage Manual \(OEH\)](#)

Land

[Primefact 1063: Infrastructure proposals on rural land \(DPI\)](#)
[Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry \(ARENA\)](#)
[Local Land Services Act 2013](#)
[Australian Soil and Land Survey Handbook \(CSIRO\)](#)
[Guidelines for Surveying Soil and Land Resources \(CSIRO\)](#)
[The land and soil capability assessment scheme: second approximation \(OEH\)](#)

Noise

[NSW Industrial Noise Policy \(EPA\)](#)
[Interim Construction Noise Guideline \(EPA\)](#)
[NSW Road Noise Policy \(EPA\)](#)

Transport

[Guide to Traffic Generating Developments \(RTA\)](#)
[Road Design Guide \(RMS\) & relevant Austroads Standards](#)
[Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development](#)

Water

[Managing Urban Stormwater: Soils & Construction \(Landcom\)](#)
[Floodplain Development Manual \(OEH\)](#)
[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 \(DPI Water\)](#)

Waste

[Waste Classification Guidelines \(EPA\)](#)

Electromagnetic Interference

[ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields](#)

Environmental Planning Instruments

[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. 44 – Koala Habitat Protection](#)
[State Environmental Planning Policy No. 55 – Remediation of Land](#)
[Mid-Western Regional Local Environmental Plan 2012](#)



Department of Primary Industries

OUT17/3110

Ms Diana Charteris
Resource Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Diana.charteris@planning.nsw.gov.au

Dear Ms Charteris

Beryl Solar Farm (SSD 8183)
Request for Secretary's Environmental Assessment Requirements (SEARs)

I refer to your email of 24 January 2017 to the Department of Primary Industries (DPI) in respect to the above matter. Comment has been sought from relevant divisions of DPI. Views were also sought from NSW Department of Industry - Lands that are now a division of the broader Department and no longer within NSW DPI. Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

DPI has reviewed the Preliminary Environmental Assessment and accompanying draft SEARs and provides the following recommendations:

- Specific Issues – Land should include a requirement for the proponent to develop Rehabilitation and Decommissioning/Closure Plans that outline rehabilitation objectives and strategies, including:
 - o A description of the design criteria of the final landuse and landform;
 - o indicators to guide the return of the land back to agricultural production;
 - o expected timeline for the rehabilitation program;
 - o monitoring and mitigation measures to be adopted for rehabilitation remedial actions; and
 - o a commitment to burying cables and pipes to a depth >500mm on any land with a cropping history or land with a capability for cropping to allow greater opportunity for agricultural activities to continue above the cables. This is especially relevant for the cables/pipes which will be left in situ once restoration is complete.
- Specific Issues – Water should include:
 - o A detailed description of the proposed management of watercourses on site, outlining if these watercourses are to be diverted or how they will be managed, with particular focus in relation to panels placed within the watercourses;
 - o specific details outlining the estimated volume of water required for dust suppression and construction purposes and the source of this water.

(Water supply requires careful consideration in the early stages of the project in order to ensure the availability of supply. Similar projects have encountered delays as a result of difficulty in obtaining the required water supply.)

Yours sincerely

A handwritten signature in blue ink, appearing to read 'M. Isaacs', with a stylized, cursive script.

Mitchell Isaacs

Director, Planning Policy & Assessment Advice

24 January 2017

DPI appreciates your help to improve our advice to you. Please complete this three minute survey about the advice we have provided to you, here:

<https://goo.gl/o8TXWz>



Diana Charteris
Senior Planning Officer
Resource Assessments & Planning Services
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Diana.Charteris@planning.nsw.gov.au

Dear Diana

Beryl Solar Farm (SSD 8183)

I refer to your email dated 10 January 2017, inviting the Division of Resources & Energy (DRE) to provide comments on the Beryl Solar Farm Preliminary Environmental Assessment (PEA) for the Division's requirements for draft SEARs.

The Division notes that the project site for the Beryl Solar Farm contains a number of occurrences for gold and diamonds. Notably, drilling programs have tested the western margin of the proposal area (Figure 1) for gold and diamond deposits and the area generally remains prospective.

The Division has reviewed and assessed the Beryl Solar Farm draft SEARs and recommends the requirement for demonstrated, authentic consultation with mineral resource stakeholders including the Geological Survey of NSW, adjacent mineral title holders and quarry operators impacted by the Beryl Solar Farm proposal, be incorporated in the SEARs as outlined below.

The Environmental Assessment (EA) must consider the potential impact of the project, including associated ancillary infrastructure, on any mineral resources, as prescribed under the *Mining Act 1992* and construction materials, both within and adjacent to the project area.

The EA is to indicate, on a map or other visual means, the following:

- the extent of the Project area,
- the location of affected minerals titles (adjacent and adjoining),
- transmission and (project) related infrastructure,
- any transmission corridors, and
- any other relevant information.

The proponent must conduct an assessment as part of the EA, regarding the potential impacts of the project, including electricity transmission infrastructure, on any significant mineral resources, including:

- Any operating mines, extractive industries or known mineral or petroleum resources.
- Exploration activities in the vicinity of the proposed development.
- Access for future exploration in the area.

The proponent must liaise with the Division regarding the location of proposed electricity transmission infrastructure.

The EA should also provide evidence of any associated stakeholder consultation documents and, where required detail the ongoing engagement strategy in the form of management plans. Specifically, the EA should demonstrate:

- consultation with Boral Resources (Country) Pty Ltd regarding potential impacts on the continued operation and any potential future expansions of the quarry.
note: this should include evidence of notification of the project provided to Boral Resources (Country) Pty Ltd as set out in the requirements above.
- Consideration of the provisions of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2010* for compatibility with existing extractive operations.

The Division's database indicates that the contact details for the Beryl Quarry are:

Beryl Quarry
Boral Resources (Country) Pty Limited
PO Box 2185
ORANGE NSW 2800

- Consultation with current titleholders to determine their level of interest. A record of consultation is required in the EA. This should include a letter of notification of the proposal to the title holder or their agent including a map indicating the location of the solar farm proposal area (including electricity transmission infrastructure) in relation to the exploration title boundaries, and a letter of response from the title holder or their nominee to the proponent.
note: this should include evidence of notification of the project provided to titleholders as set out in the requirements above.

The Department's database indicates that the contact details for both EL8160 and EL8405 are:

Bowdens Silver Pty Limited (subsidiary of Silver Mines Limited)
C/- Enrizen Enable Pty Ltd
Level 11
52 Phillip Street
SYDNEY NSW 2000

For current titles the proponent should refer to:

<http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/common-ground>

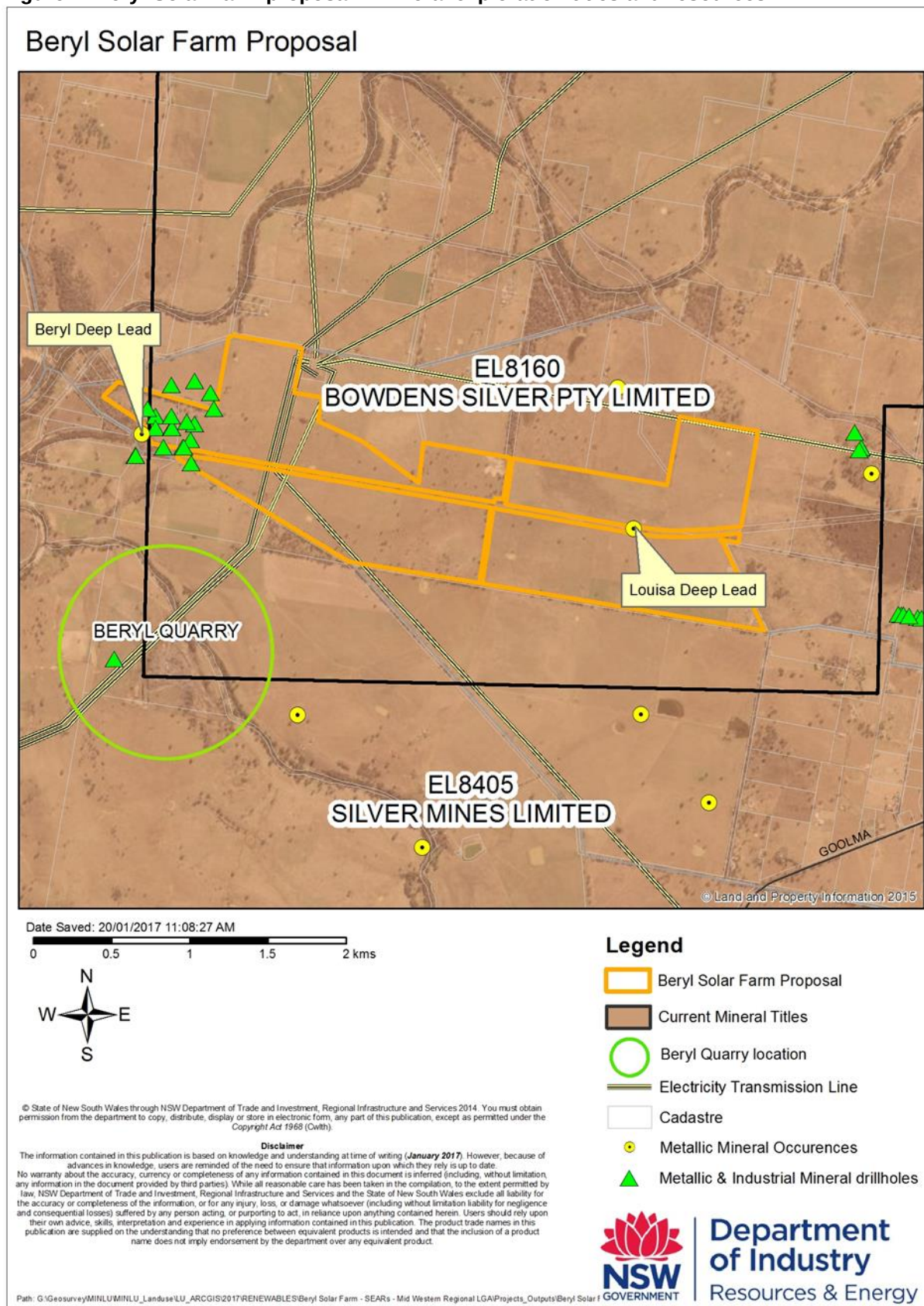
Should you have any enquires regarding this matter please contact Steve Cozens, Senior Project Officer, Royalty & Advisory Services on 9842 8573.

Yours sincerely



Zane West
Manager Royalties & Advisory Services

Figure 1: Beryl Solar Farm proposal – Mineral exploration titles and resources





Our reference: FIL13/4934 & SF17/1806; DOC16/11979-01
Contact: Sheridan Ledger 02 6332 7608

Mrs Diana Charteris
Senior Planning Officer
Resource Assessments
Department of Planning and Environment
PO Box 39
SYDNEY NSW 2001

23 January 2017

Dear Mrs Charteris,

Beryl Solar Farm (SSD 8183)
EPA Request - Secretary's Environmental Assessment Requirements

I refer to your email of 10 January 2017 requesting the Environment Protection Authority's (EPA) requirements for the preparation of an Environmental Impact Statement (EIS) for the proposed Beryl Solar Farm (the Proposal). The EPA understands that the application will be assessed by the Department of Planning and Environment (DPE) under Part 4 of the *Environmental Planning and Assessment Act 1979* as a State Significant Development.

The EPA has considered the details provided regarding the Proposal, including the Beryl Solar Farm Scoping Report, dated December 2016. The EPA notes that the Proposal will have a capacity of 95 MW from approximately 220 ha of photovoltaic modules.

The EPA would like to advise that Section 17 of Schedule 1 of the *Protection of the Environment Operations Act 1997* (the POEO Act) does not include electricity generation from solar. Therefore the Proposal will not require an environment protection licence (EPL) should it be approved by the Department of Planning & Environment (DPE).

In accordance with the provisions of the POEO Act Mid-Western Regional Council is the appropriate regulatory authority for this Proposal and as such, any future correspondence regarding it should be directed to Council.

Should you wish to discuss the matter further please contact Ms Sheridan Ledger from the Central West (Bathurst) Office of the EPA by telephoning (02) 6332 7608.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Darryl Clift'.

DARRYL CLIFT
Head Central West Unit
Environment Protection Authority

JR:CA:ENE100020

24 January 2017

NSW Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Diana Charteris

Dear Madam,

RE: BERYL SOLAR FARM

Thank you for providing Mid-Western Regional Council (Council) with the opportunity to review and provide input into the Secretary's Environmental Assessment Requirements (SEAR's) for the proposed Beryl Solar Farm (SSD 8183). Council has reviewed the requirements for SSD 8183 and requests the following issues be specifically addressed as part of the impact assessment:

Transport:

Council requests that details be provided on the proposed road upgrades that the applicant intends on undertaking. This will include intersection treatments, railway crossings, lane widths and surfacing details in accordance with the relevant AustRoads Guidelines. The proponent will need to 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. Roads that are anticipated to be affected by the proposal are the Castlereagh Highway and Beryl Road.

Community Consultation:

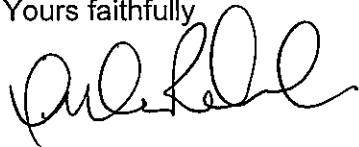
Council requests that the proponent conducts extensive consultation with the community and in particular, impacted/adjoining land owners. This will ensure the community has current and accurate information to provide feedback on the proposed project including visual, noise or social impacts.

Boundary Realignment

Council understands that the department would like to specifically discuss the proposed boundary adjustment. Lindsay Dunstan or Cameron Amos, from Council's Planning and Development team, can be contacted directly.

Should you have any further enquiries in relation to this matter, please contact Council on (02) 6378 2850.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Julie Robertson', written in a cursive style.

**JULIE ROBERTSON
DIRECTOR DEVELOPMENT**

Our Ref: DOC17/25197-1
Your Ref: SSD 8183

Ms Diana Charteris
Senior Planning Officer
Resource Assessments
Department of Planning and Environment
Diana.Charteris@planning.nsw.gov.au

Dear Ms Charteris,

Beryl Solar Farm – SSD 8183

I refer to your email dated 10 January 2017 seeking input into the Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Assessment (EIS) for the Beryl Solar Farm (SSD 8183).

OEH has considered your request and provides SEARs for the proposed development in **Attachments A, B and C** and guidance material in **Attachment D**.

OEH recommends the EIS needs to appropriately address the following:

1. Biodiversity and offsetting
2. Aboriginal cultural heritage
3. Historic heritage
4. Water and soils
5. Flooding

OEH notes that there are a number of Endangered Ecological Communities and threatened species potentially affected by the development, and that Aboriginal cultural heritage items may also be present. OEH recommends that the design of the Solar Farm avoids areas of native vegetation as much as possible. Where the project may impact on potential habitat areas of *Diuris tricolor*, targeted surveys should be undertaken during the months of September and October.

Please note that the NSW Biodiversity Offsets Policy for Major Projects <http://www.environment.nsw.gov.au/resources/biodiversity/140672biopolicy.pdf> is now being implemented. The policy provides a standard method for assessing impacts of major projects on biodiversity and determining offsetting arrangements.

The policy is underpinned by the Framework for Biodiversity Assessment (FBA) <http://www.environment.nsw.gov.au/resources/biodiversity/140675fba.pdf> which contains the assessment methodology that is adopted by the policy to quantify and describe the impact assessment requirements and offset guidance that applies to Major Projects. The FBA must be used by a proponent to assess all biodiversity values on the development site.

If you have any questions regarding this matter further please contact David Geering on 02 6883 5335 or email david.geering@environment.nsw.gov.au.

Yours sincerely,

A handwritten signature in dark ink, appearing to be 'SC', with a long horizontal stroke extending to the right.

STEVEN COX
Senior Team Leader Planning
North West Region

Date: 19 January 2017

Contact officer: DAVID GEERING
6883 5335

Attachment A - Environmental Assessment Requirements

Attachment B – Species/Populations/Ecological Communities which Require Further Consideration

Attachment C - Critically Endangered Entities Specifically Excluded from Requiring Further Consideration

Attachment D - Guidance Material

Attachment A – Standard Environmental Assessment Requirements

Biodiversity
1. Biodiversity impacts related to the proposed Beryl Solar Farm are to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the <i>Threatened Species Conservation Act 1995</i>. 2. Impacts on the species and ecological communities listed in Attachment B will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment.
Aboriginal Cultural Heritage
3. The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the <i>Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW</i> (DECCW, 2011) and consultation with OEH regional officers.
4. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the <i>Aboriginal cultural heritage consultation requirements for proponents 2010</i> (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.
5. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.
Historic Heritage
6. The EIS must provide a heritage assessment including but not limited to an assessment of impacts to <i>State and local heritage</i> 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: a. outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996), b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria), c. include a statement of heritage impact for all heritage items (including significance assessment), d. consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.
Water and Soils
7. The EIS must map the following features relevant to water and soils including: a. Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map). b. Rivers, streams, wetlands, estuaries (as described in Appendix 2 of the Framework for Biodiversity Assessment). c. Groundwater. d. Groundwater dependent ecosystems. e. Proposed intake and discharge locations.

8. The EIS must describe background conditions for any water resource likely to be affected by the development, including: - Existing surface and groundwater. - Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations. - Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters. - Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.
9. The EIS must assess the impacts of the development on water quality, including: - The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction. - Identification of proposed monitoring of water quality.
10. The EIS must assess the impact of the development on hydrology, including: - Water balance including quantity, quality and source. - Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas. - Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems. - Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches). - Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water. - Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options. - Identification of proposed monitoring of hydrological attributes.
Flooding
11. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: - Flood prone land. - Flood planning area, the area below the flood planning level. - Hydraulic categorisation (floodways and flood storage areas).
12. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event.
13. The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: Current flood behaviour for a range of design events as identified in 11 above. This includes the 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
14. Modelling in the EIS must consider and document: - The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. - Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. - Relevant provisions of the NSW Floodplain Development Manual 2005.

15. The EIS must assess the impacts on the proposed development on flood behaviour, including:
 - a. Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
 - b. Consistency with Council floodplain risk management plans.
 - c. Compatibility with the flood hazard of the land.
 - d. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
 - e. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
 - f. Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
 - g. Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.
 - h. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.
 - i. Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.
 - j. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

Attachment B – Species/Populations/Ecological Communities which Require Further Consideration

Table 1

Class	Scientific Name	Common Name	NSW Status	Comm. Status
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	Critically Endangered	Critically Endangered
Flora	<i>Dichanthium setosum</i>	Bluegrass	Vulnerable	Vulnerable
Flora	<i>Euphrasia arguta</i>		Critically Endangered	Critically Endangered

Attachment C – Critically Endangered Entities Specifically Excluded From Requiring Further Consideration*

Table 2

Class	Scientific Name	Common Name	NSW Status	Comm. Status
Aves	<i>Lathamus discolor</i>	Swift Parrot	Endangered	Critically Endangered
Flora	<i>Prasophyllum sp. Wybong</i>		Protected	Critically Endangered
Community	<i>White Box Yellow Box Blakely's Red Gum Woodland</i>	White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	Critically Endangered Ecological Community

* Further information, as detailed in section 9.2.5.2 of the FBA, is not required for the excluded entities in Table 2. However, assessment of impacts and offset requirements must still be included in the biodiversity assessment report for these entities in accordance with the FBA.

Attachment D – Guidance Material

Title	Web address
<u>Relevant Legislation</u>	
<i>Coastal Protection Act 1979</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+13+1979+cd+0+N
<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>	https://www.legislation.gov.au/Details/C2016C00777
<i>Environmental Planning and Assessment Act 1979</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
<i>Fisheries Management Act 1994</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
<i>Marine Parks Act 1997</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
<i>National Parks and Wildlife Act 1974</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
<i>Protection of the Environment Operations Act 1997</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
<i>Threatened Species Conservation Act 1995</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
<i>Water Management Act 2000</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
<i>Wilderness Act 1987</i>	http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N
Biodiversity	
NSW Biodiversity Offsets Policy for Major Projects (OEH, 2013)	http://www.environment.nsw.gov.au/resources/biodiversity/140672biopolicy.pdf
Framework for Biodiversity Assessment (OEH, 2013)	http://www.environment.nsw.gov.au/resources/biodiversity/140675fba.pdf
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
Revocation, recategorisation and road adjustment policy (OEH, 2012)	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/parks/policyRevocations.pdf
Heritage	
The Burra Charter (The Australia ICOMOS charter)	http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf

Title	Web address
for places of cultural significance)	
Statements of Heritage Impact 2002 (HO & DUAP)	http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf
NSW Heritage Manual (DUAP) (scroll through alphabetical list to 'N')	http://www.environment.nsw.gov.au/Heritage/publications/index.htm#M-O
Aboriginal Cultural Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)	http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
Aboriginal Site Recording Form	http://www.environment.nsw.gov.au/resources/parks/SiteCardMainV1_1.pdf
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/resources/cultureheritage/120558asirf.pdf
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Care Agreement Application form	http://www.environment.nsw.gov.au/resources/cultureheritage/20110914TransferObject.pdf
Water and Soils	
Acid Sulphate Soils	
Acid Sulfate Soils Planning Maps via 'The NSW Natural Resource Atlas'	www.nratlas.nsw.gov.au/
Acid Sulfate Soils Manual (Stone et al. 1998)	Manual available for purchase from: http://www.landcom.com.au/whats-new/the-blue-book.aspx DPI's Guidelines Register: Chapter 1 Acid Sulfate Soils Planning Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Planning%20Guidelines.pdf Chapter 2 Acid Sulfate Soils Assessment Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Assessment%20Guidelines.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.advancedenvironmentalmanagement.com/Reports/Savannah/Appendix%2015.pdf <i>This replaces Chapter 4 of the Acid Sulfate Soils Manual above.</i>

Title	Web address
Flooding	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Guidelines for Preparing Coastal Zone Management Plans	Guidelines for Preparing Coastal Zone Management Plans http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf
NSW Climate Impact Profile	NSW Climate Impact Profile
Climate Change Impacts and Risk Management	Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

18 January 2017

SF2017/006730; WST17/00005

Manager
Resource Assessments
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Ms Diana Charteris

Dear Ms Charteris

**SSD 8183: Lot 20 DP 1173059 and Lot 1 DP 1012926; Perseverance Lane, Beryl;
Request for Secretary's Environmental Assessment Requirements (SEARs); Beryl Solar Farm**

Thank you for your email on 10 January 2017 referring the *Scoping Report* for the proposed Beryl Solar Farm Project and seeking SEARs from Roads and Maritime Services.

The *Scoping Report* has been reviewed. Roads and Maritime notes the proposal is for construction and operation of a 95 megawatt solar farm on land near Beryl west of Gulgong. Roads and Maritime has identified and recommends that the following issues be addressed in the Environmental Assessment:

- A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's *Guide to Traffic Generating Developments 2002* and including:
 - Hours and days of construction.
 - Schedule for phasing/staging of the project.
 - Traffic volumes:
 - Existing background traffic.
 - Project-related for each stage of the project including construction, operation and decommissioning.
 - Projected cumulative traffic volumes.
 - Traffic volumes are to also include a description of:
 - Ratio of light vehicles to heavy vehicles.
 - Peak times for existing traffic.

Roads and Maritime Services

- Peak times for project-related traffic.
- Transportation hours.
- Project related traffic interaction with existing background traffic.
- The origin, destination and routes for:
 - Employee and contractor light traffic.
 - Heavy traffic.
 - Oversize and over mass traffic.
- A description of all oversize and over mass vehicles and the materials to be transported.
- Details of access requirements to the Castlereagh Highway and an analysis of affected intersections with the Castlereagh Highway (Perseverance Lane and Beryl Road) for such access to determine suitability.
- The impact of generated traffic and measures employed to ensure efficiency and safety on the public road network during construction, operation and decommissioning of the project.
- The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.
- Local climate conditions that may affect road safety for vehicles used during construction, operation and decommissioning of the project (eg fog, wet and dry weather, etc)
- 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.
- The layout of the internal road network, parking facilities and infrastructure within the project boundary.
- A Traffic Management Plan (TMP) is to be developed in consultation with the Mid Western Regional Council and Roads and Maritime prior to the commencement of haulage and/or construction operations. The TMP is to identify and provide management strategies to manage the impacts of projected related traffic including:
 - Haulage of materials to site.
 - Transportation of construction workers from accommodation facilities to site and return.

Roads and Maritime appreciates the opportunity to contribute to the SEARs and requests that a copy of the SEARs be forwarded to Roads and Maritime at the same time they are sent to the applicant.

Should you require further information please contact Andrew McIntyre, Manager Land Use Assessment, on 02 6861 1453.

Yours faithfully



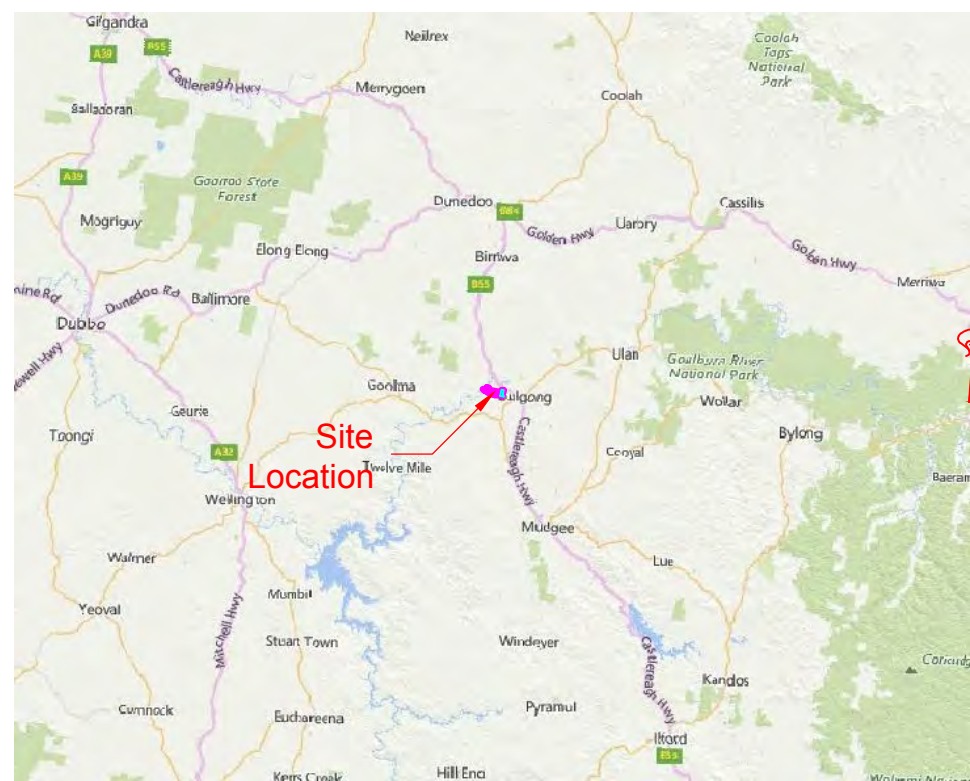
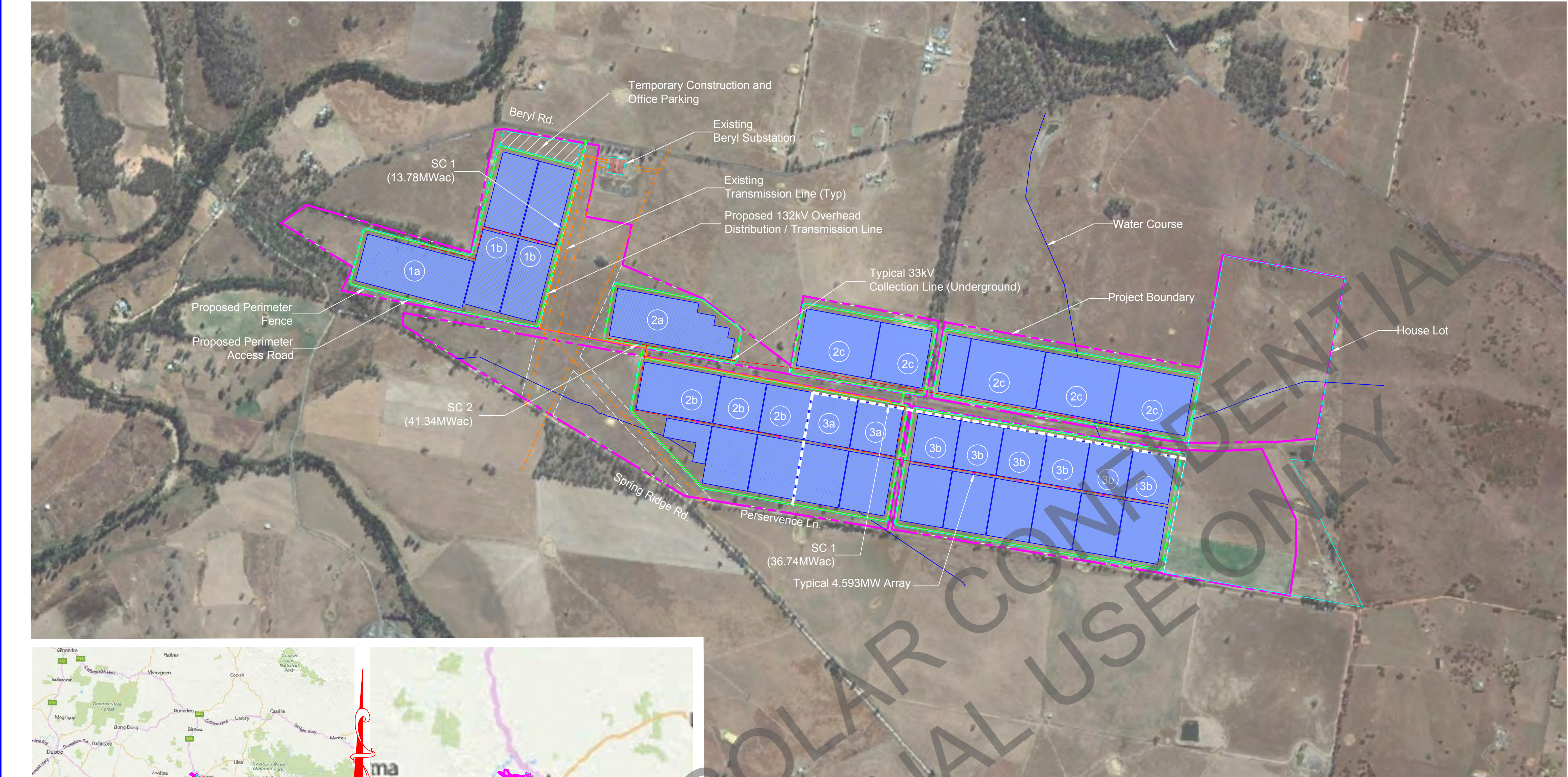
Susie Mackay
Network & Safety Manager
Western

APPENDIX B PROPOSAL MAPS AND DRAWINGS

B.1 ORIGINAL LAYOUT

B.2 REVISED LAYOUT (TAKING INTO ACCOUNT CONSTRAINTS)

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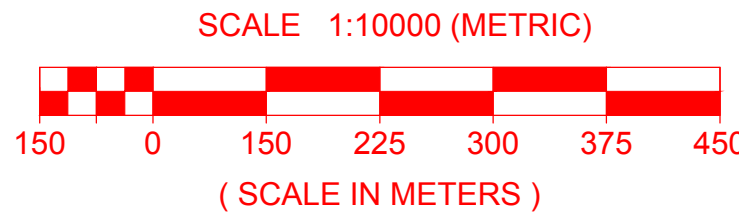
Country Map
Scale NTS



Key Plan
Scale NTS



Site Development Plan
Scale 1:10 000



Legend:

- Project Boundary
- AC Elec. Collection Line (Underground)
- AC Elec. Collection Line (Overhead)
- AC Elec. Distribution / Transmission Line
- Existing Distribution / Transmission Line
- Perimeter Fence
- Proposed Access Road (Dirt)

Beryl Solar Plant

Beryl, New South Wales, Australia

Product Offering

TBD

Project Developer/Owner Operator

First Solar

Project Site Description

302.03 ± Hectare Site
± Hectare Array
Latitude 32°21'26" S
Longitude 149°28'17" E
Elevation 420 m



PROFESSIONAL ENGR.

Beryl Solar Plant
Beryl
New South Wales
Australia, Australia

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
A	10-28-16	Conceptual Design - Tracker Mounting System	DK	JH	JH

FS JOB #:	0000-0000-00
PROJ. DSGR:	Daiva Kinneman
PROJ. ENGR:	
PROJ. MGR:	
PROJ. DIR:	John Hartelius P.E.
SCALE:	AS NOTED

SHEET TITLE

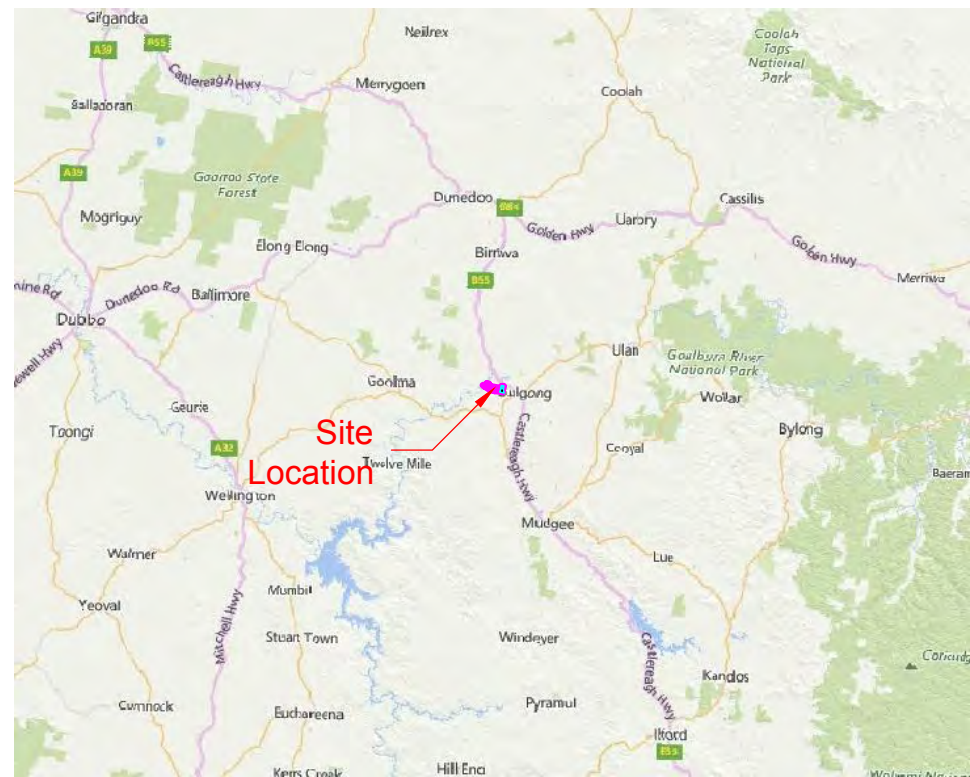
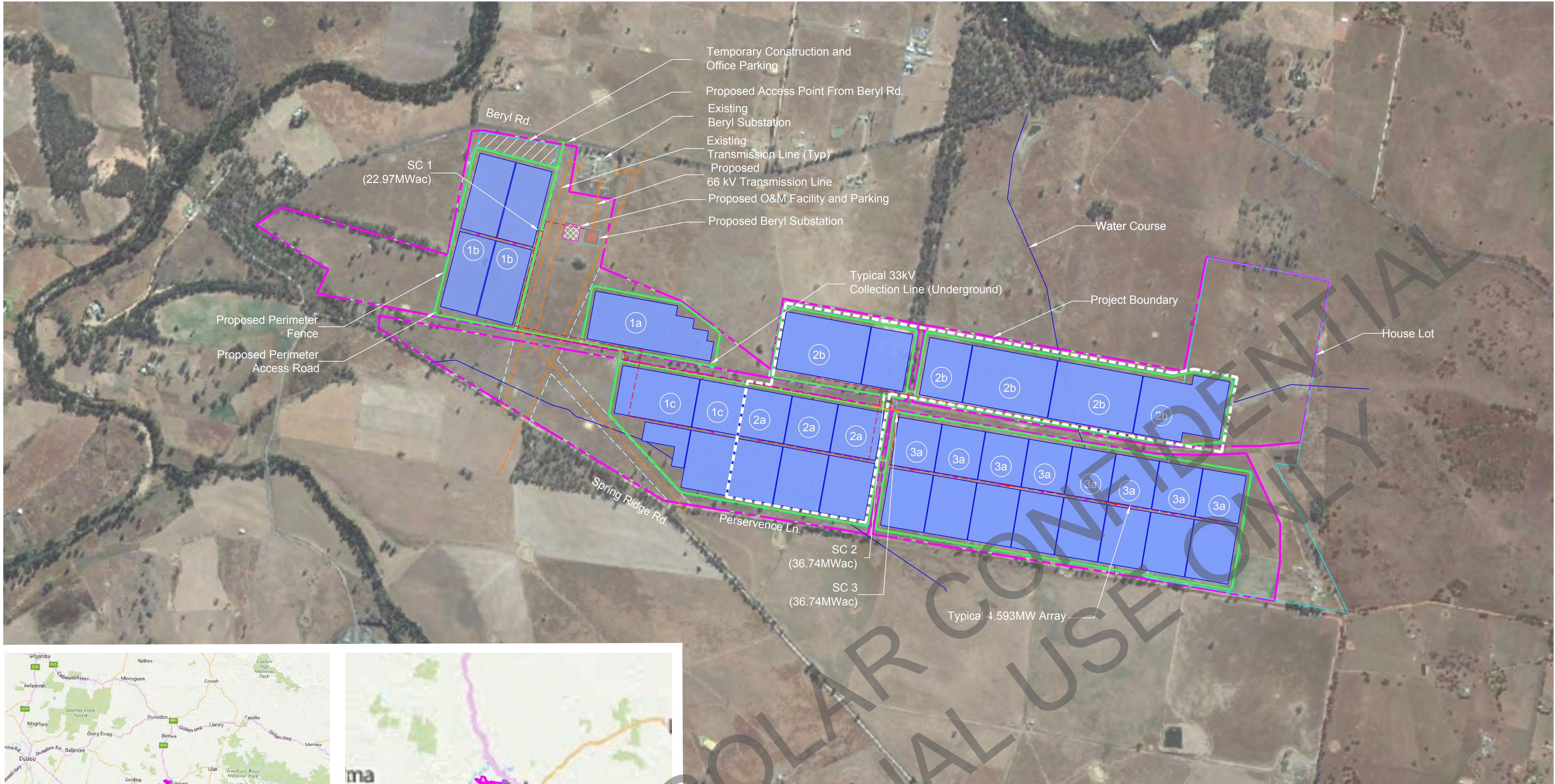
Site Development Plan

SD-100-T
SHEET 1 OF 1

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Site Plan Data Source	
Feature	Description
Boundary	Beryl PV Site KMZ
Coordinate System	Map Grid of Australia Zone 55, using GDA94 datum
Topography	
Hydrology	
Wetlands	
Geotechnical	
Environmental Constraint	
THIS PRINT IS DESIGNED FOR 24" X 36" PLOTTING	
THIS SITE DEVELOPMENT PLAN IS PRELIMINARY AND SUBJECT TO REVISION BASED ON, AMONG OTHER THINGS, CHANGES IN PROJECT SCHEDULE, TECHNOLOGY, AND/OR SITE SPECIFIC CONSTRAINTS.	
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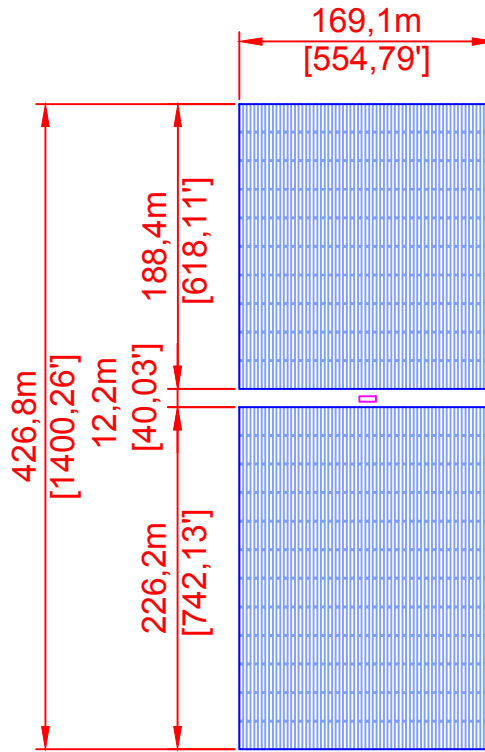
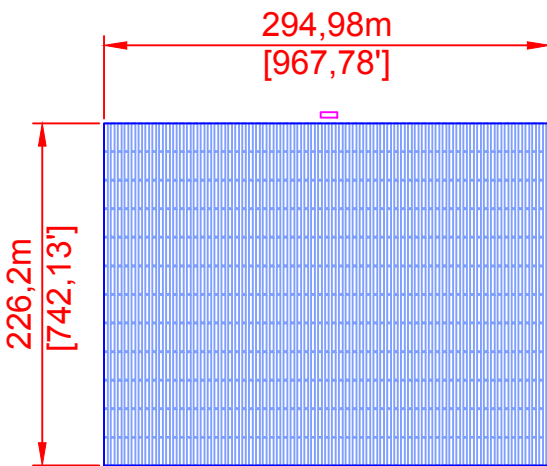
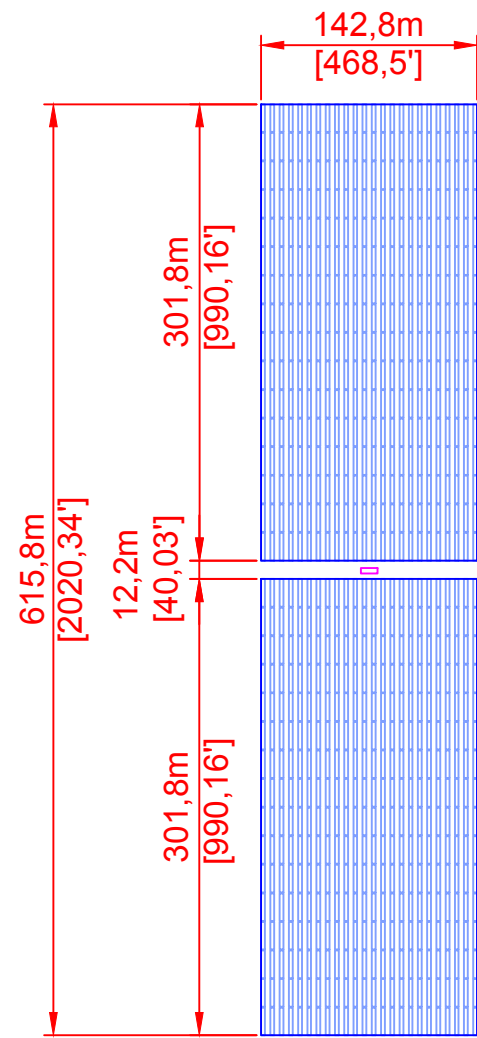
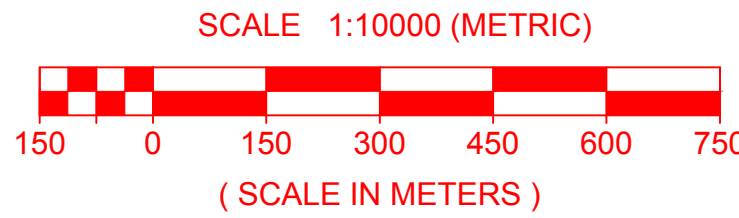


Country Map
Scale NTS



Key Plan
Scale NTS

Site Development Plan
Scale 1:10 000



- Legend:**
- Project Boundary
 - AC Elec. Collection Line (Underground)
 - AC Elec. Collection Line (Overhead)
 - AC Elec. Distribution / Transmission Line
 - Existing Distribution / Transmission Line
 - Perimeter Fence
 - Proposed Access Road (Dirt)

Beryl Solar Plant

Beryl, New South Wales, Australia

Product Offering

TBD

Project Developer/Owner Operator

First Solar

Project Site Description

303.94 ± Hectare Site
169.24 ± Hectare Array
Latitude 32°21'26" S
Longitude 149°28'17" E
Elevation 420 m

Project Climatic Conditions

ASHRAE Station No. 947270
Extreme Max (50 year) Temp 43.1 °C
Extreme Min (50 year) Temp -7.7 °C
Annual Cooling Design Temp 34.7 °C
Annual Heating Design Temp -2.7 °C
(ASHRAE 2013)

Project Design Data

Snow Load Sg=0
Wind Load Region A1, Vr=43m/s
Seismic Load Z=0.08, Kp=0.75

Project Interconnection

66 kV Distribution / Transmission Line to Existing Beryl Substation

Photovoltaic System Parameters

96.45 - MWac System Capacity (Nominal Output)
116.76 - MWdc System Capacity (Nominal Output)

Solar Production

Tracker Mounting System
10° Azimuth
1500 Volt dc PV System Design
33 kV Collection System
66 kV Dist. or Trans. System

Array	Types	Qty
Standard	3	17
Sub-Array	1	1
Custom	3	3

Beryl Solar Plant
Beryl
New South Wales
Australia, Australia
95MWac Net Capacity

REV	DATE	DESCRIPTION	BY	CHK	APP
D	3-17-17	Revised Capacity	VK	JH	JH
C	2-20-17	Revised Per Comments	FD	JH	JH
B	11-03-16	Revised Array Layout	FD	JH	JH
A	10-28-16	Conceptual Design - Tracker Mounting System	DK	JH	JH

FS JOB #: 0000-0000-00
PROJ. DSGR: Daiva Kinneman
PROJ. ENGR:
PROJ. MGR:
PROJ. DIR: John Hartelius P.E.
SCALE: AS NOTED

Site Development Plan

SD-100-T

SHEET 1 OF 1

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APPENDIX C CONSULTATION

C.1 COMMUNITY CONSULTATION PLAN

C.2 LETTER TO MID WESTERN REGIONAL COUNCIL

C.3 RESPONSE FROM MID WESTERN REGIONAL COUNCIL

Community Consultation Plan

BERYL SOLAR FARM

MARCH 2017



Document Verification



Project Title:

CCP - Beryl Solar Farm

Project Number: 16-347

Project File Name: Beryl CCP V1

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
V1	10/11/16	Marilyn Purton	Jane Mills Jane Blomfield	Nick Graham-Higgs

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1 INTRODUCTION

1.1 COMMUNITY CONSULTATION PRINCIPLES

Best practice community consultation involves the community in all decision-making stages of a project. There is a role for the community from project conception, through the assessment process and on to project development. Effective community consultation has three important functions:

1. It facilitates deeper understanding of issues and decisions required for the project;
2. It improves the quality of decisions made for the project;
3. It allows people to be involved in decisions that affect their lives.

Important community engagement principles for a project include:

- Openness – combats assumptions and misinformation.
- Inclusiveness - consultation should be diverse and representative, not responding only to the most vocal stakeholders.
- Effective communication – requiring trust between parties and tools appropriate to the task.
- A communication strategy – clarity about what is being undertaken:
 - Inform - one-way communication to deliver information about the project.
 - Consult - two-way communication to seek input into the project.
 - Collaborate and involve – seek participation in elements of the project design and implementation.
- Early rather than late – to maximise engagement opportunities.
- Accountability – the process should be monitored and evaluated to ensure its aims are being achieved.

1.2 AIM OF THIS PLAN

This Community Consultation Plan (CCP) has been developed for the Beryl Solar Farm.

The aim of the plan is to:

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

The plan identifies:

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

Effective engagement will require an understanding of community stakeholders and prioritisation of potential impacts. It also relies on the community understanding the project and specific issues of interest to them, to contribute effectively. The focus of the consultation plan will be on providing this understanding and engagement.

1.3 STRUCTURE

The structure of this plan is:

1. Proposal overview
2. Identification of community stakeholders for the project
3. Issue management – what specific issues need consideration
4. Project based activities – what vehicles will be utilised in the consultation process

1.4 IMPLEMENTATION AND REVISION OF THIS DOCUMENT

The plan has been developed to coincide with the early planning and assessment stages of the project.

If the project is approved, consultation will also be required to continue into the construction and operational phases of the project. These phases will require a new or updated plan, to reflect any changes to consultation objectives but also the increasing knowledge gained about the community.

1.5 RELEVANT GUIDELINES

This CCP has been prepared with reference to the following guidelines / references:

- *Establishing the social licence to operate large scale solar facilities in Australia: Insights from social research for industry*, Australian Renewable Energy Agency (ARENA).
- *Beyond Public Meetings: Connecting community engagement with decision making*, Twyford Consulting 2007.

2 PROPOSAL OVERVIEW

The proposed solar farm would be located on Lot 20 DP 1173059, Lot 1 DP 1012926, Lot 1 DP 190927 and Lot 1 DP 1016556, Beryl .

The construction phase would include the installation of Photovoltaic modules (solar panels), mounted on steel frames over most of the site, as well as electrical conduits, inverters, access tracks, site office and perimeter fencing.

Access to the site would be off Beryl Road.

Additional electrical transmission infrastructure would be required to connect the solar panel infrastructure to an existing Beryl substation adjacent to the site.

To avoid duplication of information and errors as the proposal is developed, all detailed proposal information is contained within the Environmental Impact Statement and is not repeated here.

3 COMMUNITY PROFILE

Understanding the makeup and values of the community is essential to finding effective ways to reach the community as well as beginning to identify ways that the project may impact the community. This section provides a broad overview of the local government area, closest major town of Gulgong and the locality of Beryl.

3.1 MID-WESTERN REGIONAL LOCAL GOVERNMENT AREA

The Mid-Western Government area (LGA) had a population of 24,017 in 2014 (ABS 2016) and covers an area of approximately 9000 square kilometres (Mid-Western Regional Council 2015). The area's population has steadily been increasing from 23,020 recorded on the 2011 Census, an increase of almost 5% (ABS 2011a). The median age of the locality is 41 years of age; this is comparable to the Australian average of 37.3 (ABS 2016). The 2011 census records indicate that 3.9% of the population is from Aboriginal and Torres Strait Islander origin and 14.5% of the population was born overseas (ABS 2011a).

The main local industries for employment within the Mid-Western LGA is mining (13.8% in 2011a), followed by the retail trade at 11.3%; agriculture, forestry and fishing industry with 9.5% employed and health care and social assistance at 9.2% (ABS 2011a). The region is also renowned for its vineyards, wineries, wilderness areas and historic villages (Mid-Western Regional Council 2015, Destination NSW 2016a). The regional council is anticipating significant population growth in the area over the next five years due to the recent and ongoing expansions in the coal mining industry (Mid-Western Regional Council 2015).

The Mid-Western Regional LGA is in the central west of NSW, approximately 300kms from Sydney (Mid-Western Regional Council 2015). Towns in the LGA include Mudgee, Gulgong, Rylstone and Kandos (Destinations NSW 2016a).

The Mid-Western Regional Council (MWRC) states that advantages to living in this region include:

- A diverse and growing economic base;
- centrally located to regional centres;
- strong transport links (air and bus services daily);
- a skilled workforce,
- strong business service sector
- thriving tourism and arts/cultural industries (Mid-Western Regional Council 2015).

Some of the community facilities and economic features of the Mid-Western regional LGA include:

- Health facilities include: Mudgee Hospital, Rylstone Hospital, The Carmel Croan Community centre (this includes community transport, meals on wheels, respite care and cultural services), doctors, aged care facilities, (Mid-Western Regional Council 2015).
- Recreation and sporting facilities include: Glen Willow Regional Sports Complex, various showgrounds, three swimming pools, pony clubs, horse clubs, poultry club, woodworkers group, pottery groups and various art and craft groups (Mid-Western Regional Council 2015).
- Community facilities include: Mudgee Town Hall, three libraries, various halls and community buildings, airport (five km from Mudgee), rotary club and aero club (Mid-Western Regional Council 2015).
- The MWRC maintains 55 parks, gardens and sporting fields, 11 cemeteries, numerous playgrounds, parks and reserves ((Mid-Western Regional Council 2015).

- Active business organisations in the LGA include: Cudgegong business group, Gulgong Chamber of Commerce, Mudgee Chamber of Commerce, Mudgee Fine Foods Inc. and Mudgee grape growers' association Inc. (Mid-Western Regional Council 2015).
- Events in the region include the Rylstone Street Feast, Mudgee fine foods farmers market (monthly), Black tie at Burnbrae and the Huntington Estate Music festival (Destinations NSW 2016a).
- Environmental attractions include: Putta Bucca Wetlands, Capertee National Park, Wollemi National Park, Coorongoora National Park, Munghorn Cap Nature Reserve, Goulburn River National Park and Coolah Tops National Park, Ferntree Gully and Windamere Dam (Destinations NSW 2016a).

3.1.1 Gulgong

Gulgong is the closest large township, to the locality of Beryl, and is 6 km from the proposed site and approximately 350km from Sydney (Destinations NSW 2016b). The population of Gulgong was 2,383 in the 2011 Census (ABS 2011b). This comprises of a high 4.9% Aboriginal and Torres Strait Islander people, compared to the Australian average of 2.5% (ABS 2011b). The median age is 39, comparable to the Australian median of 37 (ABS 2011b). In Gulgong 12.8% of the population was born overseas, with the most common countries of birth being England (2.2%) or New Zealand (0.8%) (ABS 2011b).

The main local industry for employment in Gulgong is the coal mining industry (ABS 2011b). The proposed solar farm would provide opportunity of employment diversification as NSW moves towards a carbon neutral economy by the year 2050. Full time employment, recorded at the 2011 census, was 56.6%, this is comparative to the Australian rate of the time of 59.7%; with the unemployment rate high at 6.5%, compared to the Australian average of 5.6% (ABS 2011b). The median age for full time employment in Gulgong is 42 (ABS 2011b). The main industries are coal mining at 16.6%; followed by school education at 6.6%, supermarket and grocery stores 4.2% and sheep, beef cattle and grain farming at 3.3% (ABS 2011b). The median weekly income for residents of Gulgong was \$412 in 2011 (ABS 2011b).

This area of rural NSW is rich in European heritage and was settled in the 1860's during the Australian gold rush (Destination NSW 2016b). Gulgong was the first town to be featured on the original ten-dollar note (Destinations NSW 2016b). There are currently 130 buildings, within the town of Gulgong, listed under National Trust classification many still have the original verandahs and iron-lace balconies (Destinations NSW 2016b). Today the town is renowned for its arts and crafts and is world famous for its clay/pottery (Mid-Western regional council 2015, Destinations NSW 2016b).

- Tourism attractions include the Pioneer Museum, Henry Lawson centre, The Prince of Wales opera house (oldest operating opera house in the southern hemisphere) and the Gulgong Symbol trail; a secret code of symbols used in the gold rush to communicate the 'lie of the land' (Destinations NSW 2016b).
- Events include: the annual Henry Lawson Festival, Gulgong Folk Festival; celebrating 30 years in 2016, Gulgong Gold Chinese festival, Community fun day and camel races, Gulgong annual eisteddfod and the triannual clay festival - Clay Gulgong (Destinations NSW 2016).
- Recreational and sporting facilities include: Billy Dunn Oval, Victoria Oval, swimming pool, turf club, golf club and dance academy (Destinations NSW 2016b).
- Community facilities and clubs include: a memorial hall, branch library, cemetery, Gulgong musical and dramatic society (MADS), craft club, RSL club and youth council (Destinations NSW 2016b, Gulgong Chamber of Commerce 2016).

- Health services include: Wenonah lodge aged care facility and Gulgong health services (Service NSW 2016).
- Services include: banks, supermarkets, post office, real estate, trades people, machinery and farming services, accommodation, cafes and restaurants, fire station (Gulgong Chamber of Commerce 2016).
- Education facilities include: Gulgong pre-school, Gulgong public school, Gulgong high School, All Hallows Catholic Primary School and the Red Hill environmental Centre (Service NSW 2016).
- Churches – St Luke’s Anglican, St John’s Catholic, Uniting and Presbyterian (Destinations NSW 2016a).

Beryl

Beryl is a small rural locality approximately 9 km North-West from Gulgong. The proposed solar farm is approximately 4 km South of Beryl. The locality of Beryl is accessed from the Castlereagh Highway; it’s residents are sprawled out on large rural properties. There was no data available from the Australian Bureau of Statistics (ABS) on population, businesses or number of dwellings in the Beryl locality.

4 STAKEHOLDER GROUPS AND CONSULTATION STRATEGIES

It is important to identify all key stakeholder groups and relevant characteristics and tailor engagement strategies to suit each group. Different levels of engagement suit varying degrees of potential impacts in the community. Where impacts are less significant, for example, the International Association for Public Participation (IAP2) consultation spectrum suggests approaches such as 'Inform' and 'Consult'. Greater impacts on communities require approaches such as 'Involve', 'Collaborate' and 'Empower'. Appropriate strategies are set out below for each stakeholder group.

Stakeholder group	Defining characteristics	Consultation strategies
1. Adjacent neighbours	Neighbours adjacent to the project and those who may be directly affected, for example: those with a view of infrastructure, noise or vibration from haulage route or construction activities. Twenty-seven residences are located within 1km of the site and may experience direct impacts.	Meet first – Inform and consult Understanding the values and potential impacts to this group is highly important. Face to face consultation and direct feedback is required. Mitigation strategies may require changes to the project or the development of specific plans of management i.e. screening visual impact. All consultation should be documented.
2. Near Neighbours (Residents of Beryl locality)	Neighbours to the project and those who may be directly affected, for example: those with a view of infrastructure, noise or vibration from haulage route or construction activities. Being a major development close to a small settlement, direct impacts may be of great interest to residents and businesses. This is a large development with potential to define the locality in many ways. Approximately 60 residences are located within 2km of the site and may experience direct impacts.	Inform and Consult Understanding the values and potential impacts to this group is highly important. It will assist the assessment process and development of appropriate mitigation strategies. Face to face consultation and direct feedback is required. All consultation should be documented.

Stakeholder group	Defining characteristics	Consultation strategies
3. Local Businesses	One business is located within 2km of the site. Businesses within the locality of Gulgong may experience direct impacts.	Inform and Consult Understanding the values of this group will assist the assessment process and development of appropriate mitigation strategies. Direct contact and direct feedback is required. Potential opportunity to distribute project information and understand community sentiment. All consultation should be documented.
4. Special interest groups	Special interest groups, for example, recreational groups, sporting groups. A number were identified specific to this proposal. These include: • Turf club • Pony club • Horse club • Aero club • Golf Club	Inform and Consult These should be directly contacted. Specific information or assessment may be required to understand and mitigate impacts for these groups. An avenue to provide feedback or ask questions should be provided.
5. Representative bodies	Representatives of groups such as: • Gulgong Chamber of Commerce • Mid-Western Regional Council	Inform and Consult Specific information may be required for this group. An avenue to receive information and provide specific feedback or ask questions should be provided.
6. Media	Outlets to ensure a clear message is delivered: Local radio, television, newspapers.	Inform A contact should be provided to this group, for further information if required.

Stakeholder group	Defining characteristics	Consultation strategies
7. Broader community	The town of Gulgong is approximately 6 km from the proposed solar farm. There are numerous residences and business located in and around the township. While direct impacts are unlikely, the project would be a large new development for the broader community.	Inform Newsletters, advertisements, website information used to relay information about the project. A contact should be provided to this group, for further information if required.
8. Mid-Western shire	The regions history has been rich in the mining industry. The proposed solar farm would provide an economic stimulus for the area, during construction, and would be a positive step forward in the renewable energy sector. While direct impacts are unlikely, the project would be a large new development for the broader community.	Inform Advertisements and website information used to relay information about the project. A contact should be provided to this group, for further information if required. Direct contact with specific representative groups (Chamber of Commerce).

5 ISSUE MANAGEMENT

A set of project-specific issues and risks to maximising community engagement in the project have been identified below. These issues pose potential risks to the effective identification and mitigation of impacts important to the community. Mitigation strategies have been developed below, specific to the identified issues. These have been incorporated into the Project-based Activities, in Section 6.

Issue	Risks	Mitigation strategies
The project may define / overwhelm the locality	This may polarise the community. They may not feel that the project reflects their values. The scale of the project may overwhelm the existing local character.	Education material about the role of solar energy in the country's energy mix, the technology and its impacts. Early dissemination of information about the project and its specific justification and benefits, particularly with reference to developing new income streams on agricultural land and the ability to restore the land capability after decommissioning. Seek direct input into how the project may reflect the communities 'personality' and values and how the benefits of the project may be spread to the local community. Clear communication of key environmental impacts and mitigation strategies of the project. Offer direct contact to project manager.
Misinformation: Word of mouth / rumours first source of information	Feel left out, disengaged, misinformed.	Direct communication early to local community – adjacent landowners first, near neighbours second, then the wider community.

Issue	Risks	Mitigation strategies
Lack of support for project	Lack of interest, leading to low levels of public support. Unaddressed concerns may generate opponents of this project. Large proportion of jobs in local area are reliant on coal mining may influence support of development of renewable infrastructure.	Early dissemination of information about the project and its justification and project benefits. Clear communication of key environmental impacts and mitigation strategies. Make participation easy – to ensure all concerns are addressed. Be creative – seek support for renewable project that demonstrates how benefits are felt at the local level.
The approvals process can be complex.	Perception that the process is too difficult to become involved in. Suspicion that input will not be valued.	Clearly illustrate approvals process. Clearly define opportunities for community input including what is required and when it is required. Communicate back, identifying where input has been used. Reinforce this at each relevant stage for community input – pre lodgement, during public exhibition etc.
Distrust in environmental assessment process.	Distrust of impact identification and mitigation strategies.	Establish credentials of assessment team and First Solar. Present these in the EIS and in newsletters etc. Make participation easy – create opportunities to discuss issues with the team.
Fear of unknown / complex information	Exaggerated fears / misunderstanding of information.	Layman explanations of issues. Offer to follow up – one on one, or special interest meetings.

Issue	Risks	Mitigation strategies
Relationship with community	Risk that during the long approval and assessment process, the community will lose enthusiasm, become disengaged or negative.	Milestone events should be identified early and celebrated.
Representative	Risk of biased consultation, serving only the most vocal community members. Sections of the community may be “overpowered” and may be marginalised.	Ensure community is engaged in a forum that minimises risk of debate being side tracked. Follow up with smaller groups where required. Use established social (and media) channels in dissemination of materials, i.e. sport clubs.
Unified message	Differing messages may create confusion and mistrust.	Limit points of contact. Have message clearly set out for use, rather than reinventing it for each consultation activity.
Unequal distribution of benefits	Residents close to the development are likely to feel more strongly.	Identification of stakeholder groups should reflect differences in impacts.

6 PROJECT BASED ACTIVITIES

The following table outlines the different project stages and associated community consultation objectives and activities, in chronological order. The stages include:

- Decision to proceed with early investigations, proposal development
- Receipt of SEARs
- Detailed assessment and proposal development
- EIS on public exhibition, submissions reporting
- Approval determination
- Construction contract award
- Construction commences
- Operation commences
- Decommissioning commences

6.1 MILESTONES

Mile stone events should be celebrated, and used as an opportunity to keep the community on board. Milestones can include:

1. Announce project – notify near residents first, follow up with consistent information
2. Receipt of SEARs
3. Early studies update – meet the community face to face
4. EIS submitted – explain avenues for input
5. Submissions Report submitted – explain avenues for input
6. Approval – celebrate in a way that involves the community
7. Construction contractors awarded - opportunity for local employment
8. Construction commences - sod turning ceremony
9. Operation commences – public open day

6.2 THROUGHOUT PROCESS

Relevant to all activities:

- One person would remain key spokesperson, this would be Tom Best, First Solar (Australia) Pty Ltd Project Manager, to:
 - Limit points of contact, ensuring a clear message and no contradictions in terminology or project information.
 - Retain personal direct relationship with the community, identifiable face for the project.
- Feedback would be sought using a standard form where possible, allowing this information to inform the assessment (example provided in Appendix A). This form would be made available during meetings and on the project website.

Stakeholder group	Issue	Consultation objective	Community engagement activities	Format
Decision to proceed with early investigations, proposal development, and receipt of SEARs				
Adjacent landowners	May define locality Lack of support Other concerns	Inform and engage	Early dissemination of information about solar development generally. Early dissemination of information about the project and its justification and benefits. Seek direct input to include in assessment approach and development of proposal.	Face to face meeting Include feedback form and encourage direct contact with Project Manager.
Council	Misinformation Lack of support	Inform and engage	Ensure that the information is available Build relationship to understand their key issues	Face to face meeting
Near neighbours (Beryl locality)	May define locality Lack of support Unequal distribution of benefits Other concerns	Inform and engage	Early dissemination of information about solar development generally. Early dissemination of information about the project and its justification and benefits. Seek direct input to include in assessment approach and development of proposal, regarding: • General feeling toward solar development • Specific feeling toward the Beryl solar proposal • Specific concerns • Ways the project may reflect the communities 'personality' and values. • How the benefits of the project may be spread to the local community? Offer to meet Face to Face with Project Manager.	Newsletter 1 / factsheet drop Include feedback form and opportunity for follow up call by Project Manager.

Stakeholder group	Issue	Consultation objective	Community engagement activities	Format
	Distrust in environmental assessment process	Inform	Ensure the timelines and the stages for community input are clearly documented - use graphics and indicate where we are now at for the assessment. Make information on the project team and assessment team available	Factsheet to include graphic showing stage of the process and opportunities for input Website, links to other projects and accreditations
Local business owners	Misinformation	Inform and engage	Ensure that the information is available to the local community first. As well as letter drop, meet local business owners and offer to leave information with them to distribute. Build relationship with these owners and staff as they may assist to 'get the word out'.	Face to face meeting with local business owners
Broader community	Distrust in environmental assessment process. The approvals process can be complex.	Inform	Preliminary project announcement, including stage of assessment, likely timelines, ways in which the community can be involved.	Media release, link to website
Detailed assessment and proposal development				
Adjacent landowners	May define locality Lack of support	Inform and engage	Feed information into the final assessment to ensure all their issues have been identified and addressed by the project.	Face to face meeting / Phone call

Stakeholder group	Issue	Consultation objective	Community engagement activities	Format
Near neighbours	May define locality Lack of support	Inform and engage	Identify ways the community can participate in the project and seek input on these: - Vegetation screen planting, adopt a tree (one for project, one for landowner?) - Signage / logo for solar farm (will be prominent part of the town?) - Other renewable or energy saving programs that the proponent could support?	Competitions, Adopt a tree, other programs
Near neighbours	Fear of unknown, complex information	Inform and engage	Identify ways simplify and present the key information, seek feedback.	Open house – specialist and project information
Broader community	Unequal distribution of benefits Risk of biased consultation, serving only the most vocal community members.	Consult and inform	Feed information into the final assessment to ensure all community issues have been identified and addressed by the project, differentiating between stakeholder groups	Newsletter 2, Website
EIS on public exhibition, submissions reporting				
Adjacent landowners	Relationship with landowners and community	Inform and engage	Reinforce stage in the project and ways to have input	Face to face meeting / Phone call
Near neighbours	Relationship with community	Inform and engage	Celebrate milestone, reinforce stage in the project and ways to have input	Newsletter 3

Stakeholder group	Issue	Consultation objective	Community engagement activities	Format
Near neighbours	Fear of unknown, complex information	Inform and engage	Special interest groups – address specifically in meeting.	Meeting with group, if required.
Approval determination				
Near neighbours	Relationship with community	Inform and engage	Celebrate milestone, reinforce stage in the project and ways to have input. Thank the community for their support Results of competition: signage / logo?	Newsletter 4
Broader community	Differing messages may create confusion and mistrust. The approvals process can be complex.	Inform	Keep project information up to date. Provide link to relevant information including feedback form. Provide a contact for further information.	Media release Website
Construction contract award				
Near neighbours	Relationship with community	Inform and engage	Celebrate milestone, reinforce stage in the project and ways to have input. What opportunities for local employment?	Newsletter 5
Construction commences				
Near neighbours	Relationship with community	Inform and engage	Celebrate milestone, reinforce stage in the project and ways to have input. Notify about impacts that can be expected, avenues to complain, for more information.	Newsletter 6 Event: sod turning

Stakeholder group	Issue	Consultation objective	Community engagement activities	Format
Broader community	Differing messages may create confusion and mistrust.	Inform	Keep project information up to date Provide link to relevant information including feedback form Provide a contact for further information	Website
Operation commences				
Near neighbours	Relationship with community	Inform and engage	Celebrate milestone, reinforce stage in the project and ways to have input Notify about impacts that can be expected, avenues to complain, for more information.	Newsletter 7 Event: public open day
Broader community	Differing messages may create confusion and mistrust.	Inform	Keep project information up to date Provide link to relevant information including feedback form Provide a contact for further information	Website
Decommissioning commences				
Near neighbours	Relationship with community	Inform and engage	Reinforce stage in the project and ways to have input Notify about impacts that can be expected, avenues to complain, for more information.	Newsletter 8
Broader community	Differing messages may create confusion and mistrust.	Inform	Keep project information up to date Provide link to relevant information including feedback form Provide a contact for further information	Website

7 MONITORING AND EVALUATION

To ensure this plan is effective during the implementation of activities, and adapts as required to new information, the following review actions will be undertaken alongside implementation activities:

- Appoint and maintain a consultation manager for the project to implement activities and review this plan regularly.
- Keep an accurate record of all feedback from consultation activities and all correspondence with the community.
- Monitor regularly and respond promptly to email and phone queries.
- Are the activities reaching a diverse and representative section of the community; do new activities need to be implemented?
- Has relevant information been passed back to:
 - Project developers
 - Assessment staff.

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APPENDIX A COMMUNITY FEEDBACK FORM

COMMUNITY FEEDBACK FORM: BERYL SOLAR FARM

Your feedback is important to develop a solar farm project that best suits the local area and community.

Your comments ensure local feedback is understood by the developers and assessment team.

Please send your feedback to (or seek further information directly, from):

Tom Best, First Solar Australia Pty Ltd
Level 3 16 Spring Street, Sydney, NSW 2000
berylsolarfarm@firstsolar.com

For further information about the project, please see the project website at berylsolarfarm.com.au

Your contact details: (this information will be treated as confidential)

Name: Address: Ph:

Circle which best describes how far you live from the proposed Beryl Solar Farm:

<1 km 1-2 km 2-5 km >5 kilometres Not a member of the local community

Tell us what you value about the local area:

What do you value most about the local area?

.....
.....
.....
.....

What views or landscape characteristics in the region and local area are important to you?

.....
.....
.....
.....

What do you like about solar farms?

.....
.....
.....
.....

Do you have any concerns about solar farms?

.....
.....
.....
.....

Do you have any specific concerns regarding the proposed solar farm at Beryl?

.....
.....
.....
.....

2 March 2017

Mr Brad Cam
The General Manager
Mid-Western Regional Council
PO Box 156
MUDGEES NSW 2850

Attention Mr Lindsay – Manager Statutory Planning

Email to: council@midwestern.nsw.gov.au
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www.nghenvironmental.com.au

Dear Sir,

RE: PROPOSED SOLAR FARM, BERYL ROAD BERYL - SUBDIVISION OF LAND

I refer to recent consultation with Council's Manager of Statutory Planning regarding the subdivision of land required to facilitate the operation of a proposed solar farm development at Beryl. The development proposal is declared a State Significant Development (SSD 8183). This development proposal was presented to Council by a representative of First Solar at its meeting held 15 February 2017.

NGH Environmental act on behalf of First Solar (Australia) Pty Ltd, the proponent for the proposed solar farm. We are presently preparing an Environmental Impact Assessment in accordance with the Environmental Assessment Requirements issued on 25/01/2017.

During the preparation of the scope of works it was understood that the proposal involved a 'boundary adjustment' that would be dealt with under the provisions of the State Environmental Planning Policy Exempt and Complying Code or as a development application at the local level. However, it has since been established that the boundary adjustment is technically defined as a subdivision due to the proposed arrangement of land and other determining factors.

Following review of the local planning provisions and subsequent consultation with the Mid-Western Regional Council, it was advised that there are no provisions within the Mid-Western Regional Council Local Environmental Plan (LEP) 2012 or State Environmental Planning Policy Infrastructure (ISEPP) that would permit approval of the subdivision at the local level.

Subsequently, we sought the direction of the Department, being the consent authority for the proposed development, given the State Environmental Planning Policy (State and Regional Development) 2011 and the *Environmental Planning and Assessment Act 1979* could permit the land subdivision if assessed as part of the overall state significant development.

The Department advised that they could include the subdivision in their assessment however, requested evidence from the Mid-Western Regional Council that there would be no objection to the proposal during the notification period. It was also advised that the Department required evidence of Council's concurrence prior to the assessment of the proposed development.

In this regard, the following information is provided for Council's consideration.

The proposal

The proposed development includes the construction and operation of a photovoltaic solar generation facility with an estimated capacity of 100 Megawatts of electricity generation that would supply electricity to the national electricity grid. Ancillary components include infrastructure and grid connection. The development is declared as a State Significant Development due to the proposed capacity of electrical generation.

The proposal site is located approximately 6km west of Gulgong in the locality of Beryl. The site is bound by Beryl Road to the north, Spring Ridge Road to the southwest and Perseverance Lane to the southeast. The land contains one dwelling and straddles a disused rail line.

The site would be accessed directly off Beryl Road, on the northern property boundary, adjacent to the existing Beryl Substation.

The subject land is shown in Figure 1 below.

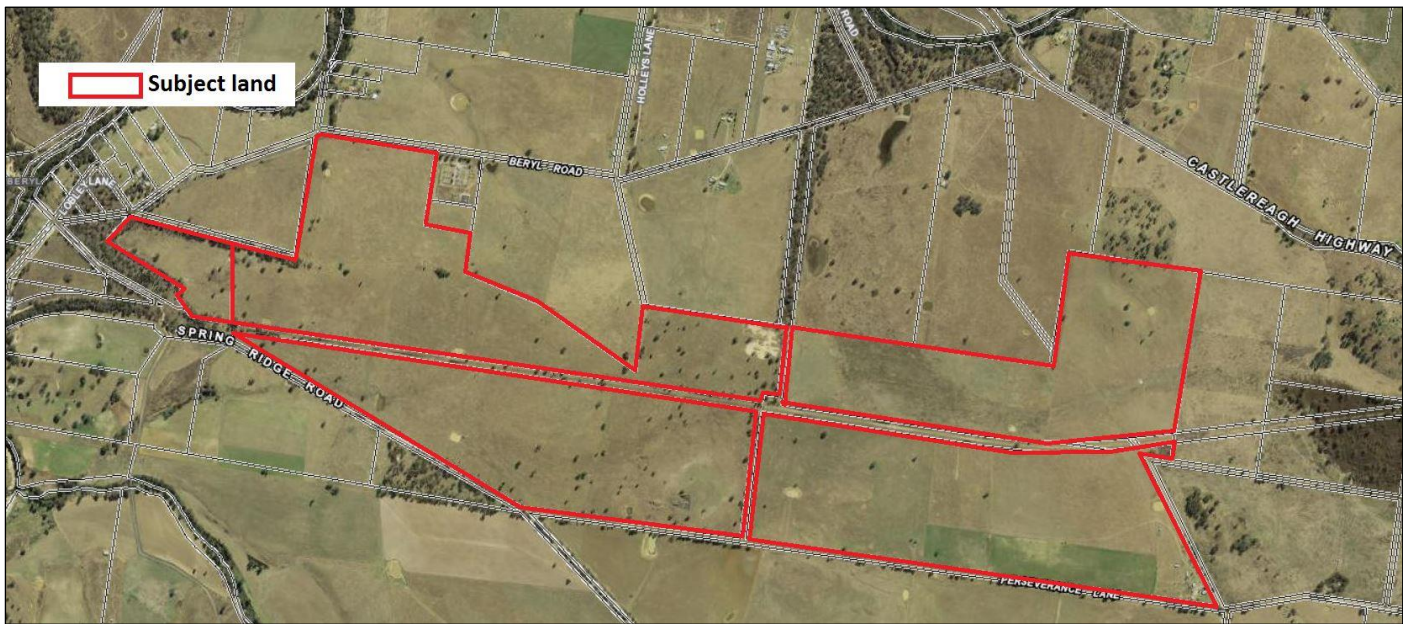


Figure 1: Subject land

Existing environment

The subject land comprises two allotments with the legal description of Lot 1 DP 1012926 and Lot 20 DP 1173059, Beryl Road, Beryl. A map of the subject land and its current environment is provided in Figure 2 below and described in Table 1.

Table 1: Summary of existing environment

Lot & DP	Area (approx)	Zone	Min lot size	
Lot 1 DP 1012926	10 hectares	RU1 Primary Production	100 hectares	Vacant with dwelling entitlement (M271/00)
Lot 20 DP 1173059	290 hectares	RU1 Primary Production R5 Large Lot Residential	100 hectares 12 hectares	Existing dwelling

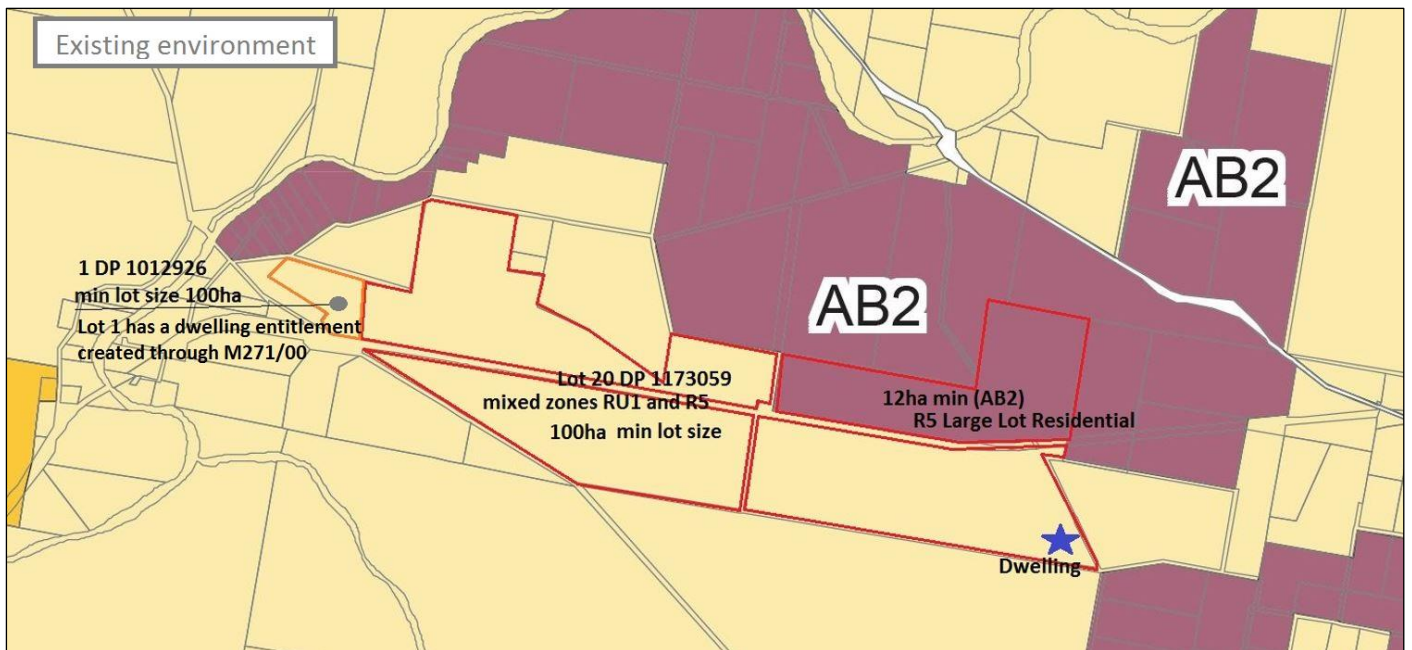


Figure 2: Existing Environment

Proposed modified environment

It is proposed to:

- Consolidate land contained within Lot 1 with Lot 20. This land will contain the proposed solar farm development, and
- Excise the existing dwelling and surplus land with an area of approximately 12ha from Lot 20. The dwelling will remain in the ownership of the current landowners and will not be associated with the solar farm development.

The proposed arrangement is shown below in Figure 3 below.

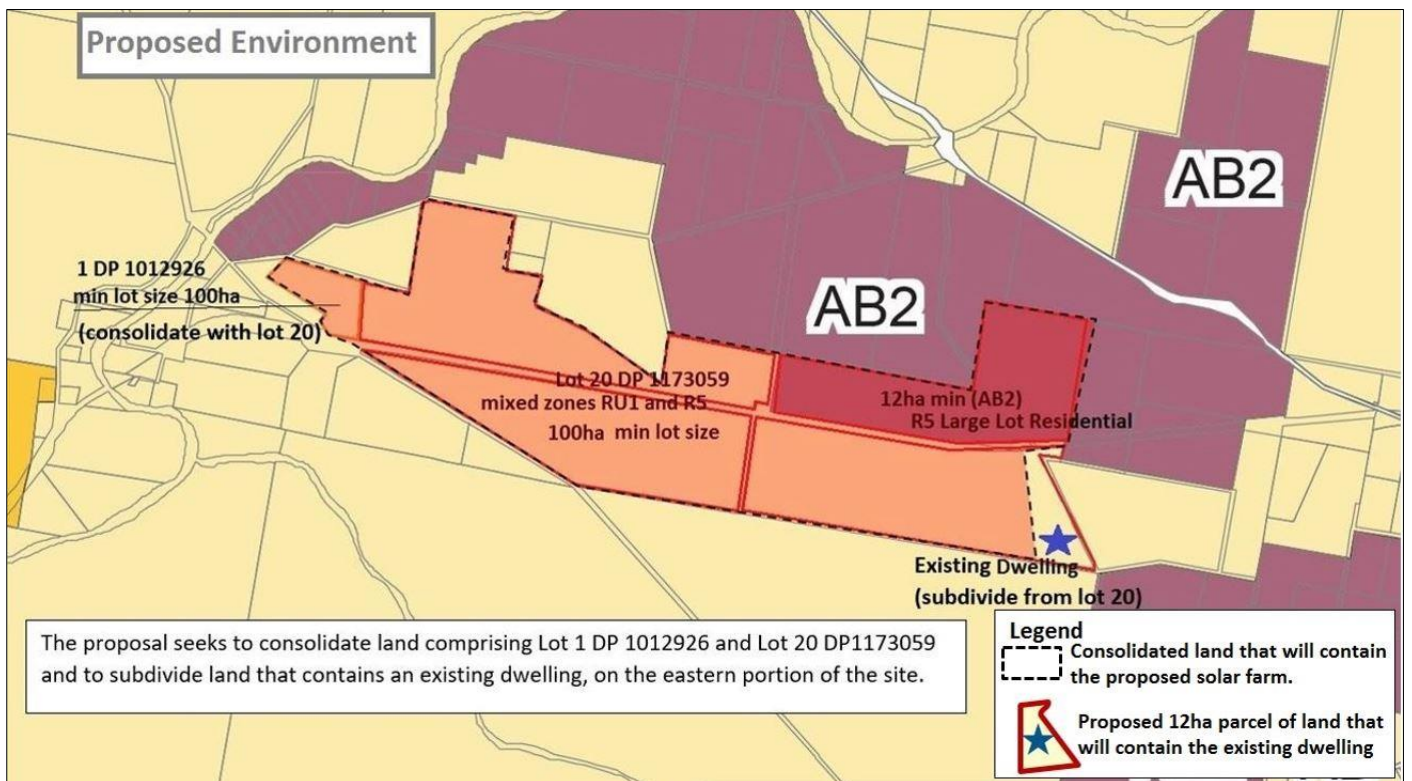


Figure 3: Proposed modified environment

The proposed solar farm development is reliant upon the ability to subdivide the surplus agricultural land and dwelling from the site as shown in Figure 3. In principle, the proposed subdivision would result in a land swap within the RU1 Primary Production zone. The dwelling entitlement attached to Lot 1 would be surrendered once the land is consolidated with the greater part of Lot 20, and the existing dwelling would continue to operate on a smaller parcel of land. Agricultural activities associated with the existing dwelling would also continue on a smaller scale. The proposed subdivision would not result in any change or impact to the existing environment or increase in the dwelling potential of the land.

Planning Framework

Limitations of the Mid-Western Local Environmental Plan 2012

The development proposal seeks approval to excise the existing dwelling and an area of 12 hectares, surplus to the needs of the solar farm, so it can be retained by the current landowner.

Clause 4.3(3) of the Mid-Western Local Environmental Plan (LEP) 2012 states that *the size of any lot resulting from a subdivision of land to which this clause applies is not to be less than the minimum size shown on the [Lot Size Map](#) in relation to that land.*

With respect to the subject land, which is zoned RU1 Primary Production, the minimum lot size shown on the Lot Size Map is 100ha. Therefore, the proposed subdivision is under the prescribed minimum lot size and not permitted under the provisions of the Plan. Other avenues under the Plan were explored, however the LEP2012 does not permit the creation of an undersized lot for the purpose of a dwelling.

Justification for the proposal

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

Clause 8(2) of the SEPP State & Regional Development 2011 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 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.

In addition, Section 89E(3) of the *Environmental Planning and Assessment Act 1979* states “development consent may be granted despite the development being partly prohibited by an environmental planning instrument”. Consultation with the Department confirmed that the intent of the section means that even if the subdivision is prohibited by the LEP, development consent may still be granted.

State Environmental Planning Policy (Rural Lands) 2008

Planning Principles

Consideration has been given to the Rural Planning Principles, which are as follows:

- (a) *The promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,*
- (b) *Recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,*
- (c) *Recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,*
- (d) *In planning for rural lands, to balance the social, economic and environmental interests of the community,*

- (e) *The identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,*
- (f) *The provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,*
- (g) *The consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,*
- (h) *Ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.*

It is considered that the proposed subdivision is in accordance with the above rural planning principles given the proposal will continue to provide the opportunity for a rural lifestyle that contributes to the social welfare of the rural community whilst accommodating a productive, sustainable economic activity in the rural area.

This proposed development will facilitate the establishment of a state significant development that is consistent with the principles of strategy endorsed by of the Department of Planning and Environment.

Rural Subdivision Principles

The Rural Subdivision Principles are as follows:

- a) *The minimisation of rural land fragmentation,*
- b) *The minimisation of rural land use conflicts, particularly between residential land uses and other rural land uses,*
- c) *The consideration of the nature of existing agricultural holdings and the existing and planned future supply of rural residential land when considering lot sizes for rural lands,*
- d) *The consideration of the natural and physical constraints and opportunities of land,*
- e) *Ensuring that planning for dwelling opportunities takes account of those constraints.*

It is considered that the proposed subdivision would not generate any land use conflicts or have an impact on the nature of existing surrounding agricultural holdings given the proposal will not alter the existing environment. The proposed subdivision would facilitate the management of the solar farm while ensuring surplus land remains as productive agricultural land.

Furthermore, the proposed subdivision would prevent the potential fragmentation of resource lands that may arise from subdivision should the proposed solar farm not proceed. It is estimated that a total of 8 dwellings could potentially be created under clause 4.2 Rural subdivision of the LEP 2012 given the existing zoning and minimum lot sizes applicable to the subject land.

The proposed subdivision satisfies the subdivision principles of this clause.

Clause 10 – Matters to be considered in determining development applications for rural subdivisions or rural dwellings

Clause 10 of the Rural Lands SEPP lists the following matters to be taken into account when determining a rural subdivision:

- (a) *The existing uses and approved uses of land in the vicinity of the development,*
- (b) *Whether or not the development is likely to have a significant impact on land uses that, in the opinion of the consent authority, are likely to be preferred and the predominant land uses in the vicinity of the development,*
- (c) *Whether or not the development is likely to be incompatible with a use referred to in paragraph (a) or (b),*
- (d) *If the land is not situated within a rural residential zone, whether or not the development is likely to be incompatible with a use on land within an adjoining rural residential zone,*
- (e) *Any measures proposed by the applicant to avoid or minimise any incompatibility referred to in paragraph (c) or (d).*

In consideration of the above matters the proposed subdivision would not have an impact on surrounding land uses, would not be incompatible with a preferred land use and would facilitate the management of an approved land use on the subject land. The proposed subdivision satisfies the requirements of this clause.

Mid-Western Local Environmental Plan 2012

General Aims

The aims of the Mid-Western Local Environmental Plan 2012, listed in clause 1.2 are as follows:

(1) This Plan aims to make local environmental planning provisions for land in Mid-Western Regional in accordance with the relevant standard environmental planning instrument under section 33A of the Act.

(2) The particular aims of this Plan are as follows:

- (a) to promote growth and provide for a range of living opportunities throughout Mid-Western Regional,*
- (b) to encourage the proper management, development and conservation of resources within Mid-Western Regional by protecting, enhancing and conserving:*
 - (i) land of significance to agricultural production, and*
 - (ii) soil, water, minerals and other natural resources, and*
 - (iii) native plants and animals, and*
 - (iv) places and buildings of heritage significance, and*
 - (v) scenic values,*
- (c) to provide a secure future for agriculture through the protection of agricultural land capability and by maximising opportunities for sustainable rural and primary production pursuits,*
- (d) to foster a sustainable and vibrant economy that supports and celebrates the Mid-Western Regional's rural, natural and heritage attributes,*
- (e) to protect the settings of Mudgee, Gulgong, Kandos and Rylstone by:*
 - (i) managing the urban and rural interface, and*
 - (ii) preserving land that has been identified for future long- term urban development, and*
 - (iii) promoting urban and rural uses that minimise land use conflict and adverse impacts on amenity, and*
 - (iv) conserving the significant visual elements that contribute to the character of the towns, such as elevated land and the rural character of the main entry corridors into the towns,*
- (f) to match residential development opportunities with the availability of, and equity of access to, urban and community services and infrastructure,*
- (g) to promote development that minimises the impact of salinity on infrastructure, buildings and the landscape.*

It is considered that the proposed development is not inconsistent with any of the aims of the LEP.

Objectives of the RU1 Primary Production zone

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

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

It is considered that the proposed subdivision is not inconsistent with the objectives of the RU1 zone. The solar farm met the objective to encourage diversity in primary production. The proposed subdivision would not fragment resource lands, given there will be no alteration to the existing environment.

Without the subdivision, the residual agricultural land and dwelling would be taken away from agricultural production as it would be incorporated into the solar farm site. The subdivision would facilitate the management of the solar farm while ensuring surplus land remains as productive agricultural land.

We respectfully request that Council consider their position and provide a formal response at its earliest convenience. Should you have any questions please don't hesitate to contact me on 6923 1508 or lizzie.oj@nghenvironmental.com.au.

Yours sincerely,



Lizzie Olesen – Jensen
Principal Town Planner

NGH Environmental

DR: P22180

21 March 2017

Lizzie Olesen-Jensen
NGH Environmental
PO Box 5464
WAGGA WAGGA NSW 2650

Dear Lizzie,

PROPOSED BERYL SOLAR FARM – 276 PERSEVERANCE LANE, GULGONG

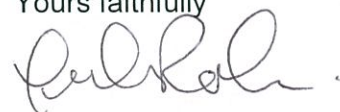
I refer to your letter dated 2 March 2017 concerning the proposed subdivision to support the development of the Beryl Solar Farm, which will be assessed as part of the overall State Significant Development process.

Council raises no objection to the proposed subdivision, even though it is not compliant with Council's LEP. The proposal will not result in any additional dwelling entitlements for the site and will essentially relocate the existing smaller Lot 1 to encompass the existing dwelling that sits upon the larger Lot 20.

It is requested that the direct access arrangements to Perseverance Lane for the dwelling be retained and that the location of the new lot boundaries ensure that all ancillary structures and septic systems in association with the dwelling are retained within the same lot with adequate setbacks.

If you need any further information or clarification in relation to the above, please contact Drew Roberts, Senior Town Planner on telephone (02) 6378 2850.

Yours faithfully



JULIE ROBERTSON
DIRECTOR DEVELOPMENT



Biodiversity Assessment Report

BERYL SOLAR FARM



MARCH 2017



Document Verification



Project Title: Beryl Solar Farm Biodiversity Assessment Report

Project Number: 16-347

Project File Name: Beryl Solar Farm_BAR_final v1

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
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ACRONYMS AND ABBREVIATIONS

BBAM	BioBanking Assessment Methodology
BCC	BioBanking Credit Calculator
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
Cwth	Commonwealth
EEC	Endangered Ecological Community
EIS	Environmental impact statement
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwth)</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
FBA	Framework Biodiversity Assessment
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
ha	Hectares
km	Kilometres
m	Metres
NSW	New South Wales
MW	Megawatt
OEH	(NSW) Office of Environment and Heritage (formerly DECCW and DECC)
PCTs	Plant Community Types
SEARs	Secretary Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
sp/spp	Species/multiple species
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>

EXECUTIVE SUMMARY

First Solar is planning for the construction and operation of a solar photovoltaic (PV) plant with an upper limit of 100MW and associated infrastructure within the Mid-Western Regional Council Local Government Area (LGA).

This Biodiversity Assessment Report (BAR) has been prepared by NGH Environmental on behalf of First Solar. The aim of this BAR is to address the requirements of the Framework for Biodiversity Assessment (FBA), developed for Major Projects, including requirements under the NSW Biodiversity Offsets Policy for Major Projects, and to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs). This BAR will be used to inform an Environmental Impact Assessment as part of an application for a Major Project under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The FBA underpins the Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to assess impacts and provide offset guidance for Major Projects. This report follows 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.

Field surveys of the study area identified one Endangered Ecological Community (EEC): White Box Yellow Box Blakely's Red Gum Grassy Woodland listed under the *Threatened Species Conservation Act 1995* (TSC Act). The project would result in the removal of 17.13 ha of this Box-Gum Woodland EEC. The Biobanking Credit Calculator (BCC) returned a total of 684 ecosystem credits for total removal of this vegetation.

Two threatened flora and one threatened fauna species were recorded within the study area. These included the Pine Donkey Orchid (*Diuris tricolor*), the Silky Swainson-pea (*Swainsona sericea*), and the Dusky Woodswallow (*Artamus cyanopterus*). The Pine Donkey Orchid and Silky Swainson-pea are both species credit species, however all individuals were recorded outside of the development footprint and were therefore considered not to be impacted by the proposed solar farm. Based on this, no species credit were generated by the BCC.

Consideration has been given to avoiding and minimising impacts to biodiversity. The layout has been revised twice and now excludes impacts on higher value Box-Gum Woodland EEC on the project site's western corner and most of the higher value EEC associated with the site's central laneway north-south. Residual impacts are mostly in low condition EEC. The low condition EEC has limited potential for regeneration after a long history of grazing; only one tree species is present in low abundance and this is not dominant species of the EEC. Groundcover vegetation is highly modified with a low percentage of native species.

Mitigation and management measures will be put in place to adequately address impacts associated with the project, both direct and indirect.

Regarding offsetting the impacts of this proposal it is noted that:

- The solar array panels will modify not remove vegetation through shading, however for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed.
- Areas existing within the project site that include better quality EEC at the western corner of the project site as well low condition EEC along the south-western boundary would be appropriate offset / revegetation sites. They would contribute to local landscape connectivity.

A Biodiversity Offset Strategy (BOS) is proposed to be developed in consultation with OEH to ensure the actual impacts of the development would be appropriately offset, in accordance with the FBA.

1 INTRODUCTION

First Solar (Australia) Pty Ltd proposes to develop a large scale solar farm at Beryl, NSW. The proposed solar farm would have an upper capacity of 100 Megawatt (MW) and would supply electricity to the national electricity grid.

The proposal is classified as State Significant Development (SSD) under the State and Regional Development State Environmental Planning Policy (SEPP) and is therefore a 'major project'. This Biodiversity Assessment Report (BAR) assesses the impacts of the proposed Beryl Solar Farm (the proposal) according to the NSW Framework for Biodiversity Assessment (FBA) as required by the Secretary's Environmental Assessment Requirements (SEARs) for the proposal (Appendix A).

As stipulated in Section 1.3 of the FBA, proponents must also identify and assess the impacts of the proposal on all nationally listed threatened species and threatened ecological communities that may be on the development site. The following sections present the detail required to adequately assess the impacts on biodiversity for the Beryl Solar Farm proposal according to the FBA.

Note that this report in its current form is provided as a preliminary assessment only, and is to be reviewed in the context of it providing information on the project feasibility with regards to offsetting requirements. The report is not, at this stage, to be considered a final Biodiversity Assessment Report.

1.1 THE PROPOSAL

1.1.1 Site location

The Beryl Solar Farm proposal site is located within the Beryl locality and is situated approximately five kilometres west of Gulgong and 80 kilometres (km) east of Dubbo, within the Mid-Western Local Government Area (LGA). The proposed solar farm would connect to an existing substation immediately adjacent to the site (Figure 1-1).

1.1.2 Site description

The Beryl Solar Farm proposal site would be located on Lot 20 DP 1173059 and Lot 1 DP 1012926, Beryl. The site is approximately 300 ha in size. It is agricultural land used for grazing and cropping purposes. A residence is located at the eastern end of the site.

The majority of the site is derived from a community of conservation significance: the Box Gum Woodland Endangered Ecological Community which is listed under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Cwth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The community remains present across some of the site in varying levels of condition (refer to Figure 3-5).

Two ephemeral waterways and eight wetlands/farm dams occur within the proposal site. One waterway, located within the south western area of site, is a tributary of the Cudgegong River. The waterway enters the Cudgegong River approximately 900 m south west of the site. The other waterway transverses the eastern area of the site, and is a tributary of the Wialdra Creek. The confluence of these two waterways is located approximately 1.2 km north of the site boundary.

Access to the site would be from Beryl Road which bounds part of the site to the north. The Castlereagh Highway, which intersects with Beryl Road 2.5 km from the proposed site entrance, would be the major transport route for haulage and site vehicles during construction and operation of the project.

Three existing electricity transmission lines pass through the proposal site mostly in a north-south direction. The proposal would require an additional transmission line to connect to the adjacent existing substation. The line would be overhead and would be a maximum of 300 m in length.

In the centre of the site, a partly raised embankment (a former railway line) intersects the proposal site in an east-west direction. The railway line infrastructure has been removed.

1.1.3 Proposal description

The Beryl Solar Farm proposal would comprise of the installation of a solar plant with an upper capacity of 100 MW that would supply electricity to the national electricity grid. First Solar (Australia) Pty Ltd proposes to purchase the land and develop around 206 ha of the 300 ha proposal site. An indicative development area is included in the site context map at Figure 1-1. A more precise development area would be informed by detailed site investigations and assessment during the planning and design stage.

Subdivision

Existing lot boundaries are shown in Figure 1-2. First Solar (Australia) Pty Ltd are proposing to purchase the land proposed for the development. As part of the project, a subdivision is proposed. This is described more fully in the EIS and is not part of / applicable to this biodiversity assessment.

The subdivision would result in the following:

1. Lot 20 DP1173059, currently 301.5 hectares, would be reduced to 12 hectares and would contain the existing residence.
2. Lot 1 DP 1012926, currently 10.05 hectares would be increased to 299.55 hectares. This lot would contain the solar farm infrastructure.

Solar farm infrastructure

The solar farm development would include the following elements:

- PV modules mounted on a fixed or tracking structure.
- Site office and maintenance building.
- An access track off Beryl Road
- Overhead cabling for grid connection to the adjacent substation (66kV)
- 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
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

The Beryl Solar Farm is expected to operate for around 30 years. The construction phase of the proposal is expected to take twelve months. After the initial 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.

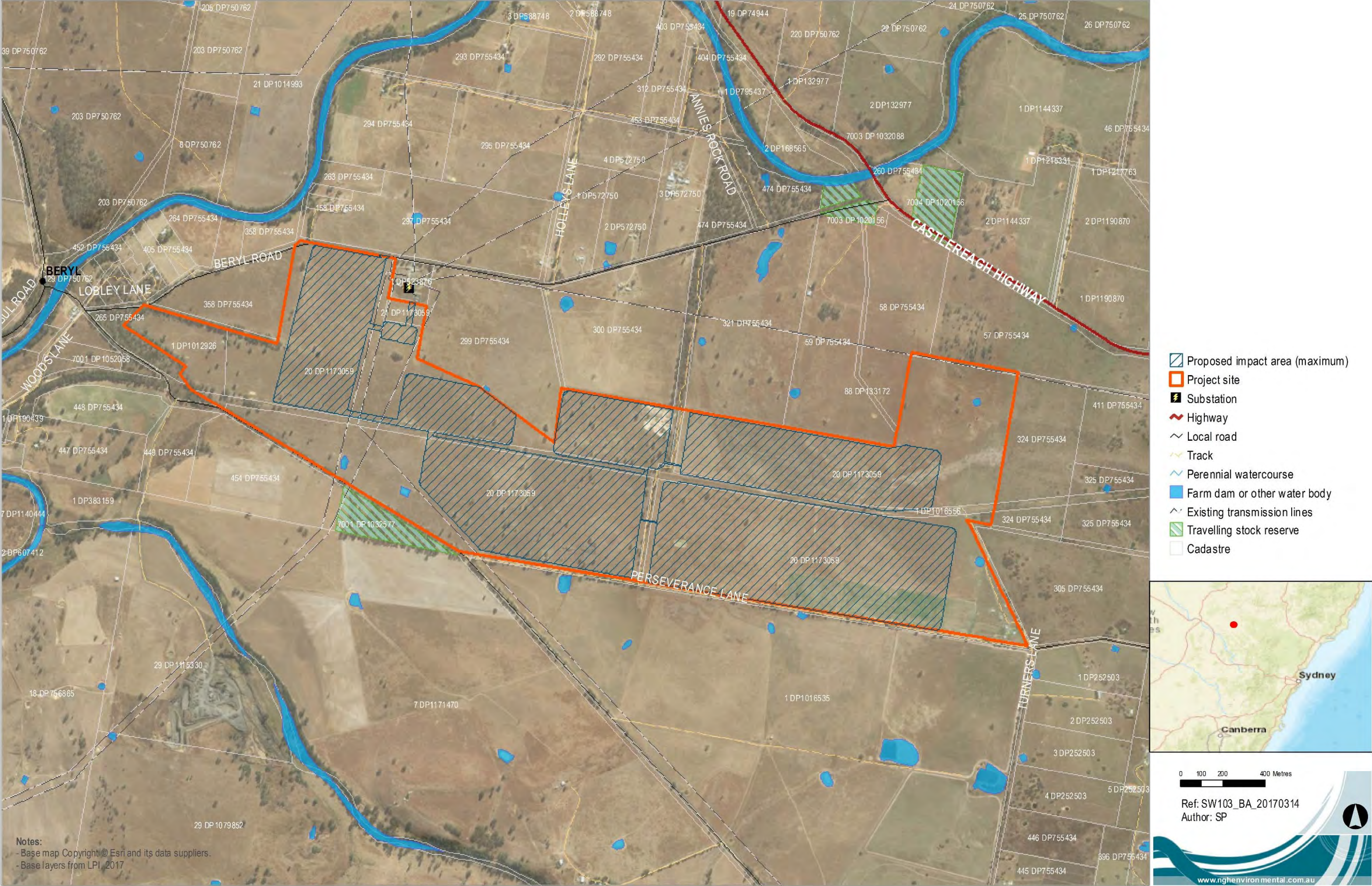


Figure 1-1 Site context

1.2 STUDY AIMS

This Biodiversity Assessment Report (BAR) has been prepared by NGH Environmental on behalf of First Solar (Australia) Pty Ltd.

The aim of this BAR is to address the requirements of the Framework for Biodiversity Assessment (FBA), developed for Major Projects, and to address the biodiversity matters raised in the Secretary's Environmental Assessment Requirements (SEARs) as well as the requirements of OEH and relevant guidance documents (refer Section 1.5). The SEAR's and OEH requirements are included below.

Secretary's Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues: Biodiversity – including an assessment of the likely biodiversity impacts of the development, (including but not limited to the impacts on Box Gum Woodland endangered ecological community, <i>Euphrasia arguta</i>, <i>Prasophyllum</i> sp. <i>Wybong</i>, Bluegrass (<i>Dichanthium setosum</i>), Pink Donkey Orchid (<i>Diuris tricolor</i>), Regent Honeyeater (<i>Anthochaera phrygia</i>), Swift Parrot (<i>Lathamus discolor</i>), and Silky Swainson-pea (<i>Swainsona sericea</i>)), having regard to the NSW <i>Biodiversity Offsets Policy for Major Projects</i>, and in accordance with the <i>Framework for Biodiversity Assessment</i>, unless otherwise agreed by the Department;	Sections 5 -8.

OEH Environmental Assessment Requirement	Where addressed
The EIS must address the following specific issues: Biodiversity – 1. Biodiversity impacts related to the proposed Beryl Solar Farm are to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the Threatened Species Conservation Act 1995. 2. Impacts on the species and ecological communities listed in Attachment B* will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment. *Species listed in Attachment B of the OEH Environmental Assessment Requirements include the Regent Honeyeater (<i>Anthochaera phrygia</i>), Bluegrass (<i>Dichanthium setosum</i>) and <i>Euphrasia arguta</i>.	Sections 5 -8.

1.3 REPORT STRUCTURE

This BAR follows the reporting requirements of Sections 1 and 2 of the FBA, including the following:

Section 1

- Identification of biodiversity values subject to the proposed major development (The Proposal) – Chapter 2 (Landscape Features), Chapter 3 (Native Vegetation), Chapter 4 (Threatened Species)

Section 2

- Impacts of the proposal on biodiversity as part of an application for approval to undertake a Major Proposal under the NSW planning legislation - Chapter 6 (Avoid and Minimise Impacts), Chapter 7 (Impact Summary).

1.4 DEFINITIONS

Beryl Solar Farm Project (the 'Project Site')

This refers to all infrastructure and activities required to construct, operate and decommission the proposed solar farm, and includes works outside of the main development site (described below), such as offsite grid connections.

The development site

This refers to the main site containing most operational infrastructure in addition to the broader area within which infrastructure would be located. This includes the solar array, operation and maintenance facilities, new substation, new cabling including proposed easement for the transmission line, temporary construction facilities, access tracks and parking. This area is approximately 206 hectares (Figure 1-2).

The development site is the impact area assessed in this BAR. For the impact assessment, GIS mapping calculated the areas within the site that would be affected by the array, access tracks and electricity easements, using the outer perimeter of infrastructure. It is noted that, being spaced to allow inter panel access, pile driven and mounted above the ground, the solar array modules will not require the removal of vegetation beneath them. However, as the panels will modify that vegetation through shading, for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed for simplicity and to provide a 'worst case' assessment.

Assessment circles

Two landscape assessment circles (the inner and outer assessment circles) have been used in the assessment. They are centred over the area of greatest impact and take into account both cover and condition of vegetation. The inner assessment circle: outer assessment circle ratio is 1:10, as per the requirements of the FBA, Appendix 4. The area of the inner and outer assessment circles for this assessment are 200 ha and 2,000 ha respectively.

1.5 SOURCES OF INFORMATION USED

The following information sources were used in the preparation of this report:

- Aerial maps, proposal layers and environmental layers provided by First Solar (Australia) Pty Ltd, local council (Mid-Western Regional Council) and OEH.

- Australian Government's Species Profiles and Threats database (SPRAT)
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2 (2002).
- Department of Environment and Climate Change NSW (DECC) (2007). Threatened species assessment guidelines. The assessment of significance
- Proposed Beryl Solar Array Environmental Impact Assessment: Fauna Survey Results. Kerle Environmental (2016)
- Flora survey results – advice email and data sheets. Florasearch (2016).
- Environment Australia (2001) A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.
- NSW OEH's BioBanking credit calculator (BCC)
- NSW OEH's Threatened Species Database
<http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>
- OEH Threatened Species Profiles
<http://www.environment.nsw.gov.au/threatenedSpeciesApp/>
- Office of Environment and Heritage (OEH) (2007). Mitchell Landscapes with per cent cleared estimates.
- Office of Environment and Heritage (OEH) (2014). Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Proposals. Published by Office of Environment and Heritage for the NSW Government.
- State of NSW and Office of Environment and Heritage (2014). NSW Biodiversity Offsets Policy for Major Proposals. Published by Office of Environment and Heritage for the NSW Government.

1.6 OEH CONSULTATION

The proposal was referred to OEH as part of the request for the SEAR's and the OEH recommendations are included in Section 1.2 above.

Additionally, OEH were consulted regarding the substitution of two "dummy" plots (DG5x and DG6x) in a low condition zone (refer to Section 3.1.3). The dummy plots were a replication of the two highest value plots (DG1 and DG3, see table 3-3). The use of dummy plots for this low condition area was seen as acceptable (Ziggy Andersons, OEH, pers. com. 14/02/17).

OEH were also consulted regarding the suitability of the survey timing to confirm that the surveys conducted were adequate for detecting the presence of Ausfled's Wattle (*Acacia ausfeldii*) and the *Prasophyllum* sp 'Wybong'. The BCC identified October as the end of the survey period for these species. Targeted surveys for these species were undertaken at the beginning (first week) of November. The consultation with OEH confirmed that the November timing was suitable (Steven Cox, OEH, pers. comm. 05/03/17).

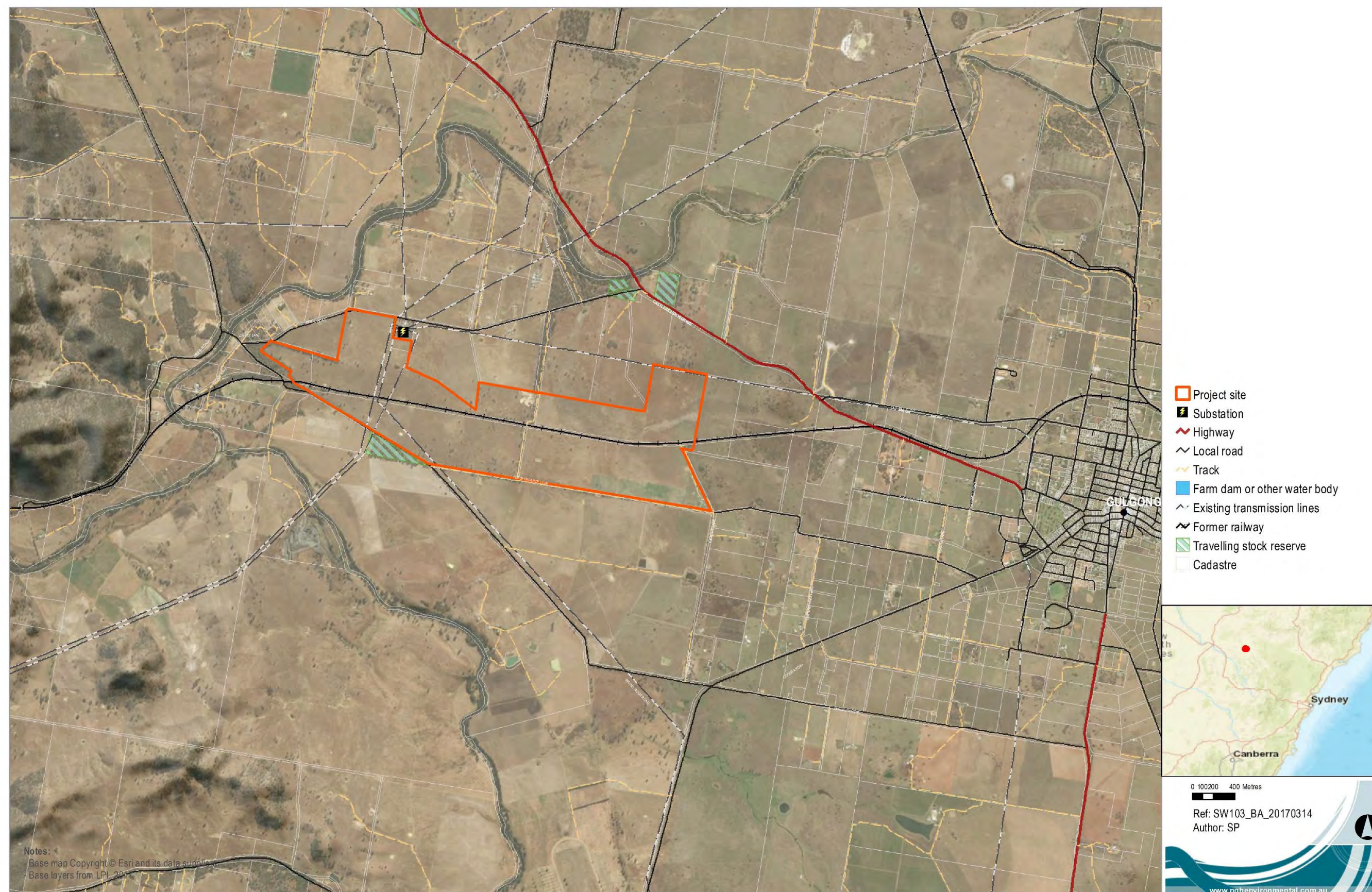


Figure 1-2 Site Map



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2 LANDSCAPE FEATURES

2.1 IBRA BIOREGIONS AND SUBREGIONS

Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The project is located within the South Western Slopes Bioregion and the Inland Slopes Subregion (IBRA v.7 2012).

The bioregion lies wholly in the eastern part of the Lachlan Fold Belt which consists of a complex series of north to north-westerly trending folded bodies of Cambrian to Early Carboniferous sedimentary and volcanic rocks. Granites are common and mostly located in large scale up-folded bodies of rock. Granite landscapes occur either as central basins surrounded by steep hills formed on contact metamorphic rocks, or as high blocky plateau features with rock outcrops and tors (OEH, 2017a).

The site is located within the far north-eastern portion of the South Western Slopes Bioregion. Within this part of the Bioregion, the vegetation types are varied and include woodlands and open woodlands of White Box (*Eucalyptus albens*) which are dominant in the higher rainfall eastern hill country, which give way to vegetation communities dominated by Grey Box (*Eucalyptus microcarpa*) and White Cypress pine (*Callitris glaucophylla*) to the west and north.

Other tree species characteristic of the bioregion include Red Stringybark (*Eucalyptus macrorhyncha*) on higher slopes, with Black Cypress Pine (*Callitris endlicheri*), Kurrajong (*Brachychiton populneus*), Red Ironbark (*Eucalyptus sideroxylon*), White Gum (*Eucalyptus rossii*), Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*) occupying the lower slopes. Valley flats are dominated by Rough-barked Apple (*Angophora floribunda*), with River She-oak (*Casuarina cunninghamiana*) found along eastern streams and River Red Gum (*Eucalyptus camaldulensis*) lining the larger central and western streams.

The dominant IBRA subregion affected by the project is the Inland Slopes Subregion. This was entered in the BCC for the project.

2.2 NSW LANDSCAPE REGIONS (MITCHELL LANDSCAPES)

Five Mitchell Landscapes occur within outer assessment circle area as follows (in order of dominance):

- The Talbragar – Upper Macquarie Terrace Sand Landscape. This occurs across the majority of the proposal site area, and is the dominant landscape within the assessment circles. The per cent cleared estimate for this landscape is currently 93% (OEH 2007).
- The Dubbo Basalts Landscape. This occurs as a series of smaller landscape patches in the southern part of the outer assessment circle area, with part of one small patch extending into the western portion of the proposal site. The per cent cleared estimate for this landscape is currently 97% (OEH 2007).
- The Gulgong Ranges Landscape. This occurs as two moderate sized patches across the northern portion of the assessment area and one moderate to large patch across the southwestern portion of the outer assessment circle area, although no parts of this landscape unit occur within the proposal site itself. The per cent cleared estimate for this landscape is currently 71% (OEH 2007).
- The Cope Hills Granite Landscape. This occurs as two small to medium sized patches across the northern portion of the outer assessment circle area, although no parts of this landscape

unit occur within the proposal site itself. The per cent cleared estimate for this landscape is currently 83% (OEH 2007).

- The Macquarie – Turon Gorges Landscape. This occurs as a relatively small patch in the southern part of the outer assessment circle area, with no parts of this patch extending into the proposal site itself. The per cent cleared estimate for this landscape is currently 68% (OEH 2007).

The Mitchell Landscape descriptions are provided in (Table 2-1) below, and their distribution at the development site shown in Figure 1-3.

Table 2-1 Description of the Mitchell Landscape relevant to the proposal (DECC 2002)

Mitchell Landscape
Talbragar – Upper Macquarie Terrace Sand (87,558.3 ha) Sandy Quaternary alluvial sediments on the floodplains and terraces of the Talbragar River, general elevation 350 to 500m, local relief 30 to 40m. Red-brown and red-yellow earthy sands with some yellow texture-contrast soils on the valley margins. River Red Gum (<i>Eucalyptus camaldulensis</i>) along the channels, Yellow Box (<i>Eucalyptus melliodora</i>) and Rough-barked Apple (<i>Angophora floribunda</i>) with White Cypress Pine (<i>Callitris glaucochylla</i>) on the plain.
Dubbo Basalts (20,375.3 ha) Slightly elevated plains and low hills on flat lying Tertiary basalt and trachyte flows, roughly parallel to the present course of the Talbragar and Macquarie Rivers. General elevation 300 to 330m, local relief 10m. Shallow stony red-brown clay loam and clay, self-mulching and with moderate fertility. Open White Box (<i>Eucalyptus albens</i>), Yellow Box (<i>Eucalyptus melliodora</i>) and Rough-barked Apple (<i>Angophora floribunda</i>) with diverse grasses.
Gulgong Ranges (182,977 ha) Strike ridges with steep slopes and long debris aprons on complexly folded steep dipping Silurian lithic sandstone, quartzite and phyllite, Devonian sandstone, siltstone, shale, rhyolite and dacite. General elevation 550 to 980m, local relief 350m. Shallow stony red and yellow texture-contrast soils with stony uniform loams on steep slopes. Large areas of dense Black Cypress pine (<i>Callitris endlicheri</i>) on slopes, Red Stringybark (<i>Eucalyptus macrorhyncha</i>) and White Gum (<i>Eucalyptus rossii</i>) on ridges. Blakely's Red Gum (<i>Eucalyptus blakelyi</i>), Narrow-leaved Peppermint (<i>Eucalyptus radiata</i>) and White Box (<i>Eucalyptus albens</i>) on lower slopes grading to Yellow Box (<i>Eucalyptus melliodora</i>).
Cope Hills Granite (58,611.6 ha) Undulating and rolling hills on Carboniferous granite and granodiorite, general elevation 500 to 740m, local relief 150m. Gritty gradational red earth and red texture-contrast soils. Forest of Yellow Box (<i>Eucalyptus melliodora</i>), Blakely's Red Gum (<i>Eucalyptus blakelyi</i>), Red Stringybark (<i>Eucalyptus macrorhyncha</i>), Apple Box (<i>Eucalyptus bridgesiana</i>), Mountain Gum (<i>Eucalyptus dalrympleana</i>) and Black Cypress Pine (<i>Callitris endlicheri</i>).
Macquarie – Turon Gorges (32,337.2 ha) Steep sided, deep gorge tract with incised meanders of the Macquarie and Turon Rivers below extensive tablelands of the Ophir-Hargraves Plateau landscape. Incised across the structural grain of north-south trending tightly folded Devonian dacite, crystal tuff, quartzite and slates. General elevation 500 to 700m, local relief to 150m. Shallow stony soils on semi-stable scree slopes and yellow texture-contrast soils on lower angle slopes. Open woodland of Yellow Box (<i>Eucalyptus melliodora</i>), Red Box (<i>Eucalyptus polyanthemos</i>) and Blakely's Red Gum (<i>Eucalyptus blakelyi</i>) on lower areas, Red Stringybark (<i>Eucalyptus macrorhyncha</i>), Broad-leaved Peppermint (<i>Eucalyptus dives</i>) and Candlebark (<i>Eucalyptus rubida</i>), on higher slopes. River She-oak (<i>Casuarina cunninghamiana</i>) dominates the channel.

The dominant Mitchell Landscape affected by the proposal is Talbragar – Upper Macquarie Terrace Sand and this was entered into the BCC for the proposal.

2.3 NATIVE VEGETATION EXTENT

Using GIS, an inner and outer assessment circle with the ratio of 1:10 was established. A 2,000 ha outer assessment circle and 200 ha inner assessment was established over the proposal site and centred over the area of native vegetation that is impacted most by the proposal.

The total area of native vegetation mapped within the outer assessment circle is 551.5 ha (Refer to Figure 1-3).

As the natural vegetation that would have occurred at the site was woodland, the native vegetation mapping used over-storey vegetation cover as a surrogate for native vegetation cover. This is considered a conservative calculation as this method would include non-native vegetation that may still provide some habitat value. The local area's native vegetation is derived from grassy woodlands, including derived grasslands.

2.4 CLEARED AREAS

Cleared areas in the project area are primarily used for agriculture or grazing and provide very little in terms of fauna habitat. These areas may provide suitable foraging habitat for raptors, woodland birds and macropods, as well as introduced species such as cats, foxes and rabbits. Approximately 77.64 ha (about 35%) of the proposal area is cleared land (i.e. non-native, pasture-improved vegetation and the existing possible quarry site).

2.5 RIVERS AND STREAMS

Cudgegong River lies approximately 750 m to the south of the site, and Wialdra Creek is situated approximately 150 m to the north of the site.

No rivers or permanent streams are present within the site. Two small ephemeral drainage lines are located within the north-eastern and south-western portions of the site. The former is a predominantly 2nd order stream draining north into Wialdra Creek (approx. 1.35 km north of the site boundary), and the latter is a 1st order stream draining west into Cudgegong River (approx. 900 m west of the site boundary). Both of these drainage lines were predominantly dry at the time of the survey.

2.6 WETLANDS

There are numerous man made dams occurring within the project area and on immediately surrounding lands. These artificial wetlands may provide potential habitat for waterbirds and amphibians, although in general, the habitat value of these dams is considered to be of low quality due to sparse aquatic vegetation and often turbid water quality.

There are no Nationally Important Wetlands within the locality, and the closest Wetlands of International Importance (Ramsar Wetlands) to the project area are the Macquarie Marshes, situated approximately 250 km northwest of the site.

2.7 STATE OR REGIONALLY SIGNIFICANT BIODIVERSITY LINKS

State significant biodiversity links, regionally significance biodiversity links, very large area biodiversity links, large area biodiversity links or local area biodiversity links are defined in the FBA. To date, no biodiversity corridor plans have been approved by the Chief Executive of the OEH.

Under the FBA criteria, no state or regionally significant biodiversity links occur within the project area or within the inner and outer assessment circles.

2.8 LANDSCAPE VALUE SCORE COMPONENTS

A BCC assessment was completed for this project. The proposal ID for the assessment is 0035/2017/4165MP Version 1 and the assessment type was selected as 'Major Project'. This section summarises the values entered into the Landscape values section of the BCC assessment.

2.8.1 Method applied

The proposal conforms to the definition of a *site-based development* according to the FBA; a development other than a linear shaped development, or a multiple fragmentation impact development. As a result, the site based landscape assessment methodology, in accordance with Appendix 4 of the FBA for a Major Project, has been used in the assessment.

2.8.2 Percent native vegetation cover in the landscape

The following steps were completed in accordance with Appendix 4 of the FBA. They were completed based on the development site as of February 2017.

Assessing percent current extent of native vegetation cover in the inner and outer assessment circles

Using a GIS an inner and outer assessment circle with the ratio of 1:10, was established and centred on the area of native vegetation that is most impacted by the proposal.

- The total area of the inner assessment circle is 200 ha.
- The total area of the outer assessment circle, including the study area, is 2000 ha.
- Current native vegetation cover within the inner assessment circle is 48.33 ha, or 24.2% (rounded to 24%).
- Current native vegetation cover within the outer assessment circle is 508.39 ha, or 25.4% (rounded to 25%).

Assessing percent future extent of native vegetation cover

Using the same inner and outer assessment circles:

- Future native vegetation cover in the inner assessment circle is approximately 8.3% and entered into the calculator as being within the 6-10% band width,
- Future native vegetation cover in the outer assessment circle is 22.48%, rounding this gives a native vegetation cover of 24%

2.8.3 Connectivity value

A connecting link is when native vegetation on the site adjoins native vegetation surrounding the site and the native vegetation:

- is in moderate to good condition, and
- has a patch size >1 ha, and
- is separated by a distance of <100 m (or <30 m for non-woody ecosystems), and
- is not separated by a large water body, dual carriageway, wider highway or similar hostile link.

State or regional biodiversity links may also occur as defined in the defining criteria from FBA table 10 below.

Table 2-2 Extract from the FBA Table 10: Connectivity value scores for site based development

Category of connecting link	Defining criteria	Score
State significant biodiversity link	An area identified as being part of a state significant biodiversity link in a plan approved by the Chief Executive, OEH OR A riparian buffer 50 m either side of a 6th order stream or greater OR A riparian buffer 50 m around an important wetland or an estuarine area	12
Regionally significant biodiversity link	An area identified as being part of a regionally significant biodiversity link and in a plan approved by the Chief Executive, OEH OR A riparian buffer 20 m either side of a 4th or 5th order stream	9

There are no state or regional significant biodiversity links within the outer assessment circle and as such, none would be impacted by the proposal.

Connectivity value

The development would not impact on any connecting links or state or regional biodiversity links. A north-south lane way is located in the central portion on the project site. The development footprint now avoids most vegetation associated with this lane way. Reflecting this, a connectivity value class width of >5-30 m was entered into the BCC for the before development value and >5-30 m was entered into the BCC for the after development corridor width.

For the woody vegetation types, the before development overstorey condition was entered as PFC at Benchmark condition, and the after development overstorey condition was also entered as PFC at Benchmark condition. For the mid storey / ground cover condition, a PFC at <50%, was entered for both the before and after development values.

2.8.4 Area to Perimeter ratio

As the development is a site based development and not a linear shaped development or a multiple fragmentation development, the area to perimeter ratio for the project is not required to be assessed.

2.8.5 Patch size

The moderate to good vegetation at the site is connected to adjacent native vegetation (primarily to the north and west). The extent of this native vegetation is estimated at over 1,000 ha in total area. A patch size of 1,001 hectares has been entered into the BCC as 1,000 ha is the maximum value considered by the BCC.

2.8.6 Landscape Value Score

Entering the data documented above into the BCC returned a landscape value score of 14.20.

3 NATIVE VEGETATION

3.1 PLANT COMMUNITY TYPES

3.1.1 Vegetation communities

One distinct Plant Community Types (PCTs) was observed in the development site; *Rough-barked Apple – red gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions* (PCT281)

Cleared areas that were dominated by non-indigenous vegetation are not considered to provide habitat for native species and thus has not been included in the BCC calculations.

Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions (PCT281)

Within the project area, the Plant Community Type (PCT) 281 occurs as small patches of good condition woodland in the western and central parts of the site, and areas of low condition woodland across the majority of the central parts of the site. Low condition derived grasslands occur across the majority of the central and north-eastern parts of the site and mixed condition derived ephemeral wetland vegetation also occurs across the other parts of the north-eastern portion of the site (Figure 3-1). The low condition derived grasslands and mixed condition derived ephemeral wetland vegetation are also considered part of PCT 281 as they are derived from this woodland community, even though these areas are generally devoid of trees, and have a proportionately low percentage of native groundcover. These low condition areas represent highly degraded pasture, and it is considered likely that most of these areas have been cultivated and possibly cropped in the past. As such, they are not regarded as constituting the EEC based on these areas not meeting the NSW Biometric vegetation condition benchmarks.

The proposed solar farm will impact on 130.06 ha of this community; some of which is in moderate to good condition (18.88 ha); the remainder is in low condition (111.8 ha). Some (17.13 ha) of this vegetation is listed as an Endangered Ecological Community (EEC) under the TSC (*White Box Yellow Box Blakely's Red Gum Woodland; Box Gum Woodland*); 0.99 ha of moderate to good condition EEC and 16.14 ha of low condition EEC that occurs within the development footprint. It is noted that the solar array panels will modify not remove vegetation through shading, however for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed.

Additionally, 4.43 ha of Critically Endangered Ecological Community (CEEC) listed under the EPBC Act (listed as *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland*) occurs west of the development footprint (equivalent to Zone 1). It would not be impacted by the development.

The dominant tree species in the community where it occurs within the development site consisted of the Rough-barked Apple (*Angophora floribunda*), although this species is mixed/co-dominant with Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*E. blakelyi*) in woodland patches immediately surrounding the site. This suggests the Yellow Box and Blakely's Red Gum have historically been selectively removed (for the timber/firewood) from the whole property, including the north-south laneways.

The understorey vegetation included a relatively sparse midstorey vegetation layer comprised primarily of younger/regrowth Rough-barked Apple, Yellow Box and Blakely's Red Gum, with very few native shrubs observed across the site. The groundcover vegetation characteristics included patches of native perennial

grasses, particularly across the western half of the site, whilst the majority of the eastern half of the site was dominated by exotic pastures.

Two threatened flora species were found to be present within the study area but located outside of the development impact footprint, these being the Pine Donkey Orchid (*Diuris tricolor*) and Silky Swainson-pea (*Swainsona sericea*). Both occur at the western end of the rail corridor. *Diuris tricolor* also occurs at two other locations at the far western end of the southern patch of the Zone 1 vegetation.

Table 3-1 Summary of the Rough-barked Apple – Red Gum – Yellow Box Woodland in the proposal area.

Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions		
Vegetation formation	Grassy woodlands	
Vegetation class	Western Slopes Grassy Woodlands	
Vegetation type	Plant Community Type (PCT) ID	281
	Biometric Vegetation Type ID	CW111
	Common Community Name	Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions
Approximate extent within proposal	This vegetation community occurs throughout the project area of which 147.93 ha is situated within the development impact footprint (of which 116.11 ha occurs as derived grassland in predominantly low condition).	
Condition	Predominantly Low Condition, with some small patches of Moderate to good Condition (in central and western parts of the site).	
Survey Effort	15 biometric plots were completed in total for PCT within the project area.	
Conservation Status	This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act and a critically endangered ecological community (CEEC) under the EPBC Act known as White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Only 17.13 ha of the community within the development footprint meets the definitions of the TSC Act listed EEC. A total of 4.43 ha of CEEC occurs in the west of the development footprint (equivalent to Zone 1), and would not be impacted by the development.	
Estimate of percent cleared	75%	
Threatened plant species habitat	Within the disturbed remnant patches, this community provides habitat for threatened flora species, including, Ausfeld's Wattle (<i>Acacia ausfeldii</i>) Euphrasia arguta (<i>Euphrasia arguta</i>) Narrow Goodenia (<i>Goodenia macbarronii</i>) Prasophyllum sp. Wybong (<i>Prasophyllum sp. Wybong</i>) Silky Swainson-pea (<i>Swainsona sericea</i>).	
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (where present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging	

Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions

for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.

Example



Figure 3-1 Example of moderate/good condition Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions in the project area.

Cleared areas (exotic dominated pasture)

A large portion of the site supports highly disturbed or modified vegetation, including areas of exotic dominated derived grassland that have been cleared of trees (Zone 4), as well as a large area of sown pastures in the western part of the site and are typically grazed on a (semi) regular basis (Figure 3-2 and Figure 3-3). The groundcover in this area is mainly exotic with common grazing species including (but not limited to) Barley Grass (**Hordeum leporinum*), Ryegrass species (**Lolium sp*), Brome species (**Bromus sp*), numerous Clover species (**Trifolium sp*), Paspalum (**Paspalum dilatatum*), Sheep Sorrel (**Acetosella vulgaris*), Delicate Hairgrass (**Aira elegantissima*), and numerous Fescue species (**Vulpia sp*). Numerous weed species are also present in these areas including (but not limited to) Capeweed (**Arctotheca calendula*), Smooth Catsear (**Hypochaeris glabra*), Flatweed (**Hypochaeris radicata*), and Stagger Weed (**Stachys arvensis*).



Figure 3-2 An example of exotic-dominated vegetation within the project area

3.1.2 Endangered Ecological Communities

White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as an EEC under the TSC Act and is listed as a CEEC under the EPBC Act (discussed further in Section 5).

The community occurs across the majority of the western half of the site, and includes areas of moderate to good and low condition woodland (identified as Zones 1, 2 and 3). These areas of the TSC-listed EEC are characterised by areas where the overstorey (treed) vegetation is at the benchmark cover value and with some native groundcover (rated as moderate/good condition), as well as areas where there is overstorey (treed) vegetation at or above 25% of the lower benchmark cover value but has groundcover vegetation dominated by exotics. A total of 17.13 ha of this EEC occurs within the development footprint. Zones 4 and 5 do not meet the criteria for the EEC or CEEC.

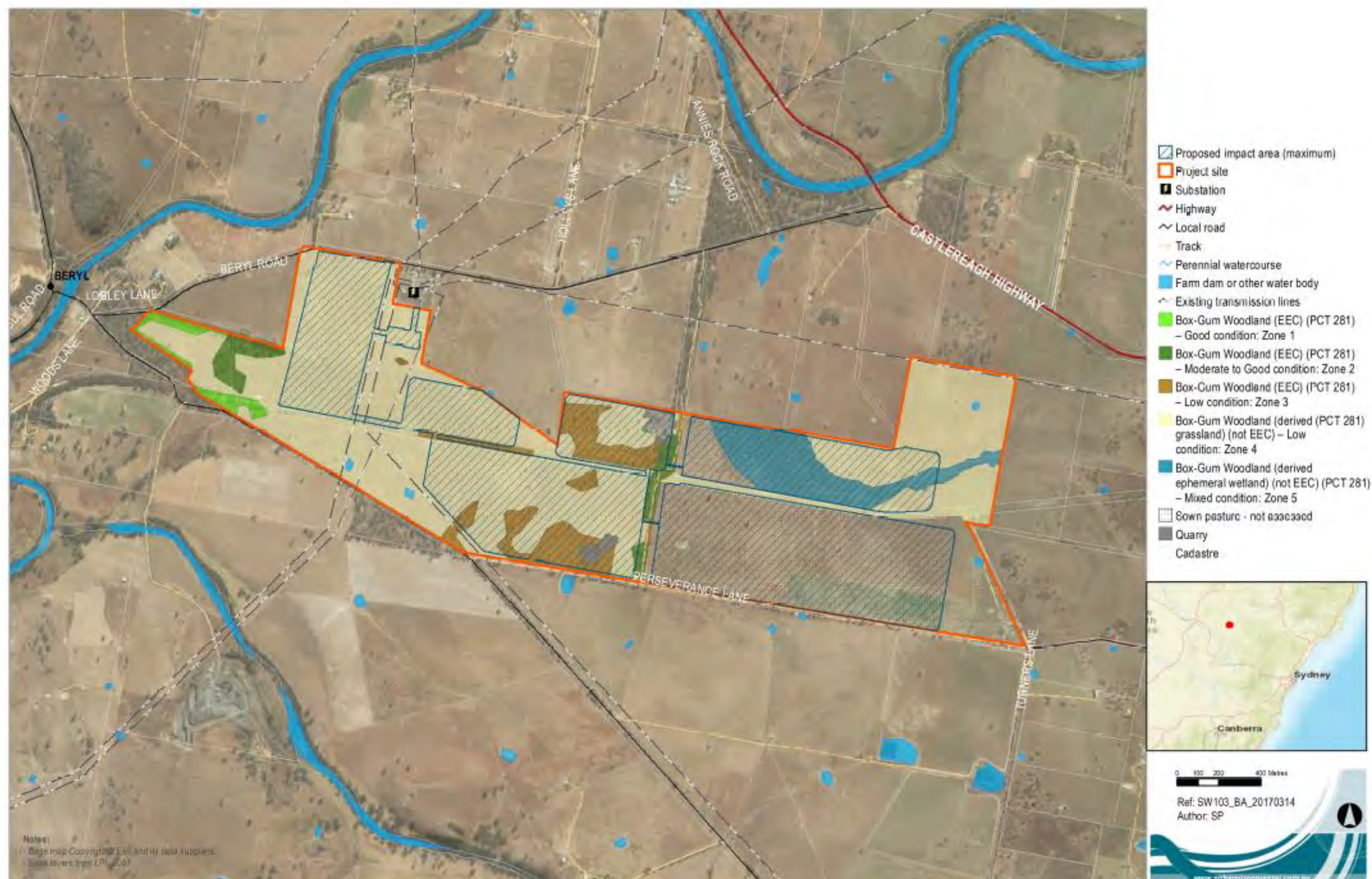


Figure 3-3 Vegetation Zones and PCTs within the project area

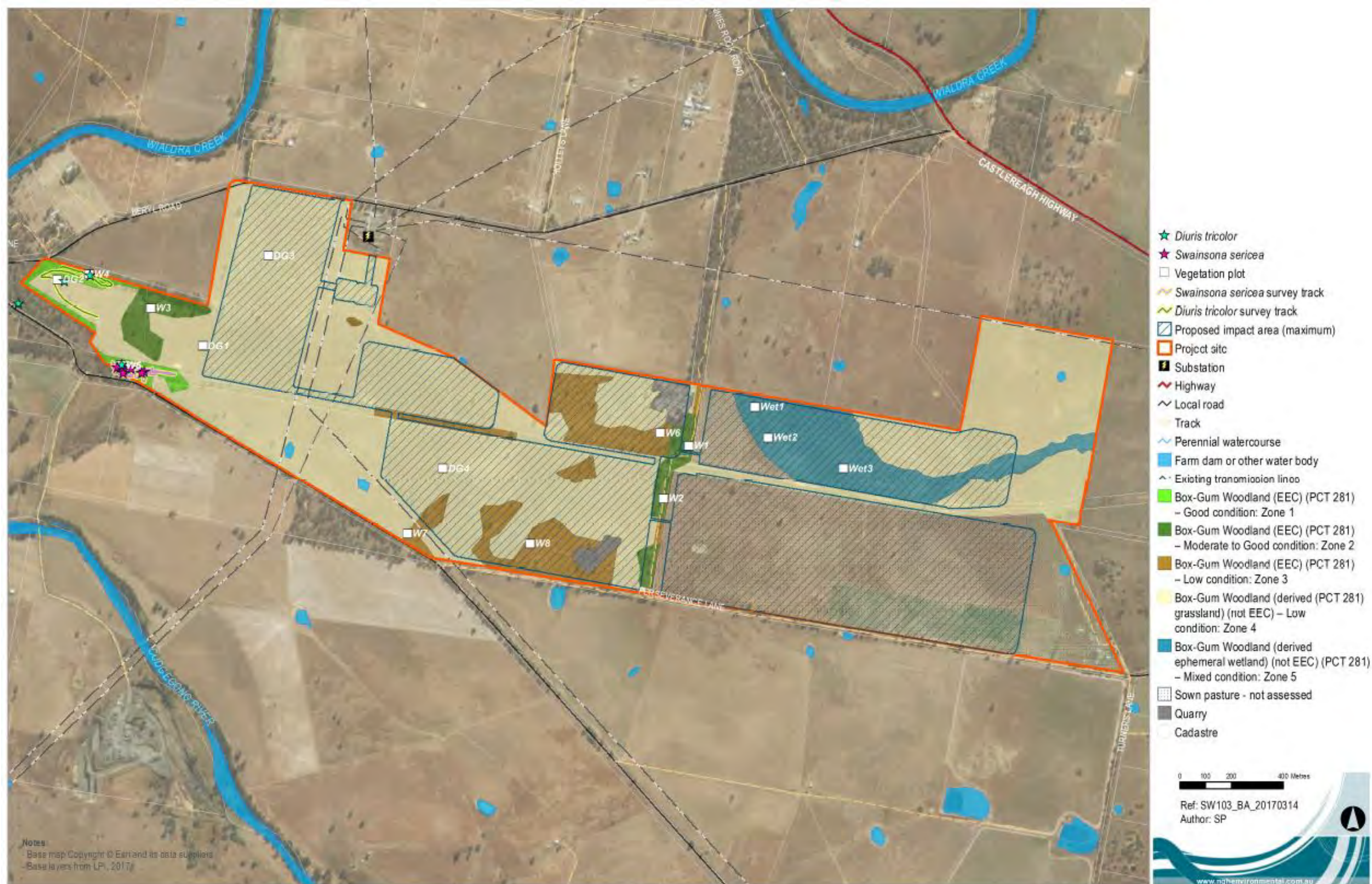


Figure 3-4 Plot and transect locations relative to Vegetation Zones, PCTs and Condition Class in the project area



Figure 3-5 Map of NSW TSC Act EECs

3.1.3 Vegetation zones in the BCC

The vegetation zones that would be impacted by the proposal, as entered into the BCC, their condition class, number of biometric plots undertaken within them and their current site value score, as determined by the BCC, are as shown in Figure 3-3, and Figure 3-4, and described in the table below.

Table 3-2 Vegetation zones within the proposal.

Zone ID	Vegetation zones	Condition class	EEC status?	Area (ha) within development footprint	Survey effort (number of plots completed)	Site value score (current)
1	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - good	Yes	0	2	66.67
2	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - Good	Yes	0.99	3	67.33
3	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Low	Yes	16.14	3	47.33
4	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Low	No	95.04	3 (+2)	10.00
5	PCT #281 BVT #CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	Moderate - good	No	17.89	3	20.67

Notes:

- Threatened species subzones / management zones were entered equivalent to the vegetation zones. No additional polygons were mapped.
- Note, the development footprint now excludes Zone 1, hence the impact area has been reduced to zero.
- Vegetation Zone 4 has a site value score of <17 and will therefore not generate credits. Further, Zone 4 required five vegetation plots as although a low condition zone, it had to be entered into the BCC as a moderate to good condition zone (the BCC cannot accept two low condition zones for the same PCT). Three plots were conducted in this area as required for a low condition zone of its size. Given the large area of this zone, its relatively homogenous values, two “dummy” plots (DG5x and DG6x) were entered into BCC to meet the minimum required plot number for a moderate to good condition zone of its size. The dummy plots were a replication of the two highest value plots (DG1 and DG3, see table 3-3). This decision was discussed with OEH (Ziggy Andersons, OEH, pers. com. 14/02/17) and the use of dummy plots for this low condition area to meet the requirements of the BCC was seen as acceptable.

3.1.4 Site values (plot data entered into BCC)

The following plot data were collected in early November 2016 for the vegetation zones listed in Table 3-2. A total of 15 plots were completed across Zones 1 to 5 and were entered into the database, however as noted above, two dummy plots were created for vegetation Zone 4 to meet the minimum plot requirement of five plots under the BCC. The locations of each survey plot is shown in Figure 3-4.

Table 3-3 Plot data

Zone 1: PCT #281 – CW111 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
W4	24	0	26	18	2	20	40	0	0.33	0	730526	6418108	55H
W5	46	6	0	34	2	14	24	0	1	12	730648	6417759	55H

Zone 2: PCT #281 – CW111 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
W1	15	16.5	0	4	0	4	66	1	1	104	732836	6417451	55H
W2	30	36	16	6	0	0	62	2	1	10	732738	6417245	55H
W3	22	35	0	6	0	6	82	3	0	86	730763	6417978	55H

Zone 3: PCT #281 – CW111 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
W6	9	7	0	6	0	4	90	0	0	6	732725	6417500	55H
W7	11	12	0	12	0	10	72	0	0.33	27	731751	6417110	55H
W8	18	16	0	36	0	0	28	0	1	0	732224	6417072	55H

Zone 4: PCT #281 – CW111 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
DG1	8	0	0	34	0	0	64	0	0	0	730965	6417833	55H
DG3	8	0	0	24	0	0	74	0	0	0	731216	6418178	55H
DG4	5	0	0	4	0	4	92	0	0	0	731888	6417363	55H
DG5x	8	0	0	34	0	0	64	0	0	0	731380	6417760	55H
DG6x	8	0	0	24	0	0	74	0	0	0	731210	6148180	55H

Zone 5: PCT #281 – CW111 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Wet1	19	0	0	10	0	38	44	0	0	0	733089	6417599	55H
Wet2	17	0	0	22	0	30	46	0	0	0	733140	6417481	55H
Wet3	22	0	0	20	0	22	48	0	0	0	733429	6417363	55H

4 THREATENED SPECIES

4.1 GEOGRAPHIC/HABITAT FEATURES

Potential habitat for the Pink-tailed Legless Lizard was identified at the development site, within the area of Transect 2a which contained loose and partially embedded surface rocks. A large number of loose or partially embedded rocks were turned and inspected for presence of the species, although none were found. Additionally, the quality of the rocky habitat for the species was also considered to be low, with the loose surface rocks regarded as being generally too small for the species preferences. This area would now be avoided by the development footprint. As such, the proposal is regarded as not impacting on this habitat feature.

Other geographic/habitat features for species that were generated by the BCC (such as the Large-eared Pied Bat, Brush-tailed Rock Wallaby, and Booroolong Frog) were not present. Specifically, the site did not contain escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels, was not located within 1 km of rock outcrops or cliff-lines, and was not located within 100m of a stream or creek banks (that would support habitat for the Booroolong Frog).

4.2 ECOSYSTEM CREDIT SPECIES

The following species are all species predicted by the BCC to occur, based on the data entered for the landscape assessment and vegetation zones in the assessment. These constitute all species which will generate ecosystem credits in the credit calculations.

Table 4-1 Ecosystem credit species predicted to occur

Common name	Scientific name	TS offset multiplier
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis subsp. gularis</i>	1.3
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus subsp. victoriae</i>	2.0
Bush Stone-curlew	<i>Burhinus grallarius</i>	2.6
Diamond Firetail	<i>Stagonopleura guttata</i>	1.3
Flame Robin	<i>Petroica phoenicea</i>	1.3
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2.0
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis subsp. temporalis</i>	1.3
Little Eagle	<i>Hieraaetus morphnoides</i>	1.4
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8
Little Pied Bat	<i>Chalinolobus picatus</i>	2.1
Little Whip Snake	<i>Suta flagellum</i>	2.3
Masked Owl	<i>Tyto novaehollandiae</i>	3.0

Common name	Scientific name	TS offset multiplier
Painted Honeyeater	<i>Grantiella picta</i>	1.3
Powerful Owl	<i>Ninox strenua</i>	3.0
Scarlet Robin	<i>Petroica boodang</i>	1.3
Speckled Warbler	<i>Chthonicola sagittata</i>	2.6
Spotted Harrier	<i>Circus assimilis</i>	1.4
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	2.6
Square-tailed Kite	<i>Lophoictinia isura</i>	1.4
Swift Parrot	<i>Lathamus discolor</i>	1.3
Turquoise Parrot	<i>Neophema pulchella</i>	1.8
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.3
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	2.2

4.3 SPECIES CREDIT SPECIES PRESENT

4.3.1 Candidate species

The following species were returned by the BCC as requiring survey. Table 4-3 summarises whether each species was detected during surveys and furthermore, if they are expected to be impacted by the proposal and therefore are required to be offset. Details regarding targeted surveys undertaken is provided further below.

Table 4-2 Threatened species requiring survey

Common name	Scientific name	Surveys	Present/presumed present	Affected by the proposal
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	Not detected during targeted surveys	No	Unlikely – not recorded within the development site during targeted surveys
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Not detected during spotlighting.	No	Unlikely – not recorded within the site during surveys, and habitat regarded as unsuitable for the species.
<i>Euphrasia arguta</i>	<i>Euphrasia arguta</i>	Not detected during vegetation plot/transect surveys	No	Unlikely – site does not contain suitable habitat for this species
Narrow Goodenia	<i>Goodenia macbarronii</i>	In view of the above the Scientific Committee is of the opinion that <i>Goodenia macbarronii</i> Carolin is no longer eligible to be listed as a Vulnerable species in Part 1 of Schedule 2 of the Act. Proposed Gazettal date: 04/07/08. This species is not considered further.		
Koala	<i>Phascolarctos cinereus</i>	Not detected during spotlighting or during habitat tree surveys	No	Unlikely – not recorded within the site during surveys, and habitat generally unsuitable within the development envelope. More favourable habitat is located outside of the site, and no obvious movement corridor present.
Pine Donkey-orchid	<i>Diuris tricolor</i>	Detected during surveys but outside of development envelope	No	Unlikely - development site is located outside of area where species occurs
Prasophyllum sp. Wybong	<i>Prasophyllum sp. Wybong</i>	Not detected during targeted survey	No	Unlikely – not recorded in development site during targeted survey.
Regent Honeyeater	<i>Anthochaera phrygia</i>	Not detected during diurnal bird surveys	No	Unlikely – not recorded within the development envelope, and nearest record is 15 km from the site.
Silky Swainson-pea	<i>Swainsona sericea</i>	Detected during targeted surveys but outside of the development site	No	Unlikely - development site is located outside of area where species occurs
Squirrel Glider	<i>Petaurus norfolcensis</i>	Not detected during spotlighting.	No	Unlikely – site does not contain suitable habitat for this species

4.3.2 Targeted survey methodologies

The following section sets out the methodologies and results of targeted surveys undertaken that underpin the biodiversity assessment of the development site. This information is used in the BCC assessment and particularly, to support the decisions regarding candidate species that would be affected by the proposal.

Flora and fauna field surveys were undertaken from the 1st to the 4th of November 2016 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. This includes flowering times of threatened flora, and known activity periods of threatened fauna. The exception is Ausfelds Wattle which is required to be surveyed from August to October inclusive, and the Prasophyllum which is to be surveyed in October only. The suitability of the surveys for these species is discussed further below.

Aims

The aims of the site surveys were as follows:

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

Random meander and targeted searches for threatened flora species

Targeted searches were conducted in parts of the study area considered potentially suitable for the targeted species. These were patches of remnant woodland with areas of ground cover containing a representation of native flora. The majority of the study area, comprising improved pasture and intensively grazed pastures in low condition, was not targeted. The searches were conducted by systematically traversing the area with linear transects approximately 10 m apart.

Fauna habitat assessment

An assessment of habitat types available and their quality and suitability as threatened species habitat was conducted across the project area. Factors such as arboreal resources, ground-layer resources, vegetation structure/types, as well as connectivity and disturbance were noted. All trees within the project area were inspected for hollows and general habitat values, including signs of use by fauna such as the presence of scratches/scats. An opportunistic record of fauna species observed during the fauna assessments was also taken.

Targeted fauna surveys

Sites for more detailed fauna survey were selected to cover the patches of remnant native vegetation that had potential to provide threatened species habitat. The western half of the property which supports predominantly cleared sown pasture was surveyed opportunistically for fauna. A detailed summary of the specific survey methods employed, including survey effort is provided below. The location of the fauna survey transects is provided in Figure 4-2.

VERTEBRATE FAUNA SURVEY METHODS

Brush-tailed Phascogale

This species prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, but may also inhabit heath, swamps, rainforest and wet sclerophyll forest. It appears to preferentially forage in rough barked trees of 25 cm DBH or greater.

Nocturnal spotlighting surveys were carried out on foot at survey transects 1 and 2 and survey site 3 (a & b) with two spotlights, including one 50W and one 100W. The site location, date and timing/duration of the spotlighting is defined in Table 4-4, and included a total of 2.5 hours of spotlighting within the treed areas of the site, as briefly summarised below:

- **Transect 1 (a & b):** 1/11/2016; 2100 – 2200 hrs. Clear cold evening. Both the north and south sections of the TSR laneway were surveyed.
- **Transect 2 (a & b):** 2/11/2016; 2100 – 2200 hrs EDST. Clear cold evening. One spotlight moving through transects around the edge of the property beginning in the rail corridor (Transect 2b) and ending on the rocky knoll (south of Transect Site 2a).
- **Survey Site 3 (a & b):** 2/11/2016; 2030 – 2100 hrs EDST Clear cold evening. One spotlight slowly moving across the property Commenced at Site 3b Paddock trees; including Site 3a.

This level of survey effort is generally in keeping with the NSW *Threatened Species Survey and Assessment Guidelines* (DEC, 2004) which requires 2 x 1 hour of spotlighting up to 200 hectares of stratification unit on two separate nights. The woodland (treed parts of the site) comprise about 32 ha, and were subject to more than 2 hours of spotlighting over two nights.

The locations of the survey transects and survey sites above are the same as those described in Table 4-3 (for the avifaunal surveys) and shown in Figure 4-2.

Koala

The dominant overstorey species in the woodland areas within the proposed development site included the Blakely's Red Gum, Yellow Box and Rough-barked Apple. None of these species are listed as feed tree species under Schedule 2 of State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection, however the Blakely's Red Gum and Yellow Box are identified as secondary food tree species in the Central West Koala Management Area (KMA) on the NSW Government (OEH) website.

During the fauna habitat assessment, described above and which included an inspection of all trees within the development envelope, included an inspection of trees for signs of fauna use, including the presence of scratch marks or scats on or at the base of trees. No signs of use by koalas was observed. Additionally, the 2.5 hours of nocturnal spotlighting surveys described above for the Brush-tailed Phascogale, similarly did not observe any koalas.

Pink-tailed Legless Lizard

This species is known to inhabit areas of rocky outcrops or scattered partly buried rock, with a preference for scattered and partly embedded surface rocks of about 0.15 m to 0.6 m (approximate of irregular diameter) in size. During the site habitat assessment, a small area of approximately 2 ha of scattered surface rocks was noted in the eastern portion of the site, near survey transect 2a. Active searches for the species was undertaken by turning over these rocks (where possible, based on overall size and degree of embeddedness), and inspecting them for signs of the species, including either directly observing individuals, or skin sloughs left behind by individuals. Approximately 50 rocks were turned over for this inspection (which represents about the total number of potentially suitable rocks able to be effectively turned over within the area).

Regent Honeyeater

In relation to avifauna, only the Regent Honeyeater required targeted surveys. During the survey investigations, diurnal bird surveys (comprising primarily 30 minute surveys) were undertaken across the fauna survey transects described in Table 4-3, for a combined total of 4 hours of timed surveys across the four survey transects (1a, 1b, 2a and 2b). In addition to this, 2 x 15 minute avifaunal surveys (on the morning and evening of 2/11/2016) were conducted within identified clumps of trees at survey site 3a, involving a general meander through this area (as shown in Figure 4-2), and an additional 105 minute survey and 60 minute survey was conducted across/throughout the area identified as survey site 3b on the mornings of 3/11/2016 and 4/11/2016 respectively. These avifaunal surveys gave a total survey effort of 7.25 hours.

The surveys were conducted at both dawn and dusk when the Regent Honeyeater is most active. The survey locations were selected to cover available/potential Regent Honeyeater habitat within the project area, which was restricted to woodland patches as well as isolated trees in paddocks (Figure 4-2). In addition to this, opportunistic records of bird species observed during fauna assessments, vegetation surveys and hollow-bearing tree assessments were recorded, and a total species list compiled.

These bird surveys were used to identify the presence of threatened species predicted to occur in the project area and the threatened species requiring survey through the BCC.

Squirrel Glider

The survey methods for this species included the nocturnal spotlighting surveys as described above for the Brush-tailed Phascogale, which included a total of 2.5 hours of nocturnal surveys over 2 nights. This level of survey effort is generally in keeping with the NSW *Threatened Species Survey and Assessment Guidelines* (DEC, 2004) which requires 2 x 1 hour of spotlighting up to 200 hectares of stratification unit on two separate nights. The woodland (treed parts of the site) comprise about 32 ha, and were subject to more than 2 hours of spotlighting over two nights. The locations of the survey transects and survey sites above are the same as those described in Table 4-3 (for the avifaunal surveys) and shown in Figure 4-2.

Table 4-3 Avifauna survey transect details

Transect/Survey No.	Site	Date/Time/Duration	Direction	Transect starting location (AMG 55H)
T1(a)		1/11/2016 2 x half-hour surveys 1 x morning and 1 x evening	North	732827 E 6417409 N
T1 (b)		1/11/2016 2 x half-hour surveys 1 x morning and 1 x evening	South	732746 E 6417396 N
T2 (a)		2/11/2016 2 x half-hour surveys 1 x morning and 1 x evening	West	730908 E 6417991 N
T2 (b)		2/11/2016 2 x half-hour surveys 1 x morning and 1 x evening	East	730611 E 6417773 N
S3 (a)		2/11/2016 2 x 15 minute timed surveys 1 x morning and 1 x evening No transect established – observations were made from within the identified clump of trees	N/A	731543 E 6417913 N
S3 (b)		3/11/2016 0715-0900 hrs 4/11/2016 0700-0800 hrs	N/A	N/A – transect not established at this site; general meanders were undertaken as described below. 3/11/16 - From western end of rail corridor, east along embankment then north through paddock with sand mine 4/11/16 - South of rail corridor, west of TSR laneway –

OPPORTUNISTIC RECORDS

An opportunistic record of fauna species observed during the fauna assessments was also taken. A list of all species recorded at the site, including flora and fauna species recorded by either targeted or opportunistic surveys is included at Appendix C.

Weather conditions during the field surveys

Table 4-4 Weather conditions during the field surveys, recorded at Gulgong (courtesy Bureau of Meteorology).

Date	Temperature min (°C)	Temperature max (°C)	Rain (mm)	Max wind speed (km/h)
01/11/16	4.0	21.1	0	Calm
02/11/16	6.2	22.4	0	13
03/11/16	6.6	25.2	0	9
04/11/16	7.5	26.6	0	9

4.3.3 Previous surveys conducted in the local area

It is unclear whether dedicated biodiversity surveys have been previously undertaken within the locality, however evidence from the Atlas of Living Australia indicates that occasional opportunistic surveys are undertaken and the results provided to the relevant government agencies. None of the candidate species have been previously recorded within the development envelope.

4.3.4 Targeted survey results

Three threatened species listed under the NSW TSC Act were detected during the survey (Figure 4-1), including:

- Dusky Woodswallow *Artamus cyanopterus cyanopterus* – Vulnerable (TSC Act)
- Silky Swainson-pea *Swainsona sericea* – Vulnerable (TSC Act)
- Pine Donkey Orchid *Diuris tricolor* – Vulnerable (TSC Act)

The Silky Swainson-pea and Pine Donkey Orchid are species credit species, whilst the Dusky Woodswallow is neither an ecosystem or species credit species.

The results of targeted surveys for the other candidate species requiring survey are detailed below along with a discussion regarding habitat suitability, likely presence and potential impacts.

Ausfeld's Wattle

This species was not detected at the site during the flora surveys at the site, which were conducted at the end of the recommended survey period. This species is a conspicuous medium sized shrub or small tree to 2-4 m in height that grows in eucalypt woodland in sandy soil often in remnant roadside patches. This species can be distinguished on the basis of its foliage, although the differences between it and *A. verniciflua* are small (Tame 1992). Using foliage characters means that survey effectively could happen at any time of the year. As such, there is a high level of confidence that had it been present, it would have been detected during the flora surveys. This assessment is therefore confidence that *A. ausfeldii* is absent from the site.

Euphrasia arguta

This species was not detected during the targeted flora surveys at the site. The species is only currently known from a few montane sites near Nundle and historic records suggest it prefers alluvial soils in river valleys, of which there is none present at the site. The species is considered unlikely to occur at the.

Narrow Goodenia

This species was not detected during the targeted flora surveys at the site. The NSW Scientific Committee made a Final Determination to remove the species from the Schedules of the TSC Act.

Prasophyllum sp. Wybong

This species is recognised at the Commonwealth level as being synonymous with *Prasophyllum petilum*. The species was not detected during the targeted flora surveys at the site. Whilst the field surveys were conducted just after the recommended survey period, the field botanist did observe *Prasophyllum petilum* in Ilford Cemetery on 21 October 2016, and noted 'Five inflorescences in full bloom – many others still in bud.' This indicated that flowering at Ilford would have gone well into November, as peak flowering had not arrived by 21 October. Given this, the survey timing at Beryl (of 1-4 November) was regarded as suitable for this species in 2016, noting that although flowering times for both sites are likely to be similar, Beryl (424 m) is at a much lower altitude than Ilford (816 m at the cemetery). This would likely result in a slight difference to the flowering times by about a week, with Beryl likely to flower a bit earlier. Even so, it is believed that there would still have been open flowers at Beryl at the time of the survey.

This species is very sensitive to grazing, therefore being unlikely to survive on regularly managed farmland. It typically only survives in ungrazed areas (such as cemeteries) or lightly grazed areas (some Travelling Stock Reserves and Routes). It is considered highly unlikely to be present at the site.

Pine Donkey Orchid

This species was detected during the targeted flora surveys at the site, with a total of two plants recorded within the good condition woodland (Zone 1) in the far western portion of the project site, but outside of the development footprint, and a further two plants found in woodland just outside of the proposal site but within the leased area of land. The remaining parts of the site are considered generally unsuitable for this species and targeted surveys did not detect it in these areas. The recorded location of the species is outside of the proposed development footprint and measures have been recommended in Section 6 to protect individuals at this location. As such, the species has not been entered into the BCC as being impacted by the development.

Silky Swainson-pea

This species was detected during the targeted flora surveys at the site, with a total of 38 plants recorded within the good condition woodland (Zone 1) in the far western portion of the site. The other parts of the site are considered generally unsuitable for this species and targeted surveys did not detect it in these areas. The recorded location of the species is outside of the proposed development footprint and measures have been recommended in Section 6 to protect individuals at this location. As such, the species has not been entered into the BCC as being impacted by the development.

Brush-tailed Phascogale

No Brush-tailed Phascogales or signs of Brush-tailed Phascogales were detected during the survey. The species also has not been previously recorded within 20km of the site. This species prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, as well as heath, swamps, rainforest and wet sclerophyll forest. It typically nests and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. The site is considered to provide only marginal habitat for the species, being an open woodland rather than dry sclerophyll forest habitat, with existing trees considered to be too sparse across the property. Given this and the lack of previous records nearby, it is considered unlikely that the species would be present at the site.

Koala

No Koalas or signs of Koalas were detected during the survey despite extensive searches for signs of koalas (i.e. scratches/scats on or at base of trees). Koalas have been previously recorded only occasionally in the locality, with two records approximately 9 and 15 km to the east of the site. The areas of moderate to good condition woodland support secondary Koala food tree species for the Central West region (OEH), however, they do not support the particular tree species listed in Schedule 2 of the Koala SEPP. As such, the site is not considered to support either 'Core' or 'Potential' Koala habitat under the Koala SEPP. Furthermore, the Mid Western Regional Council LGA is not listed under Schedule 1 of SEPP 44 (for LGA's within which the SEPP applies).

Given the lack of observations of signs of Koalas despite extensive searches, it is considered unlikely that the site would support a resident population of Koalas, although the occasional presence of a Koala at the site cannot be completely discounted. Given the retention of treed corridors across the south of the site, as well as the presence of treed corridors along Wialdra Creek and Cudgegong River to the west, north and south of the site, broader connectivity and movement potential for Koalas would not be lost as a consequence of the development.

Given the above factors, the proposal is not regarded as being likely to impact on Koalas.

Pink-tailed Legless Lizard

This species was not detected during targeted surveys at the site. A small area of scattered surface rocks was noted in the eastern portion of the site, which was considered to be of marginal suitability for the species based on the overall small size of loose surface rocks, as well as the high degree of embeddedness of larger rocks. Despite active searches for the species by turning rocks, as described previously, the species was not located at the site. The species has not been previously recorded within 20 km of the site. Based on the lack of detection during survey, the low suitability of habitat and lack of previous records, it is considered unlikely that the species would be present at the site.

Regent Honeyeater

This species was not detected during the targeted avifauna surveys at the site. The avifauna surveys included a combined 8.5 hours of timed (0.5 hr) diurnal (morning and evening) surveys across two days, as well as a 1.75 hr morning survey and 1 hr evening survey on the third survey day. The surveys were conducted within the recommended seasons for this species in the BCC.

This species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak, particularly, woodlands that have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The species is patchily distributed in NSW with only three known breeding sites remaining, none of which occur near the project area.

The site is generally regarded as providing unsuitable for the species, with low canopy cover and no mistletoes. The species has been previously recorded approximately 15km east of the site in more dense woodland and forest areas. The species is considered more likely to move along corridors and prioritise the larger patches.

Given the above, the species is regarded as being unlikely to be present at the site on a regular basis, and is therefore considered unlikely to be impacted by the proposal.

Squirrel Glider

This species was not detected during the fauna surveys at the site. The fauna surveys included a combined 2.5 hours of nocturnal spotlighting over two evenings within woodland areas. This species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range, and typically prefers mixed species stands with a shrub or Acacia midstorey, which are absent from the development site. The species also requires abundant tree hollows for refuge and nest sites. These resources are limited within the development site to scattered paddock trees. Nearest records of the species include a collection of about 10 records in forests near Bungaba, more than 25km to the northeast of the site. This species is therefore considered unlikely to be present at the site and would not be impacted by the proposal.

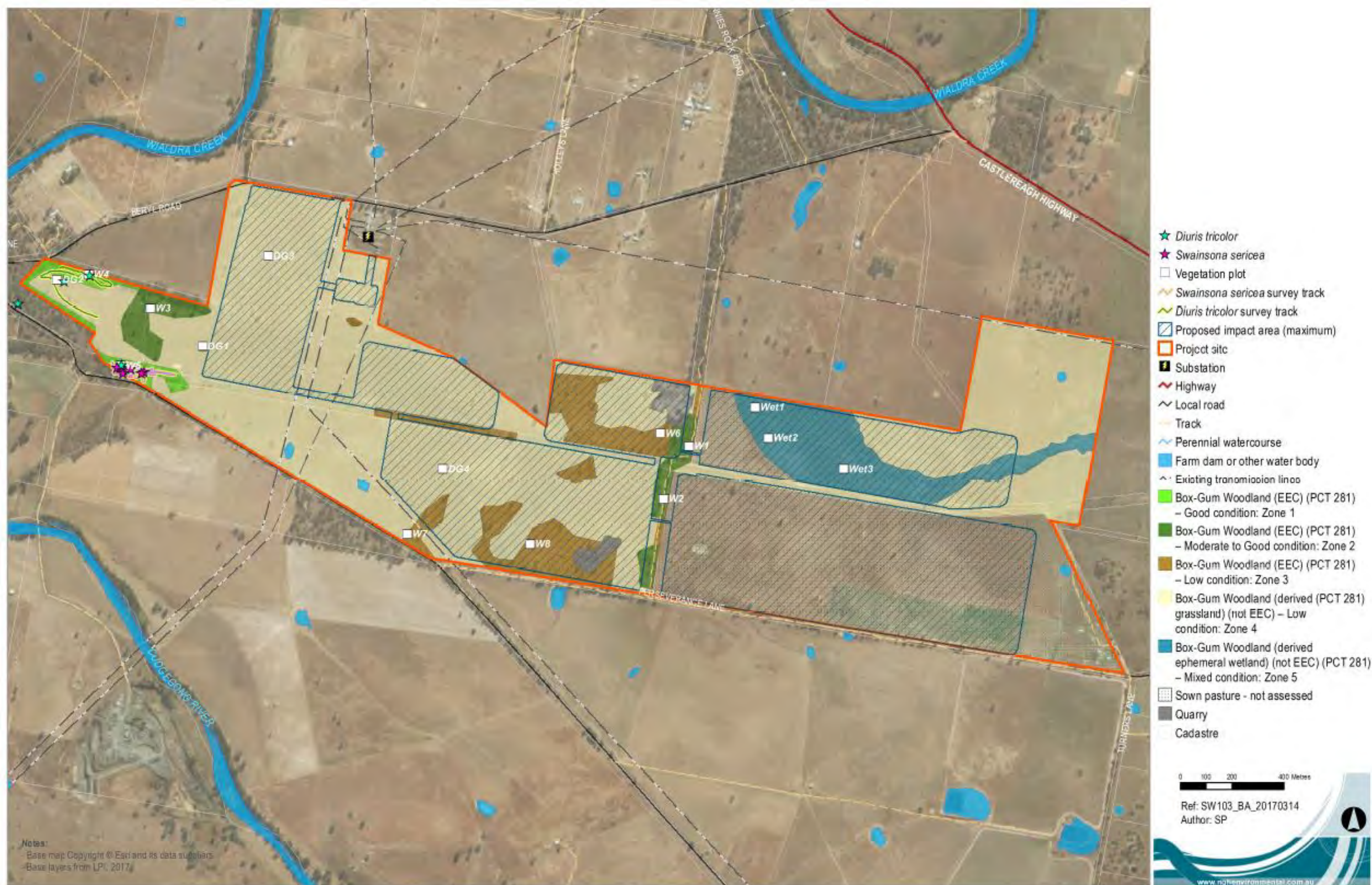


Figure 4-1 Flora survey locations and recorded threatened flora species.

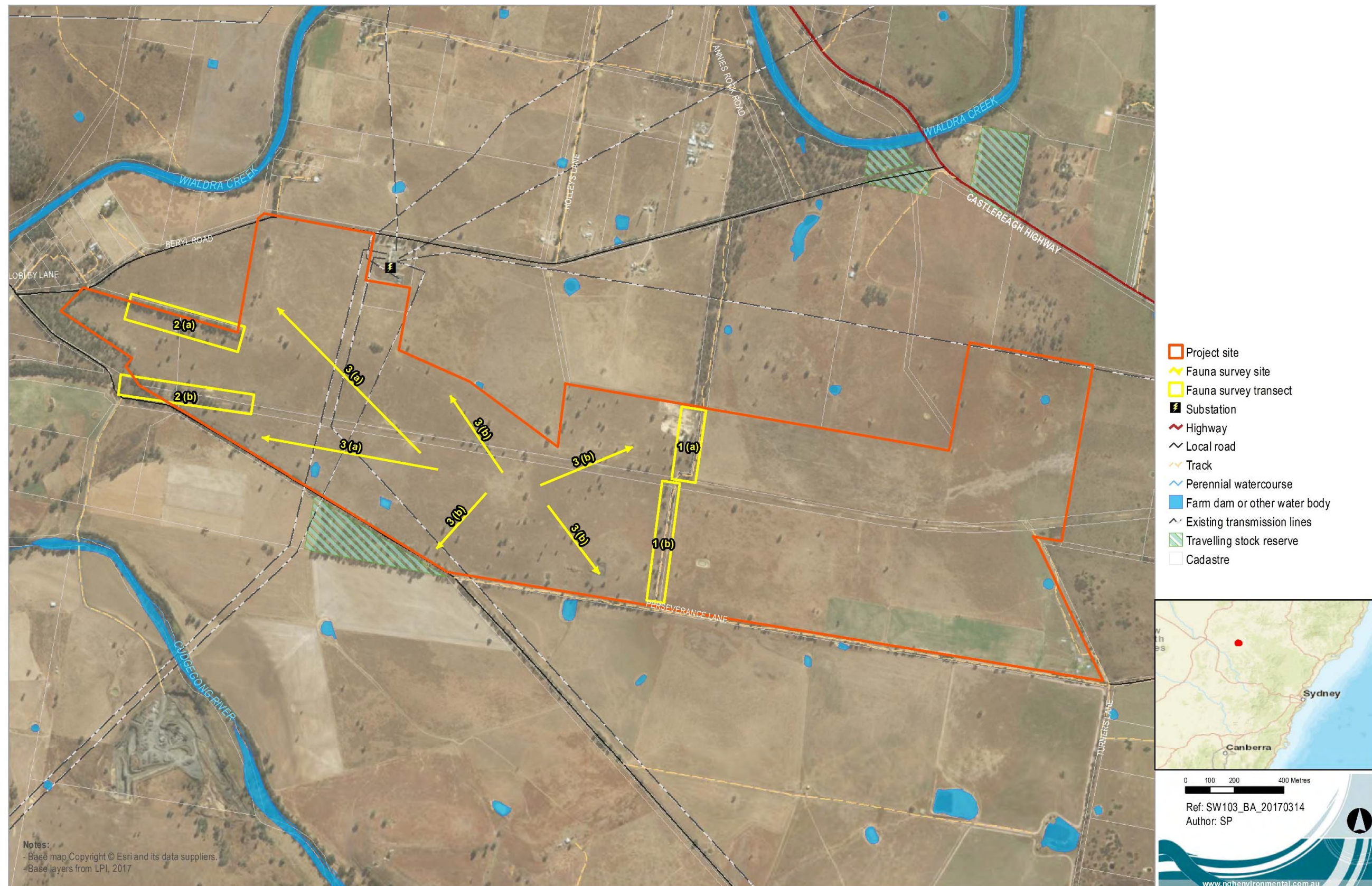


Figure 4-2 Fauna survey effort



Figure 4-3 Fauna geographic / habitat features within the site.

4.4 SUMMARY OF SPECIES CREDIT SPECIES

In summary, applying the above information to the BCC assessment. The following data (Table 4-5) were entered into the BCC.

Table 4-5 Summary of Species Credit Species assessed in the BCC.

Common name	Scientific name	Impacted by development?	ID method	Loss (ha)	Survey date
Ausfeld's Wattle	<i>Acacia ausfeldii</i>	No	Survey	0.00	1/11/2016
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	No	Survey	0.00	1/11/2016
Euphrasia arguta	<i>Euphrasia arguta</i>	No	Survey	0.00	1/11/2016
Koala	<i>Phascolarctos cinereus</i>	No	Survey	0.00	1/11/2016
Narrow Goodenia	<i>Goodenia macbarronii</i>	No	Survey	0.00	1/11/2016
Pine Donkey Orchid	<i>Diuris tricolor</i>	No	Survey	0.00	1/11/2016
Prasophyllum sp. Wybong	<i>Prasophyllum sp. Wybong</i>	No	Survey	0.00	1/11/2016
Regent Honeyeater	<i>Anthochaera phrygia</i>	No	Survey	0.00	1/11/2016
Silky Swainson-pea	<i>Swainsona sericea</i>	No	Survey	0.00	1/11/2016
Squirrel Glider	<i>Petaurus norfolcensis</i>	No	Survey	0.00	1/11/2016

5 EPBC MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on the 10 January 2016 (10km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. Relevant to biodiversity matters 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. A copy of the search results in attached at Appendix D.

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Four wetlands of international importance were returned from the protected matters report. The nearest of these (approximately 250 km from the development site) is the Macquarie Marshes. All other wetlands returned from the search are over 500km away. There is no apparent connectivity between the development site and the Macquarie Marshes.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Four 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 CEEC occurs within the development site. Based on the EPBC listing criteria, 4.43 ha of the CEEC occurs west of the development footprint (equivalent to Zone 1). It would not be impacted by the development (Figure 6-1). A referral to the Commonwealth is therefore not considered to be warranted in relation to a potential impact on the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland EEC.

The other three EEC's are not present within or near the proposal site.

5.3 THREATENED SPECIES

Twenty-nine threatened species were returned from the protected matters report. None of the listed species are considered to have the potential to utilise the habitats at the development site, based on either or both an assessment of the habitat conditions present at the site, or a lack of existing records in the database within close proximity (i.e. less than 15 km) to the site. A referral to the Commonwealth is therefore not considered to be warranted in relation to threatened species.

5.4 MIGRATORY SPECIES

Eight listed migratory species were returned from the protected matters report. None of these species are considered likely to occur at the site on a regular basis or rely on the habitats present. A referral to the Commonwealth is therefore not considered to be warranted in relation to migratory species.

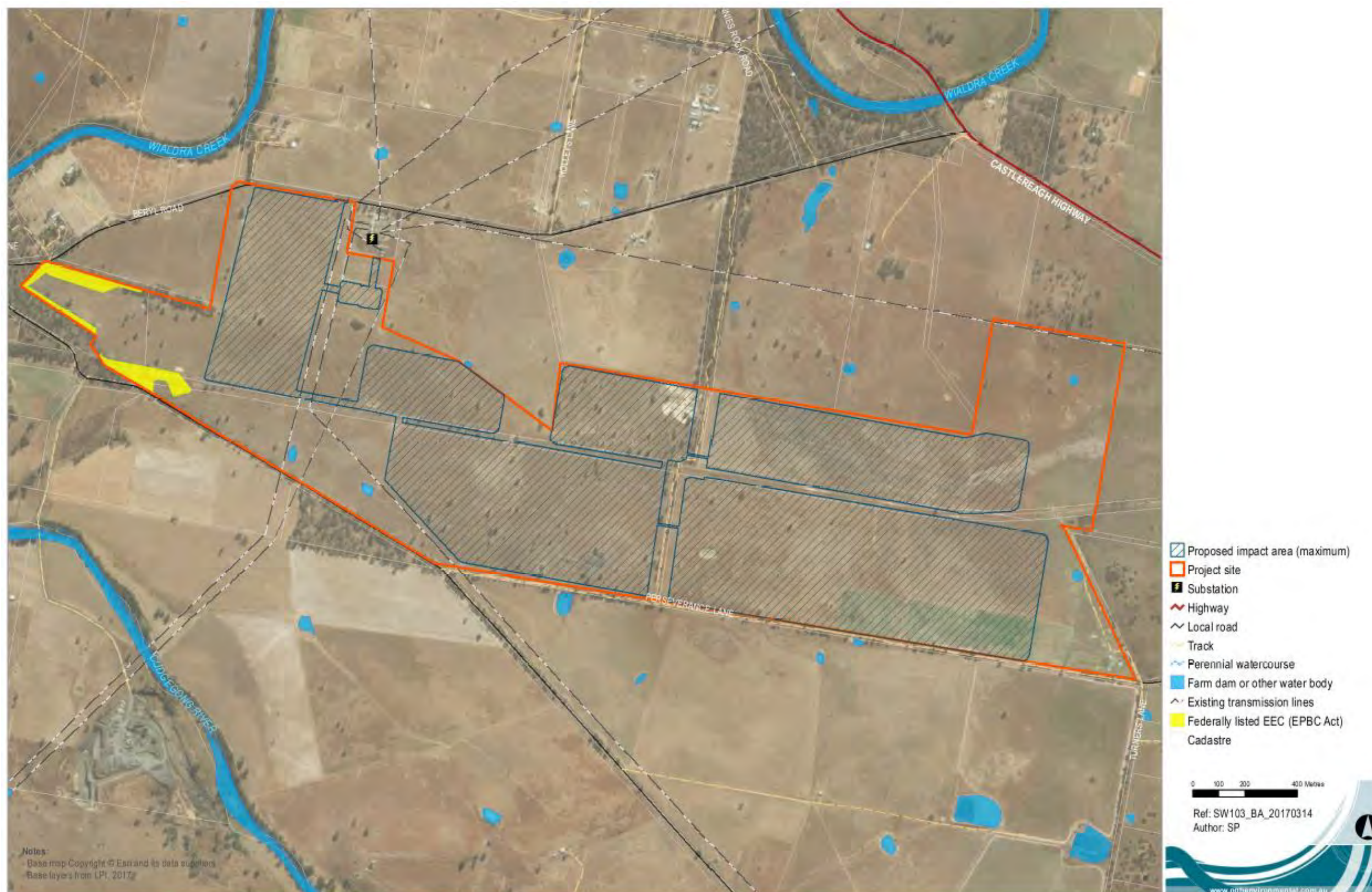


Figure 5-1 Mapped location of EPBC-listed Box Gum Woodland (CEEC)

6 AVOID AND MINIMISE IMPACTS

6.1 DIRECT IMPACTS

6.1.1 Site selection and planning phase

A preliminary constraints analysis was conducted by NGH Environmental (2016) which informed the site layout design. This analysis included identification of low, moderate and high environmental constraints, as summarised below. From this assessment, a development footprint was established which was designed to minimise impacts on the Zone 1 EEC/CEEC vegetation in the far-west of the project site, including avoidance of the small woodland patches in the west of the site which have the potential to support listed threatened species such as the Silky Swainson-pea and Pine Donkey Orchid.

After the first calculation of offset requirements, the layout was further scrutinised in terms of 'credit drivers'. The layout was further adapted:

- To remove all impacts on Zone 1 EEC/CEEC vegetation
- To reduce impacts on Zone 2 and 3 EEC, where they occur near the north-south laneway in the centre of the site. A 30m buffer either side of the fenced lane way was mapped and the development footprint excluded from this buffer.

The final design footprint is detailed in Figure 6-1. It allows for areas of better quality vegetation at the western corner of the project site (as well areas along the south-western boundary) to be avoided. These have been highlighted as potential offset / revegetation sites. They would contribute to local landscape connectivity.

6.1.2 Construction phase

The construction phase of the proposal has the potential to impact a number of biodiversity values of the site through habitat clearance and modification of habitat, refer to Table 6-1 below.

Table 6-1 Potential impacts to biodiversity during the construction phase

Impact	Frequency	Intensity	Duration	Consequence
Habitat clearance for permanent and temporary construction facilities (e.g. solar infrastructure, compound sites, stockpile sites, access tracks)	Regular/ Permanent	High	Construction phase	• Direct loss of native flora and fauna habitat. • Potential clearing of habitat outside of the development footprint. • Introduction and spread of noxious weeds and pathogens. • Injury and mortality to fauna during clearing of fauna habitat. • Disturbance to fallen timber, dead wood and bush rock.

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

Mitigation measures have considered methods of clearing, clearing operations, timing of construction and other measures that would minimise impacts of the project on biodiversity values.

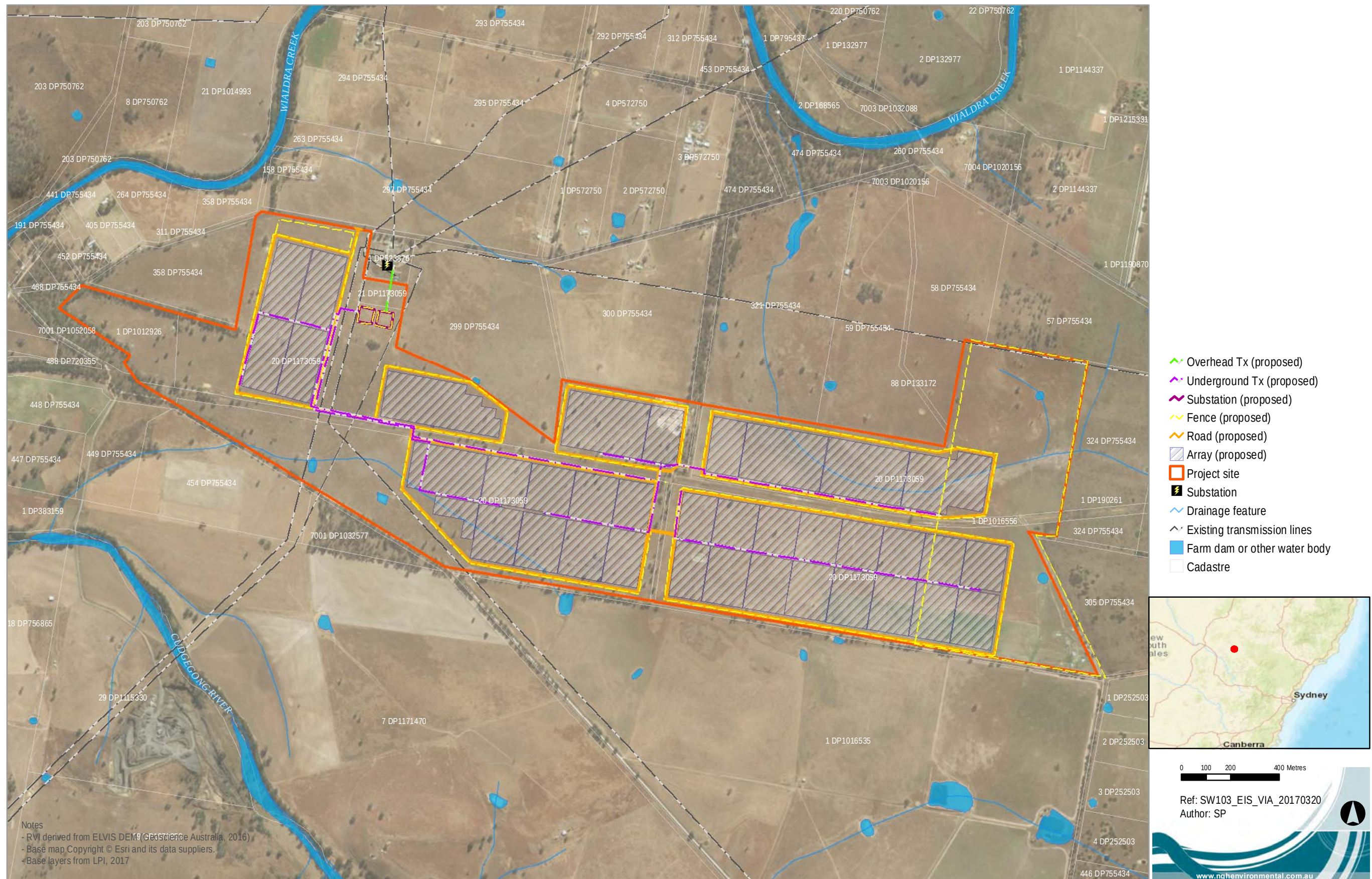


Figure 6-1 Final proposed development and operational footprint

Table 6-2 Measures proposed to avoid and minimise direct impacts of the project during the construction phase

Impact	Consequence	Measures to be implemented	Timing	Outcome
Removal or degradation of threatened and/or migratory species habitat	Impacts to hollow dependant fauna	- Clearing of Hollow-bearing trees within the development site avoided between June and January, to avoid the breeding season of hollow-dependant fauna including the Superb Parrot as well as the Large-eared Pit Bat and Corben's Long-eared Bat, which whilst considered unlikely to occur within the site, nevertheless may have some small potential as occurring within the site from time to time. The nominated clearing period above will also help to avoid the core hibernation period for the two bat species. - If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure these species do not occur.	Construction phase	Impacts to threatened hollow dependent species are minimised.
	- Direct loss of native flora and fauna habitat - Injury and mortality to fauna during clearing of fauna habitat. - Disturbance to fallen timber, dead wood and bush rock - Introduction and spread of noxious weeds and pathogens	- Preparation of a Flora and Fauna Management Plan (FFMP) that would incorporate protocols for: - Protection of native vegetation to be retained (including EEC) - Best practice removal and disposal of vegetation - Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist. Where possible, fallen timber with hollows is to be collected and placed into adjacent suitable habitats outside the development footprint. - The relocation of displaced fauna during clearing - Weed management, particularly noxious weeds - Pathogen management - Unexpected threatened species finds - Rehabilitation/stabilisation of disturbed areas	Pre-construction phase Construction phase	Minimise the impacts of habitat removal on native flora and fauna. Prevent spread of Noxious Weeds and pathogens.

Impact	Consequence	Measures to be implemented	Timing	Outcome
		The FFMP would form part of the Beryl Solar Farm Construction Environmental Management Plan (CEMP).		
Habitat clearance	Potential over clearing and/or damage of habitat outside of the development site.	- Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree that originates from outside of the development site. - 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.	Construction phase	Prevention of over-clearing

6.1.3 Operational phase

The operational phase of the project has potential to result in direct impact to biodiversity values. Direct impacts are as follows:

Table 6-3 Operational impacts on biodiversity values

Impact	Frequency	Intensity	Duration	Consequence
Existence of permanent solar infrastructure	Constant	Moderate	Operational phase	Collision risk to birds and microbats to exterior barbed-wire fencing.
Shading by solar array infrastructure	Variable throughout the day and season	Moderate	Operational phase	Potential to modify the growing characteristics of the existing ground cover through reduced sunlight exposure and evapotranspiration rates. As a worst case, areas of bare ground may develop and lead to erosion and sedimentation requiring additional planting or other control measures.

Measures to avoid and minimise impacts that may occur during the operational phase would be implemented as part of the project. Where practical, measures to avoid impacts on biodiversity during operation have been identified. Where impacts are unavoidable measures to minimise impacts would be implemented. Table 6-4 outlines the mitigation measures that would be implemented during operation, or to ensure the operational phase avoids and minimises impacts on biodiversity to the greatest extent possible.

Section 7 outlines the requirements for biodiversity offsets for those direct impacts that cannot be avoided as a result of the project.

Table 6-4 Measures proposed to avoid and minimise direct impacts of the project during the operational phase

Impact	Consequence	Measures to be implemented	Timing	Outcome	Responsibility
Existence of permanent solar infrastructure	Collision risks to birds and microbats on solar infrastructure and barbed wire fencing	Use non barbed-wire on exterior fencing where possible.	Operational phase	Minimise impacts to fauna and flora as a result of infrastructure.	Solar Operator Farm
Shading by solar array infrastructure	Potential to modify the growing characteristics of the existing ground cover through reduced sunlight exposure and evapotranspiration rates.	A groundcover management plan would be developed and implemented to ensure the existing ground cover is maintained during operation of the solar farm.	Operational phase	Retention of existing ground cover	Solar Operator Farm
Appropriate landscaping	Increase the quality of habitat for native flora and fauna species	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.	Operational phase	Increase/improve native species diversity and connectivity.	Solar Operator Farm

6.2 INDIRECT IMPACTS

Vegetation and habitat removal are considered *direct impacts* of the project.

Indirect impacts could occur as a consequence of the proposal, and can include impacts such as soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise. A number of indirect impacts to biodiversity during construction and operation have been identified in Table 6-5 below.

6.2.1 Site selection and planning phase

During the detailed design phase of the proposal, the layout of the solar farm will be further refined to avoid as much vegetation clearing as possible. This, in turn, minimises potential indirect impacts resulting from the clearing. This is consistent with the principles of avoiding and minimising biodiversity impacts, as outlined under the Framework for Biodiversity Assessment.

6.2.2 Construction phase

The construction phase of the project can have a number of indirect impacts on biodiversity values. Indirect impacts are outlined in Table 6-5 below.

Table 6-5 Indirect impacts on biodiversity during the construction phase.

Impact	Frequency	Intensity	Duration	Consequence
Accidental spills and contamination from construction activities (including compound sites)	Rare	Moderate	Construction phase	Pollution of aquatic habitats.
Earthworks	Regular	Moderate	Construction phase	Erosion and sedimentation of aquatic habitats.
Noise	Regular	Low	Construction phase	Construction machinery and activities may disturb local fauna.
Dust generation	Regular	Low	Construction phase	Inhibit the function of plant species and communities, waterways.
Light spills during night works	Rare	Low	Construction phase	Night works may alter fauna activities/movements.
General construction activities	Regular	Moderate	Construction phase	Feral pest, weed and/or pathogen encroachment into areas adjoining the development site.
Increased Vehicle Traffic	Regular	Low	Operational phase	Increase potential for fauna mortality through vehicle strike.

Table 6-6 Measures proposed to avoid and minimise indirect impacts of the project during the construction phase

Impact	Measures to be implemented	Timing	Outcome	Responsibility
Accidental spills and from contamination construction activities	- Carry out refuelling of plant and equipment, chemical storage and decanting at least 50 m away from aquatic habitats in impervious bunds. - Ensure that dry and wet spill kits are readily available.	Construction phase	Prevent/minimise pollution of ephemeral waterways and dams, and sensitive adjacent habitat.	Contractor
Earthworks	The draft Erosion and Sediment Control Plan would be finalised in conjunction with the final design and will be implemented.	Construction phase	Prevent/minimise erosion and sedimentation of ephemeral waterways and dams, and sensitive adjacent habitat.	Contractor
Noise pollution	Avoid night works as much as possible, and avoid altogether where in close proximity to woodland habitats on adjacent properties.	Construction phase	Prevent disturbance to local fauna at the habitat corridor location.	Contractor
Dust generation	The Construction Environmental Management Plan will include measures to prevent dust spreading to nearby habitats.	Construction phase	Prevent dust inhibiting the function of plant species and habitats adjacent to the development site.	Contractor
Light spill	- Avoid nightworks. - If night work is unavoidable, ensure any floodlights are directed away from adjacent off site vegetation.	Construction phase	Prevent disturbance to local fauna.	Contractor
General construction activities	Weed and hygiene protocols will be prepared and implemented as part of the CEMP for the proposal.	Construction phase	Prevent feral pest, weed and/or pathogen encroachment into vegetation adjoining project area.	Proponent Contractor
Increased Vehicle Traffic	Awareness training during site inductions, enforcement of site speed limits.	Operational phase	Minimise fauna strikes.	Proponent Contractor

6.2.3 Operational phase

The operational phase of the proposal can have a number of indirect impacts on biodiversity values. Indirect impacts are outlined in Table 6-7 below.

Table 6-7 Indirect impact on biodiversity during the operational phase.

Impact	Frequency	Intensity	Duration	Consequence
Light spill	Occasional	Low	Operational phase	Alter movements of fauna through the landscape
Weed encroachment	Regular	Moderate	Operational phase	Ingress of weeds along the boundary of the development
Increased Vehicle Traffic	Regular	Low	Operational phase	Increase potential for fauna mortality through vehicle strike
Solar Array Microclimate	Regular	Moderate	Operational phase	Alter movement of fauna within site and through the landscape, potential shelter habitat for pest species
Mobilisation of sediments	Irregular	Moderate	Operational phase	Sedimentation of adjacent waterways/aquatic habitats

Table 6-8 Measures proposed to avoid and minimise indirect impacts of the proposal during the operational phase

Impact	Consequence	Measures to be implemented	Timing	Outcome	Responsibility
Light spill	Alter movements of fauna through the landscape	Direct lights away from adjacent habitat.	Operational phase	Minimise impacts to fauna movements and activity	Solar Farm Operator
Weed encroachment	Ingress of weeds along the boundary of the project area	Weed management protocols will be prepared and implemented.	Operational phase	Prevent spread of weeds	Solar Farm Operator
Increased Vehicle Traffic	Increase potential for fauna mortality through vehicle strike	Awareness training during site inductions regarding enforcing site speed limits.	Operational phase	Minimise fauna strikes	Solar Farm Operator
Fences	Alter movement of fauna within site and through the landscape	Ensure that fences enclose operational areas only and do not block fauna movement along adjacent habitats.	Operational phase	Ensure no restriction of fauna movement	Solar Farm Operator
Mobilisation of sediments	Sedimentation of downstream habitats	A groundcover management plan would be developed and implemented to ensure a stable ground cover during operation of the solar farm, minimising erosion and adverse water quality/aquatic habitat impacts.	Pre-construction phase	No degradation to adjacent waterways	Solar Farm Operator

6.3 CUMULATIVE 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 2001), and the removal of vegetation for this proposal 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 proposal is assessed according to approved methodologies such as the FBA. Long term mechanisms like offsetting through the FBA, are structured to address these ongoing impacts.

The BCC generated a combined total of 684 ecosystem credit points for impacts to 17.13 ha of moderate to good and low condition EEC. Additionally, the project would impact 112.93 ha of non-EEC vegetation. It is noted that the solar array panels will modify not remove vegetation through shading, however for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed.

A Biodiversity Offset Strategy (BOS) is considered to be required as part of the approval of the proposal. The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by:

- (a) acquiring or retiring credits under the BioBanking scheme in the TSC Act;
- (b) making payments into an offset fund that has been established by the NSW Government;
- or
- (c) providing suitable supplementary measures.

A Biodiversity Offset Strategy (BOS) will therefore consider means to provide for the long term management of native vegetation, to offset the impacts of this project.

7 IMPACT SUMMARY

7.1 AREAS NOT REQUIRING ASSESSMENT

Areas without native vegetation or aquatic features do not need to be assessed further. At the development site these include treeless paddock areas with an understory of exotic pasture grasses or previously disturbed sites that have been colonised by exotic species with little to no native component. Furthermore, areas without any vegetation such as roads, existing infrastructure and other developments (such as the possible old quarry site) do not require further assessment. Essentially, for the project site this means all areas within the project area that are not an EEC. The total area of land within the project area not requiring further assessment is approximately 193.75 ha.

7.2 AREAS NOT REQUIRING AN OFFSET

7.2.1 *Impacts on native vegetation*

Offsets are not required where the project would impact on PCTs that:

- a) Have a site value score of <17; or
- b) EEC where it has a site value score of <17 (as per NSW Biodiversity Offsets Policy for Major Projects: Practice Note)
- c) Are not identified as CEEC or EEC.

Based on the above, the areas of the site mapped as Zones 2 and 3 will require offsetting. It is noted that:

- Impacts have been reduced to 0 ha in Zone 1 and therefore this zone no longer generates credits and has been deleted from the assessment – no offsets generated.
- No credits are returned for the low condition EEC in Zone 4– no offsets generated.
- Being neither EEC nor threatened species habitat, in accordance with the FBA methodology, offsets are not required for Zone 5– no offsets generated.

7.2.2 *Impacts on species and populations*

Offsets are not required where the project:

- a) Impacts on non-threatened species and populations that do not form part of a CEEC or EEC
- b) Impacts on threatened species habitat associated with a PCT within a vegetation zone with a site value score of <17

Non-threatened species or populations, or threatened species habitat with a site value of <17 do not form part of the offset requirement. With regard to the native vegetation at the site, the habitat provided by the derived grassland vegetation in Zones 4 and 5 do not require an offset as the vegetation is not part of a CEEC or EEC and is not regarded as constituting important habitat for any listed threatened species.

Species credit species

As discussed in Section 4.3.4, the following species credit species are considered unlikely to occur within the habitats within the development site:

- Ausfeld's Wattle
- Brush-tailed Phascogale
- Euphrasia arguta
- Narrow Goodenia
- Pine Donkey Orchid
- Pink-tailed Worm Lizard
- Prasophyllum sp. Wybong
- Regent Honeyeater
- Silky Swainson-pea
- Squirrel Glider

Impacts to these species are unlikely and offsets are not required.

Hollow-bearing trees

Hollow-bearing trees provide potential roosting habitat for some species of microbats, parrots, owls and arboreal mammals. Hollow-dependant fauna species within the site (such as possums) are likely to be impacted due to the proposal. However, the overall impact on hollow-dependent fauna in the development site is likely to be low given the lack of observations of any listed threatened hollow-dependant fauna, and the overall low number of common arboreal fauna species observed during the site investigations. Mitigation measures have been recommended to address the clearing risks to resident species (Section 6).

Hollow-bearing trees to be impacted is assessed within the BCC, via the plot data collected for each vegetation zone. This data adds to the value of the habitat to be removed, thereby requiring greater number of credits to be retired. No specific requirement to offset hollows has been identified.

7.3 PCTS AND SPECIES POLYGONS REQUIRING AN OFFSET

7.3.1 Impacts on native vegetation

Offsets are required where the project would impact on any native vegetation that:

- a) is identified as a CEEC that is specifically nominated in the SEARs for the Major Project as a CEEC for which an impacts does not require further consideration;
- b) is identified as an EEC that has a site value score ≥ 17 , unless it is an EEC that is specifically nominated in the SEARs for the project as an EEC for which an impact requires further consideration; or
- c) is associated with threatened species habitat and in a vegetation zone that has a site value score ≥ 17 .

The project would have a direct impact on one vegetation community listed as an EEC under the TSC Act, and which has generated ecosystem credits and therefore requires offsetting.

It is noted that for the purposes of this assessment, the areas of native derived grassland over which the panels will be installed are regarded as being completely and permanently removed. Whilst it is

acknowledged that the installation of solar panels over native grasslands has, on other projects, enabled the existing grassland community to stay relatively intact, and that upon decommissioning and removal of the solar farm, the grassland may revert back to its pre-construction condition, until further direction is provided by OEH, it must be taken that the solar panel installation will in effect, represent a complete and permanent removal of the grassland habitat, and thereby, require offsetting in accordance with the requirements of the FBA.

Table 7-1 Extent of vegetation communities within the development site that require offsetting

Vegetation Community	Threatened Ecological Community (TSC Act or EPBC Act)?	PCT Id	Biometric vegetation condition	Site value score	Extent of vegetation (ha) impacted in development site
PCT #281 BVT CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	EEC - TSC Act CEEC – EPBC Act	281	Moderate – good	66.67	0
PCT #281 BVT CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	EEC - TSC Act	281	Moderate - good	67.33	0.99
PCT #281 BVT CW111 Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions	EEC - TSC Act	281	low	47.33	16.14
Total Vegetation	-	-	-		17.13

7.3.2 Impacts on species and populations

Offsets are required where the project would impact on:

- Any critically endangered species;
- A threatened species or population that was not specifically nominated in the SEARs as a species or population for which an impact requires further consideration; or
- Threatened species habitat associated with a PCT in a vegetation zone with a site value score of ≥ 17 .

Ecosystem Credit Species

The BCC found that 23 threatened ecosystem credit fauna species were predicted to occur within the Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions PCT and thus require offsets, including:

Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis subsp. gularis</i>
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus subsp. victoriae</i>
Bush Stone-curlew	<i>Burhinus grallarius</i>
Diamond Firetail	<i>Stagonopleura guttata</i>
Flame Robin	<i>Petroica phoenicea</i>
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis subsp. temporalis</i>
Little Eagle	<i>Hieraaetus morphnoides</i>
Little Lorikeet	<i>Glossopsitta pusilla</i>
Little Pied Bat	<i>Chalinolobus picatus</i>
Little Whip Snake	<i>Suta flagellum</i>
Masked Owl	<i>Tyto novaehollandiae</i>
Painted Honeyeater	<i>Grantiella picta</i>
Powerful Owl	<i>Ninox strenua</i>
Scarlet Robin	<i>Petroica boodang</i>
Speckled Warbler	<i>Chthonicola sagittata</i>
Spotted Harrier	<i>Circus assimilis</i>
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>
Square-tailed Kite	<i>Lophoictinia isura</i>
Swift Parrot	<i>Lathamus discolor</i>
Turquoise Parrot	<i>Neophema pulchella</i>
Varied Sittella	<i>Daphoenositta chrysoptera</i>
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>

Four vegetation zones within the Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions had a site value score >17 and requires offsets for the above species.

Species credit species

The BCC found that 10 threatened species credit species were predicted to occur within the Rough-barked Apple – Red Gum – Yellow Box Woodland on alluvial clay to loam soils on valley flats in the NSW SWS and BBS Bioregions PCT, including:

Ausfeld's Wattle	<i>Acacia ausfeldii</i>
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>
Euphrasia arguta	<i>Euphrasia argute</i>
Koala	<i>Phascolarctos cinereus</i>
Narrow Goodenia	<i>Goodenia macbarronii</i>
Pine Donkey Orchid	<i>Diuris tricolor</i>
Pink-tailed Legless Lizard	<i>Aprasia parapulchella</i>
Prasophyllum sp. Wybong	<i>Prasophyllum sp. Wybong</i>
Regent Honeyeater	<i>Anthochaera Phrygia</i>
Silky Swainson-pea	<i>Swainsona sericea</i>
Squirrel Glider	<i>Petaurus norfolcensis</i>

None of the above listed threatened flora species were recorded or considered likely to occur within the development site. The Silky Swainson-pea and Pine Donkey Orchid were recorded in habitats outside of the development impact area and would be protected during construction works. Therefore, under the BCC assessment, no flora species require offsets.

Similarly, none of the listed threatened fauna species were recorded during surveys in the project area, and based on the habitat values recorded at the site, none are considered likely to occur on a regular/permanent basis, or rely on the site as important habitat. Therefore, under the BCC assessment, no fauna species require offsets.

7.4 IMPACTS REQUIRING FURTHER CONSIDERATION

7.4.1 Impacts on landscape features

There would be no impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas. There would be no impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state.

7.4.2 Impacts on native vegetation

Impacts on native vegetation that require further consideration include impacts on:

- any CEEC, unless the CEEC is specifically excluded by the SEARs
- an EEC specifically nominated in the SEARs as an EEC that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by development.

No EECs were specifically nominated in the SEARS as an EEC that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by development. The Box-Gum Woodland EEC was nominated in the SEARS as requiring assessment under the FBA and this has been addressed in this BAR. Appendix G of the OEH Environmental Assessment Requirements specifically exclude the Box-Gum Woodland EEC from requiring further consideration and as such, the provision of the information required in Section 9.2.5.2 of the FBA is not required.

The Zone 1 vegetation polygon mapped as being in moderate/good condition, meets the listing criteria for the EPBC CEEC. This area of CEEC would not be impacted on by the proposal and no further consideration is required as it would not be impacted by the proposal.

7.4.3 Impacts on threatened species

Further consideration is required where the project would impact:

- a) Any critically endangered species;
- b) A threatened species or population that is specifically nominated in the SEARS as a species or population that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development; or
- c) a threatened species that has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas.

The SEARS did not identify any threatened species or populations as likely to become extinct or have their viability significantly reduced in the IBRA subregion if impacted on by the proposal. No threatened species were detected that had not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas.

Listed entities with the potential to occur at the site have been described in Section 4. None of these species were recorded at the site, and are considered unlikely to utilise the site on a regular or permanent basis, and the site is regarded as not constituting important habitat for any of these species. Notwithstanding this, specific mitigation measures have been recommended in Section 6 to avoid impacts to these species in the unlikely event that they would occur at the site. No further assessment for any of these species is considered necessary.

7.4.4 Impacts on critical habitat

The project area does not contain any areas that have been declared as critical habitat under either the TSC Act or EPBC Act.

7.4.5 Impacts to EPBC listed entities

As stated in Section, no impacts to any EPBC listed threatened entities are considered likely.

7.5 ECOSYSTEMS AND SPECIES CREDITS

A total of 684 ecosystem credits (from Zones 2 and 3) have been generated for the development site, whilst no species credits were generated (BCC Major Project 0035/2017/4165MP Version 1). The BCC full credit report is provided in Appendix A.

Ecosystem credits

The ecosystem credits required are summarised in Table 7-3. It is noted that:

- Impacts have been reduced to 0 ha in Zone 1 and therefore this zone no longer generates credits and has been deleted from the assessment.
- No credits are returned for the low condition EEC in Zone 4.
- Being neither EEC nor threatened species habitat, in accordance with the FBA methodology, offsets are not required for Zone 5.

The total credit requirement is therefore 684 (from Zones 2 and 3). This can be retired as physical offsets in a range of PCTs as shown in Appendix A. Other options include purchasing this number of credits from the Biobanking credit market.

Species credits

No species credits are required.

Table 7-2 Credit report

Vegetation Management Zone	Biometric veg code / PC type code	Plant community type name	Management zone area (ha)	Loss in Landscape Value	Loss in site value score	EEC Offset Multiplier	Credits required for Threatened species	Threatened Species with highest credit requirements	TS offset multiplier	Ecosystem credits required
2	PCT #281 BVT: CW111	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	0.99	14.20	67.33	3.0	54	Powerful Owl	3.0	54
3	PCT #281 BVT: CW111	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	16.14	14.20	47.33	3.0	0	NA	0.0	630
4	PCT #281 BVT #CW111	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	95.04	14.20	10.00	1.0	1079	Powerful Owl	3.0	0
5 ¹	PCT #281 BVT: CW111	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	17.89	14.20	20.67	1.0	341	Powerful Owl	3.0	341

¹ While included in the credit profile, this zone is neither EEC nor threatened species habitat and therefore is not considered to require offsets under the FBA.

8 BIODIVERSITY CREDIT REPORT

The final credit report for the development is provided at Appendix A. The credit extract report produced by the BCC is provided overleaf. The report includes the requirement for 1,025 ecosystem credits, and nil species credits. However, it is noted that under the FBA, only Zones 2 and 3 would require offsets. These zones generate 684 credits.

Limitations that should be understood when interpreting these credit results include:

- Surveys have been used to identify which species would be impacted by the development and offset. However, surveys provide a snap shot and not a definitive answer to the question of whether a species may occur at some time and be impacted. It is accepted that the species determined unlikely to be impacted may at some time use the site. However, the site is not considered important habitat for these species and no areas of impact have been entered for them. This is justified in Section 4.

BioBanking Credit Calculator



Ecosystem credits

Proposal ID : 0035/2017/4165MP
Proposal name : Beryl Solar Farm
Assessor name : Brooke Marshall
Assessor accreditation number : 0035
Tool version : v4.0
Report created : 22/03/2017 11:26

Assessment area name	Land use zone	Vegetation zone name	Vegetation type name	Condition	Final flag status	Management zone name	Management zone area	Current area value	Future area value	Loss in area value	Credit required for biodiversity	Credit required for TS	TS with highest credit requirement	Average species risk	Species TS value	Final credit requirement for management zone	
One	14.20	CW111_Myoparia-Golden-Pine	Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to clay soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Moderate-Good	Yes	2		5.89	17.33	0.00	11.44	34	34	Powerful Owl	100.00	3.00	34
One	14.20	CW111_L_S	Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to clay soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Low	Yes	3		16.14	47.33	0.00	31.19	930	9		0.00	0.00	930
One	14.20	CW111_Myoparia-Golden-grassland	Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to clay soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Moderate-Good	No	4		33.24	10.00	0.00	23.24	0	1,350	Powerful Owl	0.00	3.00	0
One	14.20	CW111_Myoparia-Golden-Other	Rough-barked Apple - red gum - Yellow Box woodland on alluvial clay to clay soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Moderate-Good	No	5		11.89	20.67	0.00	8.78	0	341	Powerful Owl	0.00	3.00	341

9 CONCLUSIONS

NGH Environmental has prepared this BAR on behalf of First Solar Pty Ltd for the Beryl Solar Farm near the township of Gulgong, NSW. The purpose of this BAR was to address the requirements of the FBA, developed for Major Projects, and to address the biodiversity matters raised in the SEARs.

In this BAR, biodiversity impacts have been assessed through comprehensive mapping and assessment completed in accordance with the requirements in Appendix 4 of the FBA. The assessment identified one threatened species (not listed as a Species Credit species) within the development site and adjacent vegetation, which will be avoided. The project site is derived from Box Gum Woodland EEC vegetation. Areas of better quality EEC have been avoided through successive layout revisions. Mitigation measures which have been outlined in Section 6 will assist to further to reduce the impacts to biodiversity. Residual impacts of the proposal include the generation of 684 ecosystem credits; generated by Zones 2 and 3. This excludes vegetation that is both non-EEC and does not provide threatened species habitat, in accordance with the FBA.

A Biodiversity Offset Strategy (BOS) is considered to be required as part of the approval of the proposal. The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by:

- (d) acquiring or retiring credits under the BioBanking scheme in the TSC Act;
- (e) making payments into an offset fund that has been established by the NSW Government;
- or
- (f) providing suitable supplementary measures.

Regarding offsetting the impacts of this proposal it is noted that:

- The solar array panels will modify not remove vegetation through shading, however for the purpose of this assessment, 100% vegetation removal within the solar arrays has been assumed.
- Areas existing within the project site that include better quality EEC at the western corner of the project site as well low condition EEC along the south-western boundary. These areas would be appropriate offset / revegetation sites. They would contribute to local landscape connectivity.

A BOS is proposed to be developed in consultation with OEH to ensure the actual impacts of the development would be appropriately offset, in accordance with the FBA.

10 REFERENCES

- Cropper, S.C. (1993). *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.
- DECC (2002) Descriptions for NSW (Mitchell) Landscapes Version 2. NSW Department of Environment and Climate Change.
- (DECCW) Department of Environment, Climate Change and Water NSW. 2010. *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney.
- DoE (2016). Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: <http://www.environment.gov.au/sprat>.
- Environment Australia (2001) A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.
- NSW Scientific Committee (2001). Clearing of native vegetation – key threatening process listing.
- OEH (2016) NSW Vegetation Information System Classification Database. Accessed online via secure login at: <http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx>.
- OEH (2014). Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Proposals. Published by Office of Environment and Heritage for the NSW Government.
- (OEH) (2016). Threatened species profiles. [Online]. Available from: <http://www.environment.nsw.gov.au/threatenedSpeciesApp>.

APPENDIX A CREDIT PROFILE

As of 09/02/2017.

Proposal ID for the assessment: 0045/2017/4165MP Version 2

Assessment type: 'Major Project'.

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 22/03/2017

Time: 11:27:14AM

Calculator version: v4.0

Major Project details

Proposal ID: 0035/2017/4165MP
Proposal name: Beryl Solar Farm
Proposal address: suite 1, 216 carp st Bega NSW 2550

Proponent name: First Solar (Australia) Pty Ltd
Proponent address: Level 3, 16 Spring Street Sydney NSW 2000
Proponent phone: 0290027710

Assessor name: Brooke Marshall
Assessor address: 1/216 Carp St Bega NSW 2250
Assessor phone: 64928333
Assessor accreditation: 0035

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	130.06	1,025.23
Total	130.06	1,025

CREDIT PROFILES

1. Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, (CW111)

Number of ecosystem credits created
IBRA sub-region

395
Upper Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, (CW111)	Upper Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
Apple Box - Blakely's Red Gum most valley and footslopes grass-forb open forest of the NSW South Western Slopes Bioregion, (CW103)	
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)	
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)	
Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139)	
Blakely's Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW South Western Slopes Bioregion, (CW209)	
White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211)	
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)	
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)	
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)	
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (CW225)	
Yellow Box grassy tall woodland on alluvium or pama loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)	
Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231)	
White Box - Blakely's Red Gum - Long-leaved Box - Nortons Box - Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South Western Slopes Bioregion, (CW320)	
Riparian Blakely's Red Gum - box - shrub - sedge - grass tall open forest of the central NSW South Western Slopes Bioregion, (CW295)	
Red Stringybark - Blakely's Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South Western Slopes Bioregion, (CW285)	
Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	
Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion, (CW330)	

2. Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, (CW111)

Number of ecosystem credits created 630
 IBRA sub-region Upper Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Apple Box - Blakely's Red Gum moist valley and footslopes grass-forb open forest of the NSW South Western Slopes Bioregion, (CW103)	Upper Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion, (CW111)	
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112)	
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)	
Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139)	
Blakely's Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW South Western Slopes Bioregion, (CW209)	
White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211)	
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)	
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215)	
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216)	
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (CW225)	
Yellow Box grassy tall woodland on alluvium or pama loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)	
Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231)	
White Box - Blakely's Red Gum - Long-leaved Box - Nortons Box - Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South Western Slopes Bioregion, (CW320)	
Riparian Blakely's Red Gum - box - shrub - sedge - grass tall open forest of the central NSW South Western Slopes Bioregion, (CW295)	
Red Stringybark - Blakely's Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South Western Slopes Bioregion, (CW285)	
Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	
Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion, (CW330)	

Summary of species credits required

No species credits are required

APPENDIX B SEARS

The project is considered State Significant Development and requires assessment under Part 4.1 of the EP&A Act. Biodiversity factors are to be assessed in an EIS, as per the Secretary Environmental Assessment Requirements (SEARs) for environmental impact assessment. A Final SEARs was provided by the Department of Planning and Environment on 25 January 2017 (application number SSD8183).



Our ref: SSD 8183

Mr Tom Best
First Solar (Australia) Pty Ltd
Level 3, 16 Spring Street
SYDNEY NSW 2000

Dear Mr Best

**Beryl Solar (SSD 8183)
Environmental Assessment Requirements**

I have attached the Environmental Assessment Requirements for the preparation of an Environmental Impact Statement (EIS) for the Beryl Solar Farm.

The requirements are based on the information you have provided to date, and have been prepared in consultation with the relevant government agencies. The agencies comments are attached for your information (see Attachment 2).

Please note that the Department may alter these requirements at any time, and that you must consult further with the Department if you do not lodge a development application and EIS for the project within the next two years.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will also require approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment and Energy in Canberra (02 6274 1111 or www.environment.gov.au).

Please contact the Department at least two weeks before you plan to submit the development application and EIS for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1AA, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the required number of copies of the EIS.

It is important for you to recognise that the Department will review the EIS for the project before putting it on public exhibition. If it fails to adequately address these requirements, you will be required to submit an amended EIS.

Yours sincerely

25/1/17

Clay Preshaw
A/Director
Resource Assessments
(as nominee of the Secretary)

Environmental Assessment Requirements

State Significant Development

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*

Application Number	SSD 8183
Proposal	Beryl Solar which includes: • the construction and operation of a solar photovoltaic (PV) generation facility with an estimated capacity of 95 MW; and • associated infrastructure, including a grid connection.
Location	Beryl Road, Beryl (Mid-Western Regional Council)
Applicant	First Solar (Australia) Pty Ltd
Date of Issue	25 January 2017
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i>. In particular, the EIS must include: • a full description of the development, including: – details of construction, operation and decommissioning; – a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); – a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development; • a strategic justification of the development focusing on site selection and the suitability of the proposed site; • an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development; – an assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; – a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development; • a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and • the reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the <i>Environmental Planning and Assessment Regulation 2000</i>, 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 <i>Environmental Planning and Assessment Regulation 2000</i>); and

	the consent in writing of the owner of the land (as required in clause 49(1)(b) of the <i>Environmental Planning and Assessment Regulation 2000</i>).
Specific Issues	The EIS must address the following specific issues: Biodiversity – including an assessment of the likely biodiversity impacts of the development, (including but not limited to the impacts on Box Gum Woodland endangered ecological community, <i>Euphrasia arguta</i>, <i>Prasophyllum sp. Wybong</i>, Bluegrass (<i>Dichanthium setosum</i>), Pink Donkey Orchid (<i>Diuris tricolor</i>), Regent Honeyeater (<i>Anthochaera phrygia</i>), Swift Parrot (<i>Lathamus discolor</i>), and Silky Swainson-pea (<i>Swainsona sericea</i>)), having regard to the <i>NSW Biodiversity Offsets Policy for Major Projects</i>, and in accordance with the <i>Framework for Biodiversity Assessment</i>, unless otherwise agreed by the Department; 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; 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; Visual – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners; Noise – including an assessment of the construction noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG) and operational noise impacts in accordance with the <i>NSW Industrial Noise Policy</i> (INP), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria; Transport – including an assessment of the site access route (including Castlereagh Highway and Beryl Road), site access point, rail safety issues 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); Water – including: - an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses (including the Cudgegong River and Wialdra Creek), wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; - details of water supply arrangements; and - a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom 2004); Hazards and Electromagnetic Interference – an assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) <i>Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields</i>. Socio-Economic – including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.

Consultation	In preparing the EIS for the development, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Mid-Western 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.
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Environmental Planning Instruments, Policies, Guidelines & Plans

Biodiversity

[Framework for Biodiversity Assessment \(OEH\)](#)
[NSW Biodiversity Offsets Policy for Major Projects \(OEH\)](#)
[Threatened Species Assessment Guidelines - Assessment of Significance \(OEH\)](#)
[Biosecurity Act 2015](#)
[Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings \(DPI\)](#)
[Policy and Guidelines for Fish Habitat Conservation and Management \(DPI\)](#)

Heritage

[Aboriginal Cultural Heritage Consultation Requirements for Proponents \(OEH\)](#)
[Code of Practice for Archaeological Investigations of Objects in NSW \(OEH\)](#)
[Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW \(OEH\).](#)
[NSW Heritage Manual \(OEH\)](#)

Land

[Primefact 1063: Infrastructure proposals on rural land \(DPI\)](#)
[Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry \(ARENA\)](#)
[Local Land Services Act 2013](#)
[Australian Soil and Land Survey Handbook \(CSIRO\)](#)
[Guidelines for Surveying Soil and Land Resources \(CSIRO\)](#)
[The land and soil capability assessment scheme: second approximation \(OEH\)](#)

Noise

[NSW Industrial Noise Policy \(EPA\)](#)
[Interim Construction Noise Guideline \(EPA\)](#)
[NSW Road Noise Policy \(EPA\)](#)

Transport

[Guide to Traffic Generating Developments \(RTA\)](#)
[Road Design Guide \(RMS\) & relevant Austroads Standards](#)
[Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development](#)

Water

[Managing Urban Stormwater: Soils & Construction \(Landcom\)](#)
[Floodplain Development Manual \(OEH\)](#)
[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 \(DPI Water\)](#)

Waste

[Waste Classification Guidelines \(EPA\)](#)

Electromagnetic Interference

[ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields](#)

Environmental Planning Instruments

[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. 44 – Koala Habitat Protection](#)
[State Environmental Planning Policy No. 55 – Remediation of Land](#)
[Mid-Western Regional Local Environmental Plan 2012](#)

APPENDIX C SPECIES LISTS

C.1 FLORA SPECIES RECORDED AT THE SITE

Scientific Name	Common Name
CLASS FILICOPSIDA	
Pteridaceae	
<i>Cheilanthes sieberi</i>	
Marsileaceae	
<i>Marsilea drummondii</i>	Common nardoo
CLASS MAGNOLIOPSIDA	
SUBCLASS MAGNOLIIDAE	
Apiaceae	
<i>Daucus glochidiatus</i>	Native Carrot
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
Asteraceae	
* <i>Arctotheca calendula</i>	Capeweed
* <i>Bidens subalternans</i>	Greater Beggar's Ticks
<i>Calotis cuneifolia</i>	Purple Burr-daisy
<i>Calotis lappulacea</i>	Yellow Burr-daisy
* <i>Carduus pycnocephalus</i>	Slender Thistle
* <i>Carthamus lanatus</i>	Saffron Thistle
<i>Cassinia arcuata</i>	Sifton Bush
* <i>Centaurea melitensis</i>	Maltese Cockspur
* <i>Chondrilla juncea</i>	Skeleton Weed
<i>Chrysocephalum apiculatum</i>	Common Everlasting
* <i>Cirsium vulgare</i>	Spear Thistle
* <i>Conyza bonariensis</i>	Flaxleaf Fleabane
* <i>Conyza</i> sp.	
<i>Cotula australis</i>	Carrot Weed
<i>Cymbonotus lawsonianus</i>	Bears-ear
<i>Euchiton sphaericus</i>	
<i>Facelis retusa</i>	Annual trampweed
* <i>Gamochaeta americana</i>	Cudweed
* <i>Hedypnois rhagadioloides</i> subsp. <i>cretica</i>	Cretan Weed
* <i>Hypochaeris glabra</i>	Smooth Catsear
* <i>Hypochaeris microcephala</i> var. <i>albiflora</i>	White Flatweed
* <i>Hypochaeris radicata</i>	Flatweed
* <i>Lactuca serriola</i>	Prickly Lettuce
<i>Myriocephalus rhizocephalus</i>	Woolly-heads
<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed
<i>Senecio quadridentatus</i>	Cotton Fireweed
* <i>Silybum marianum</i>	Variegated Thistle
* <i>Soliva sessilis</i>	Bindyi
* <i>Sonchus asper</i>	Prickly Sowthistle

Scientific Name	Common Name
<i>*Sonchus oleraceus</i>	Common Sowthistle
<i>*Taraxacum officinale</i>	Dandelion
<i>*Tolpis barbata</i>	Yellow Hawkweed
<i>Triptilodiscus pygmaeus</i>	Common Sunray
<i>Vittadinia muelleri</i>	
Boraginaceae	
<i>*Echium plantagineum</i>	Paterson's Curse
Brassicaceae	
<i>*Capsella bursa-pastoris</i>	Shepherd's Purse
<i>*Lepidium bonariense</i>	
<i>Rorippa laciniata</i>	
Campanulaceae	
<i>Wahlenbergia communis</i>	Tufted Bluebell
<i>Wahlenbergia luteola</i>	
<i>Wahlenbergia planiflora</i> subsp. <i>planiflora</i>	Flat Bluebell
<i>Wahlenbergia</i> sp.	
Caryophyllaceae	
<i>*Arenaria leptoclados</i>	Lesser Thyme-leaved Sandwort
<i>*Cerastium glomeratum</i>	Mouse-ear Chickweed
<i>*Paronychia brasiliensis</i>	Brazilian Whitlow
<i>*Petrohragia nanteuillii</i>	
<i>*Polycarpon tetraphyllum</i>	Four-leaved Allseed
<i>*Silene gallica</i>	French Catchfly
<i>*Spergularia rubra</i>	Sandspurry
Chenopodiaceae	
<i>Einadia nutans</i>	Climbing Saltbush
<i>Maireana microphylla</i>	Small-leaf Bluebush
Clusiaceae	
<i>*Hypericum perforatum</i>	St. Johns Wort
Convolvulaceae	
<i>Dichondra</i> sp. A	Kidney Weed
Crassulaceae	
<i>Crassula peduncularis</i>	
<i>Crassula sieberiana</i>	Australian Stonecrop
Droseraceae	
<i>Drosera glanduligera</i>	Pimpernel Sundew
<i>Drosera peltata</i>	
Elatinaceae	
<i>Elatine gratioloides</i>	Waterwort
Euphorbiaceae	
<i>Chamaesyce drummondii</i>	Caustic Weed
Fabaceae: Faboideae	
<i>Daviesia genistifolia</i>	Broom Bitter Pea
<i>Desmodium varians</i>	Slender Tick-trefoil
<i>Glycine clandestina</i>	

Scientific Name	Common Name
<i>Glycine tabacina</i>	
* <i>Medicago minima</i>	Woolly Burr Medic
* <i>Medicago truncatula</i>	Barrel Medic
<i>Swainsona sericea</i>	Silky Swainson-pea (Vulnerable)
* <i>Trifolium angustifolium</i>	Narrow-leaved Clover
* <i>Trifolium arvense</i>	Haresfoot Clover
* <i>Trifolium campestre</i>	Hop Clover
* <i>Trifolium cernuum</i>	
* <i>Trifolium dubium</i>	Yellow Suckling Clover
* <i>Trifolium glomeratum</i>	Clustered Clover
* <i>Trifolium striatum</i>	Knotted Clover
* <i>Trifolium subterraneum</i>	Subterranean Clover
* <i>Trifolium tomentosum</i>	Woolly Clover
<i>Zornia dyctiocarpa</i>	Zornia
Gentianaceae	
* <i>Centaurium erythraea</i>	Common Centaury
Geraniaceae	
* <i>Erodium cicutarium</i>	Common Storksbill
<i>Erodium crinitum</i>	Blue Storksbill
<i>Geranium potentilloides</i>	
<i>Geranium retrorsum</i>	Common Cranesbill
Goodeniaceae	
<i>Goodenia hederacea</i>	Forest Goodenia
<i>Goodenia pinnatifida</i>	
<i>Velleia paradoxa</i>	Spur Velleia
Haloragaceae	
<i>Haloragis heterophylla</i>	Rough Raspwort
Lamiaceae	
* <i>Marrubium vulgare</i>	White Horehound
* <i>Salvia verbenaca</i>	Vervain
* <i>Stachys arvensis</i>	Stagger Weed
Lentibulariaceae	
<i>Utricularia dichotoma</i>	Fairy Aprons
Lobeliaceae	
<i>Pratia concolor</i>	Poison Pratia
Malvaceae	
* <i>Malva parviflora</i>	Small-flowered Mallow
* <i>Modiola caroliniana</i>	Red-flowered Mallow
<i>Sida corrugata</i>	Corrugated Sida
Myrsinaceae	
* <i>Anagallis arvensis</i>	Scarlet Pimpernel
Myrtaceae	
<i>Angophora floribunda</i>	Rough-barked Apple
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum
<i>Eucalyptus melliodora</i>	Yellow Box

Scientific Name	Common Name
Oxalidaceae	
<i>Oxalis perennans</i>	
<i>Oxalis radicata</i>	
<i>Oxalis</i> sp.	
<i>Oxalis</i> sp.2	
Plantaginaceae	
* <i>Linaria pelisseriana</i>	Pelisser's Toadflax
<i>Plantago debilis</i>	
* <i>Plantago lanceolata</i>	Lamb's Tongues
Polygonaceae	
* <i>Acetosella vulgaris</i>	Sheep Sorrel
* <i>Polygonum aviculare</i>	Wireweed
<i>Rumex brownii</i>	Swamp Dock
* <i>Rumex crispus</i>	Curled Dock
<i>Rumex tenax</i>	Shiny Dock
Portulacaceae	
<i>Portulaca oleracea</i>	Pigweed
Ranunculaceae	
<i>Ranunculus pumilio</i> var. <i>pumilo</i>	
Rosaceae	
<i>Acaena echinata</i>	
Rubiaceae	
<i>Asperula conferta</i>	Common Woodruff
Scrophulariaceae	
<i>Limosella australis</i>	Australian Mudwort
Solanaceae	
* <i>Solanum nigrum</i>	Black-berry Nightshade
Stackhousiaceae	
<i>Stackhousia muricata</i>	Western Stackhousia
Urticaceae	
* <i>Urtica urens</i>	Small Nettle
SUBCLASS LILIIDAE	
Anthericaceae	
<i>Arthropodium minus</i>	
<i>Tricoryne elatior</i>	Yellow Autumn-lily
Asphodelaceae	
<i>Bulbine bulbosa</i>	Native Leek
Colchicaceae	
<i>Wurmbea dioica</i>	Early Nancy
Commelinaceae	
<i>Commelina cyanea</i>	
Cyperaceae	
<i>Carex inversa</i>	
<i>Cyperus difformis</i>	Dirty Dora
<i>Eleocharis plana</i>	Flat Spike-sedge

Scientific Name	Common Name
<i>Eleocharis pusilla</i>	
<i>Fimbristylis dichotoma</i>	Common Fringe-sedge
<i>Isolepis hookeriana</i>	
Iridaceae	
* <i>Romulea minutiflora</i>	Small-flowered Onion Grass
* <i>Romulea rosea</i>	Onion Grass
* <i>Sisyrinchium rosulatum</i>	Scourweed
Juncaceae	
<i>Juncus bufonius</i>	Toad Rush
* <i>Juncus capitatus</i>	A Rush
<i>Juncus subglaucus</i>	
<i>Juncus subsecundus</i>	
Lomandraceae	
<i>Lomandra multiflora</i>	Many-flowered Mat-rush
Orchidaceae	
<i>Diuris tricolor</i>	Painted Diuris
<i>Microtis parviflora</i>	Slender Onion Orchid
<i>Microtis unifolia</i>	Common Onion Orchid
<i>Pterostylis bicolor</i>	Black-tip Greenhood
<i>Thelymitra pauciflora</i> type	
Phormiaceae	
<i>Dianella porracea</i>	Riverine Flax-lily
Poaceae	
* <i>Aira elegantissima</i>	Delicate Hairgrass
<i>Amphibromus nervosus</i>	
<i>Aristida ramosa</i>	Purple Wiregrass
<i>Austrostipa scabra</i>	Speargrass
<i>Austrostipa verticillata</i>	Slender Bamboo Grass
<i>Bothriochloa macra</i>	Red Grass
* <i>Briza maxima</i>	Giant Shivery Grass
* <i>Briza minor</i>	Small Shivery Grass
* <i>Bromus catharticus</i>	Prairie Grass
* <i>Bromus diandrus</i>	Great Brome
* <i>Bromus hordeaceus</i>	Soft Brome
* <i>Bromus molliformis</i>	Soft Brome
<i>Chloris truncata</i>	Windmill Grass
<i>Cynodon dactylon</i>	Couch
<i>Dichelachne micrantha</i>	Shorthair Plumegrass
<i>Eragrostis elongata</i>	Clustered Lovegrass
* <i>Hordeum leporinum</i>	Barley Grass
* <i>Lolium perenne</i>	Perennial Ryegrass
* <i>Lolium rigidum</i>	Wimmera Ryegrass
<i>Microlaena stipoides</i>	Weeping Grass
* <i>Paspalum dilatatum</i>	Paspalum
* <i>Poa bulbosa</i>	Bulbosa Poa

Scientific Name	Common Name
<i>Poa sieberiana</i>	
<i>Rytidosperma erianthum</i>	
<i>Rytidosperma</i> sp.	
<i>Rytidosperma</i> sp. 2	
<i>Sporobolus creber</i>	Rat's Tail Grass
<i>Themeda triandra</i>	Kangaroo Grass
* <i>Vulpia bromoides</i>	Squirrel Tail Fescue
* <i>Vulpia muralis</i>	
* <i>Vulpia myuros</i>	Rat's Tail Fescue

C.2 FAUNA SPECIES RECORDED AT THE SITE

Scientific name	Common name	Observation Method
Amphibians		
<i>Litoria peronii</i>	Peron's Tree Frog	
<i>Uperoleia rugosa</i>	Wrinkled Toadlet	
Birds		
<i>Anas superciliosa</i>	Black Duck	
<i>Chenonetta jubata</i>	Wood Duck	
* <i>Columba livia</i>	Rock Dove	
<i>Ocyphaps lophotes</i>	Crested Pigeon	
<i>Egretta novaehollandiae</i>	White-faced Heron	
<i>Falco cenchroides</i>	Nankeen Kestrel	
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	
<i>Eolophus roseicapillus</i>	Galah	
<i>Glossopsitta concinna</i>	Musk Lorikeet	
<i>Platycercus eximius</i>	Eastern Rosella	
<i>Psephotus haematonotus</i>	Red-rumped Parrot	
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	
<i>Todiramphus sanctus</i>	Sacred Kingfisher	
<i>Eurystomus orientalis</i>	Dollarbird	
<i>Malurus cyaneus</i>	Superb Fairy-wren	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	
<i>Pardalotus striatus</i>	Striated Pardalote	
<i>Anthochaera carunculata</i>	Red Wattlebird	
<i>Manorina melanocephala</i>	Noisy Miner	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike	
<i>Artamus cyanopterus</i>	Dusky Woodswallow	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	
<i>Cracticus tibicen</i>	Magpie	
<i>Cracticus torquatus</i>	Grey Butcherbird	
<i>Strepera graculina</i>	Pied Currawong	
<i>Rhipidura leucophrys</i>	Willie Wagtail	
<i>Corvus coronoides</i>	Australian Raven	
<i>Grallina cyanoleuca</i>	Magpie-lark	
<i>Corcorax melanorhamphos</i>	White-winged Chough	
<i>Struthidea cinerea</i>	Apostlebird	
<i>Cincloramphus cruralis</i>	Brown Songlark	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	
<i>Petrochelidon ariel</i>	Fairy Martin	
* <i>Sturnus vulgaris</i>	Common Starling	
<i>Anthus novaeseelandiae</i>	Pipit	
Mammals		
* <i>Lepus europaeus</i>	Hare	

<i>Macropus giganteus</i>	Eastern Grey Kangaroo	
<i>*Oryctolagus cuniculus</i>	European Rabbit	
<i>Trichosurus vulpecula</i>	Common Brushtail Possums	
<i>*Vulpes</i>	European Red Fox	
Microbats		
<i>Austronomus australis</i>	White-striped Free-tail Bat	
<i>Chalinolobus dwyeri</i> ? V	Large-eared Pied Bat	
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	
<i>Miniopterus/Vespadelus</i> complex ? V	Bentwing Bat / Forest Bat complex	
<i>Mormopterus ridei</i>	Eastern Free-tailed Bat	
<i>Nyctophilus sp</i>	A Long-eared Bat	
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	
<i>Vespadelus darlingtoni</i>	Large Forest Bat	
<i>Vespadelus vulturnus</i>	Little Forest Bat	
Reptiles		
<i>Anomalopus leuckartii</i>	Two-clawed Worm-skink	
<i>Lamprophilus delicata</i>	Delicate Skink	
<i>Tiliqua rugosa</i>	Shingleback	
<i>Tiliqua scincoides</i>	Eastern Blue-tongue	
<i>Pogona barbata</i>	Eastern Bearded Dragon	
<i>Pseudonaja textilis</i>	Eastern Brown Snake	
<i>Pseudechis (prob) porphyriacus</i>	Red-bellied Black Snake	

APPENDIX D EPBC PROTECTED MATTERS SEARCH



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/01/17 11:27:04

[Summary](#)

[Details](#)

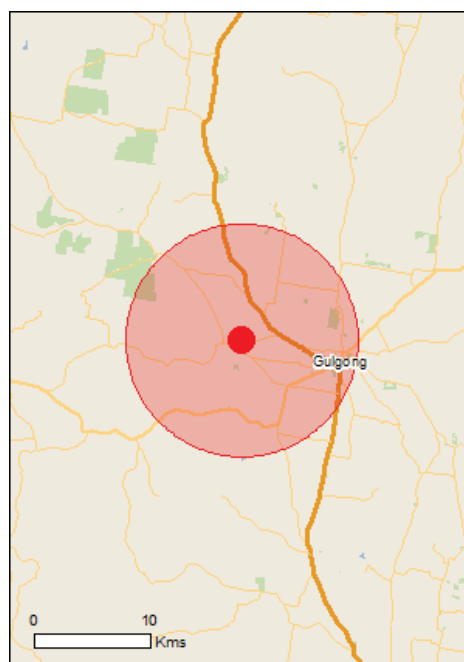
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

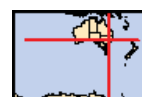
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	29
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	28
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	800 - 900km upstream
Riverland	700 - 800km upstream
The coorong, and lakes alexandrina and albert wetland	900 - 1000km upstream
The macquarie marshes	200 - 300km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Grantiella picta		
Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor		
Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Polytelis swainsonii		
Superb Parrot [738]	Vulnerable	Species or species

Name	Status	Type of Presence
Rostratula australis		habitat likely to occur within area
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Galaxias rostratus		
Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis		
Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni		
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area
Homoranthus darwinioides		
[12974]	Vulnerable	Species or species habitat may occur within area
Leucochrysum albicans var. tricolor		
Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat likely to occur within area
Philothea ericifolia		
[64942]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum petilum		
Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area

Reptiles

Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area
Delma impar Striped Legless Lizard [1649]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species

Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area

Migratory Wetlands Species

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land - Australian Telecommunications Commission

Commonwealth Land - Commonwealth Trading Bank of Australia

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
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Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Yarrobil	NSW

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Acridotheres tristis Common Myna, Indian Myna [387]	Species or species habitat likely to occur within area
--	--

Carduelis carduelis European Goldfinch [403]	Species or species habitat likely to occur within area
---	--

Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]	Species or species habitat likely to occur within area
--	--

Lonchura punctulata Nutmeg Mannikin [399]	Species or species habitat likely to occur within area
--	--

Passer domesticus House Sparrow [405]	Species or species habitat likely to occur within area
--	--

Pycnonotus jocosus Red-whiskered Bulbul [631]	Species or species habitat likely to occur within area
--	--

Streptopelia chinensis Spotted Turtle-Dove [780]	Species or species habitat likely to occur within area
---	--

Sturnus vulgaris Common Starling [389]	Species or species habitat likely to occur within area
---	--

Turdus merula Common Blackbird, Eurasian Blackbird [596]	Species or species habitat likely to occur within area
---	--

Mammals

Bos taurus Domestic Cattle [16]	Species or species
------------------------------------	--------------------

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		habitat likely to occur within area Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk,		Species or species

Name	Status	Type of Presence
Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.34881 149.45623

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX E ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Aboriginal Cultural Heritage Assessment

BERYL SOLAR FARM



MARCH 2017



Document Verification

	Project Title:	Beryl Solar Farm
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Project Number: 16-337

Project File Name: Beryl Solar Farm ACHA Draft v2

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft V1	23/03/17	Kirsten Bradley	Matthew Barber	Matthew Barber
Draft v2	24/03/17	Kirsten Bradley	Tom Best (First Solar)	Matthew Barber

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EXECUTIVE SUMMARY

INTRODUCTION

NGH Environmental has been contracted by First Solar Pty Ltd (First Solar) to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) for the proposed Beryl Solar Farm, located at Beryl approximately 6 kilometres west of the township of Gulgong, NSW.

The solar farm proposal would involve ground disturbance that has the potential to impact on Aboriginal heritage sites and objects which are protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the Aboriginal Cultural Heritage Assessment (ACHA) is therefore to investigate the presence of any Aboriginal sites and to assess the impacts and management strategies that may mitigate any impact.

The Secretary of the DPE Environmental Assessment Requirements (SEARs) relating to Aboriginal heritage were as follows:

Include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community (SEARS for Beryl Solar Farm 25/01/17).

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), and
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (OEH 2010b) produced by the NSW Office of Environment and Heritage (OEH)

The proposal area is within the Mid-Western Regional Council Local Government Area.

PROJECT PROPOSAL

The Beryl Solar Farm proposal would comprise the installation of a solar plant with a capacity up to 100 MW. The power generated will be fed into the National Electricity Market (NEM) at the transmission level from the adjacent Beryl Substation. First Solar proposes to develop approximately 206 ha of the 332 ha proposal site.

The proposal would include the following elements:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation. (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.

- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

ABORIGINAL CONSULTATION

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

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log is provided in Appendix A.

As a result of this process, four groups contacted the consultant to register their interest in the proposal. The groups who registered interest were Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation. 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 one of the two days of fieldwork. The fieldwork was carried out in late February 2017 with a representative from all four of the registered parties participating for a day of survey.

A copy of the draft report was provided to all the registered parties for comment.

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 and adjacent to the proposal area. The closest AHIMS site to the project area was recorded as an open artefact site (AHIMS # 36-2-0016) located approximately 500m north of the assessment area.

Assessment of Aboriginal site models for the region suggest 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 100-400 m 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.

SURVEY RESULTS

The intention for the heritage survey was to cover as much of the ground surface as possible, given that the project was going to disturb approximately 206 hectares, within the 332 hectare proposal site. Survey transects were undertaken on foot across the project area to achieve maximum coverage. All mature trees within or adjacent to the development footprint were also inspected for evidence of Aboriginal scarring. Visibility within the project area was variable with visibility ranging from 80% in exposures to less than 5%. The average effective visibility was 15% but overall was quite good.

Between the survey participants, over the course of the field survey, approximately, 100 km of transects were walked across the proposed solar farm development area. Allowing for an effective view width of 5m

each person, this equates to a surface area examined of 46ha. However, allowing for the visibility restrictions, the effective survey coverage was reduced to 6.9 ha, or 3.3% of the project area. The effective survey coverage for the area outside the development plan was lower at 1.9 ha or 1.5%.

Despite the variable visibility encountered during the survey, there were six stone artefacts found across the proposal area that were recorded as five site occurrences. The archaeological features have been recorded as an artefact scatter (Beryl Solar Farm AS1) and four isolated finds (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3 and Beryl Solar Farm IF 4).

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 of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the solar farm and powerline easement areas.

The models of site location for the area have been shown to be accurate, with the current survey confirming the predicted distribution and nature of archaeological material with the sites located within 100-400m to a water source, even in areas highly disturbed by farming activities.

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

POTENTIAL IMPACTS

The proposal involves the construction of a solar farm and includes connection to the nearby substation with an above ground powerline on Lot 21/DP 1173059 that will extend to the existing Beryl substation on Lot 1/ DP 523876. The development will result in disturbance of almost 206 hectares of the 332-hectare property within Lot 20/DP 1173059 and Lot 1/DP 1012926. 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.

Site name	Site integrity	Type of harm	Degree of harm	Consequence of harm	Recommendation
Beryl Solar Farm IF 1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 2	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 3	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 4	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm AS1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage objects prior to development of project.

The impact to the scientific values if the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1 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.

The Beryl 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.

RECOMMENDATIONS

It is recommended that:

1. If complete avoidance of the five recorded sites within the proposal area (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1) is not possible, the artefacts 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.
2. 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 sites are moved to record their new location on the AHIMS database.
3. Once the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1 are salvaged, the proposed work can proceed with caution within the development footprint.
4. The development proposal should now be able to proceed without any additional archaeological investigation.
5. First Solar should prepare an Unexpected Finds Protocol (UFP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm. The UFP will outline the procedure to deal with construction activity. Preparation of the UFP should be undertaken in consultation with the registered Aboriginal parties.
6. 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.
7. 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 parties and may include further field survey.

1 INTRODUCTION

First Solar Pty Ltd (First Solar) proposes to develop a commercial scale solar farm at Beryl, approximately 6 kilometres west of the township of Gulgong, NSW (Figure 1 and 2). The proposal site is approximately 332 hectares in size with 206 hectares proposed for development (Figure 3). The Beryl solar farm would have a capacity of around 100 Mega Watt (MW). NGH Environmental has been contracted by First Solar to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to investigate and examine the presence, extent and nature of any Aboriginal heritage for the proposal area as part of an Environmental Impact Assessment (EIS).

The solar farm proposal would involve ground disturbance that has the potential to impact on Aboriginal heritage sites and objects which are protected under the NSW *National Parks and Wildlife Act 1974* (NPW Act). The purpose of the Aboriginal Cultural Heritage Assessment (ACHA) is therefore to investigate the presence of any Aboriginal sites and to assess the impacts and management strategies that may mitigate any impact.

1.1 DEVELOPMENT CONTEXT

The development of renewable energy projects is one of the most effective ways to achieve the commitments of Australia and many other nations under the Kyoto Protocol to reduce greenhouse gas emissions. The Beryl Solar Farm would provide the following benefits:

- Reduction in greenhouse gas emissions.
- Provision of embedded electricity generation to supply into the Australian grid close to a main consumption centre.
- Provision of social and economic benefits through the provision of direct employment opportunities.

The establishment of a Solar Farm would therefore have both local, National and International benefits.

As part of the development impact assessment process, the proposed development application will be assessed under part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposed solar farm at Beryl is classified as “state significant development” (SSD) under Part 4 of the EP&A Act. SSDs are major projects which require approval from the Minister for Planning and Environment. The EIS has been prepared in accordance with the requirements of the Secretary of the Department of Planning and Environment (DPE).

The Secretary of the DPE Environmental Assessment Requirements (SEARs) relating to Aboriginal heritage were as follows:

Include an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community (SEARS for Beryl Solar Farm 25/01/17).

The assessment area of the proposed solar farm comprises of Lot 20/DP 1173059 and Lot 1/DP 1012926 with a transmission line on Lot 21/DP 1173059 that will extend to the existing Beryl substation on Lot 1/ DP 523876.

The Beryl Solar Farm proposal site is located between 4.5 and 7km west of the township of Gulgong, within the Mid-Western Regional Council Local Government Area (LGA).

1.2 PROJECT PROPOSAL

The Beryl Solar Farm proposal (Figures 1-3) would comprise of the installation of a solar plant with a capacity up to 100 MW. The power generated will be fed into the National Electricity Market (NEM) at the transmission level from the adjacent Beryl Substation.

Frist Solar proposes to develop approximately 206 ha of the 332 ha proposal site. The solar farm site would be accessed via Beryl Road, Spring Ridge Road and Perseverance Lane.

The proposal would include the following elements:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation. (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

The Beryl Solar Farm is expected to operate for around 30 years. The construction phase of the proposal is expected to take twelve months. After the initial 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.

Three existing electricity transmission lines pass through the proposal site, mostly in a north-south direction and in alignment with the existing Beryl substation. The existing Beryl Substation is directly adjacent to the proposal site within the north-western section. In the centre of the site, a raised embankment indicates the location of the former railway line which passes through the proposal site in an east-west direction. Most of the railway line infrastructure has been removed though some concrete culverts are present.

1.3 PROJECT PERSONNEL

The assessment was undertaken by the archaeologists Matthew Barber and Kirsten Bradley of NGH Environmental, including research, Aboriginal community consultation, field survey and report preparation.

Consultation with the Aboriginal community was undertaken following the process outlined in OEH's *Aboriginal cultural heritage consultation requirements for proponents 2010*. Four Aboriginal groups registered their interest in the proposal. These groups were Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation

Further detail and an outline of the consultation process is provided in Section 2.

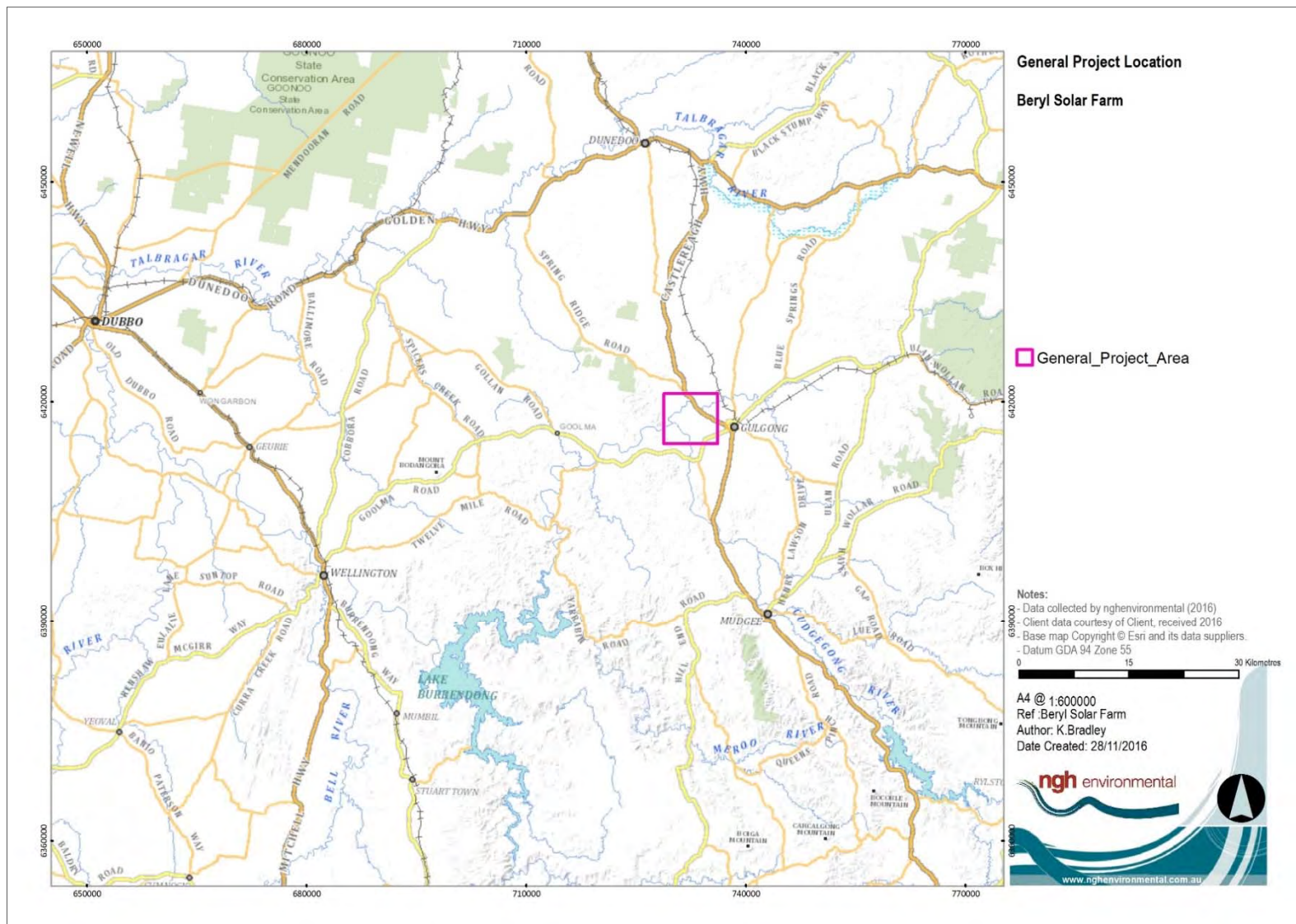


Figure 1. General project area.

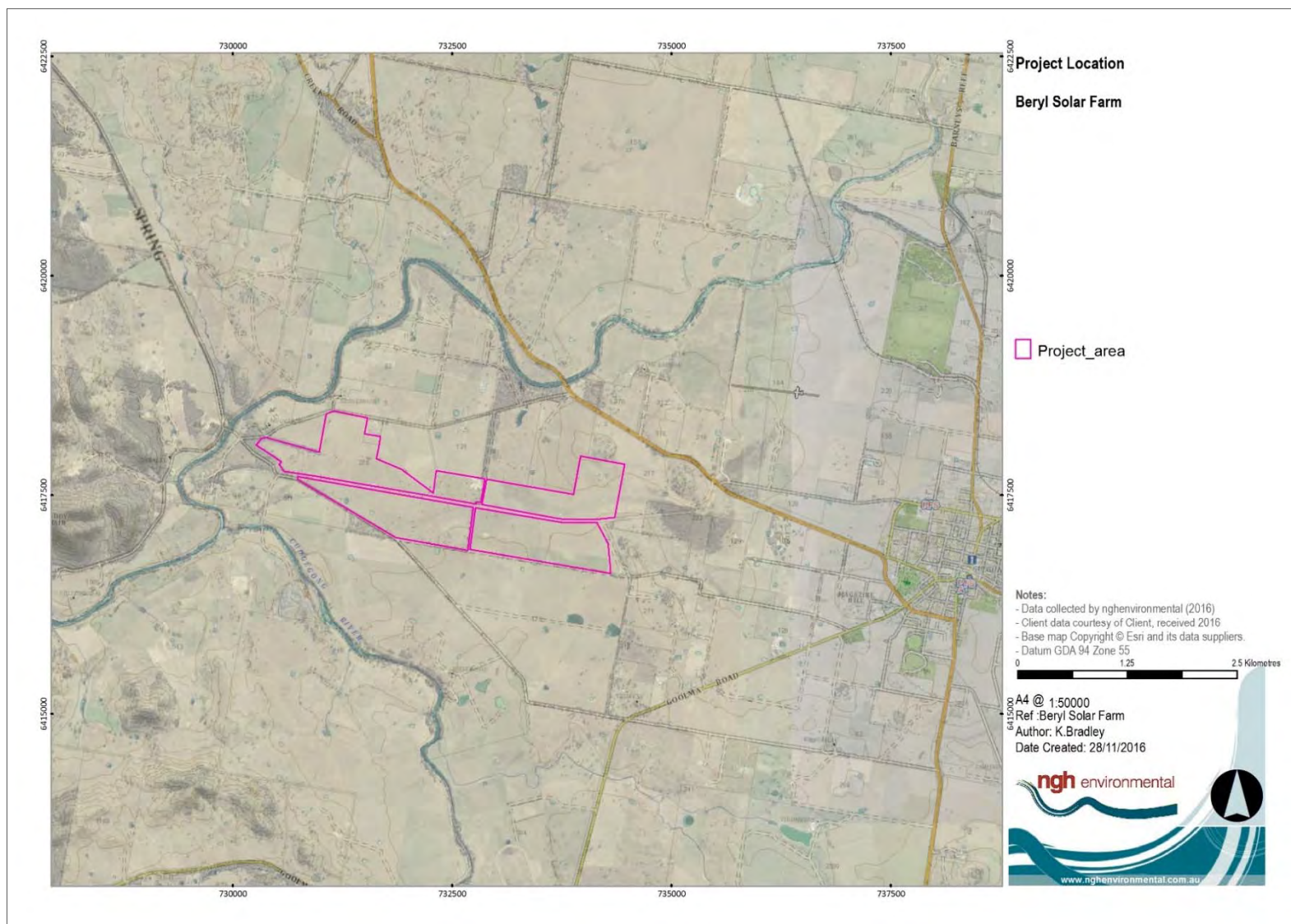


Figure 2. Project area.

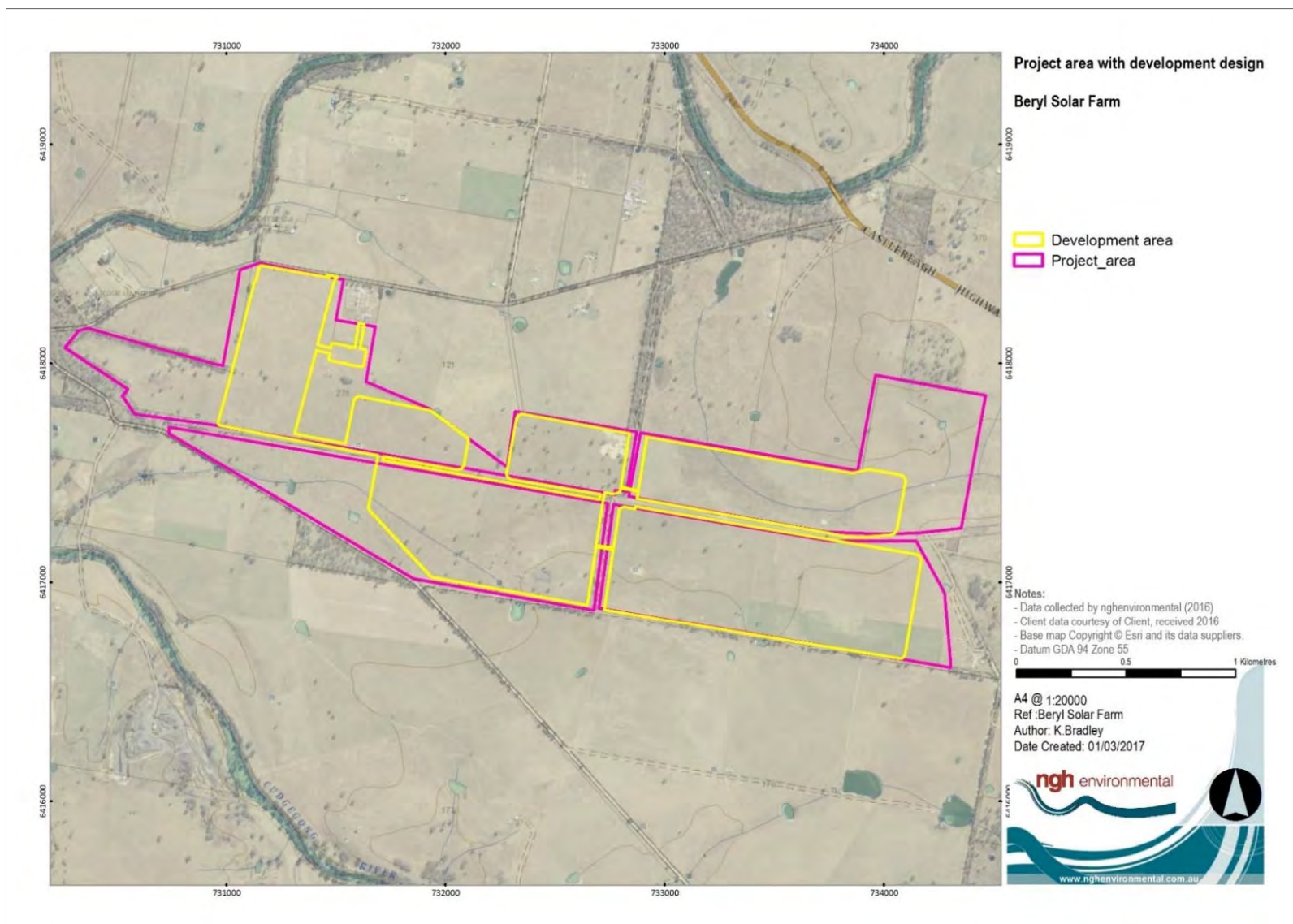


Figure 3. Project area with development design.

1.4 REPORT FORMAT

For the purposes of this assessment of the Beryl Solar Farm, we have prepared the report in line with the following:

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

The purpose of this ACHA Report is to provide an assessment of the Aboriginal cultural values associated with the study area and to assess the cultural and scientific significance of any Aboriginal heritage sites. This conforms to the intention of the SEARs.

The objectives of the assessment were to:

- Conduct Aboriginal consultation as specified in clause 80c of the *National Parks and Wildlife Regulation 2009*, using the consultation process outlined in the ACHCRP;
- Undertake an assessment of the archaeological and cultural values of the study area and any Aboriginal sites therein;
- Assess the cultural and scientific significance of any archaeological material;
- Assess the impacts of the development proposal on cultural sites, and
- Provide management recommendations for any objects found.

2 ABORIGINAL CONSULTATION PROCESS

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. The guide outlines a four-stage process of consultation as follows:

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

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

Stage 1. Letters outlining the development proposal and the need to carry out an ACHA were sent to the Mudgee LALC and various statutory authorities including OEH, as identified under the ACHCRP. An advertisement was placed in the local newspaper, the Mudgee Guardian on the 18th of November 2016 seeking registrations of interest from Aboriginal people and organisations. A further series of letters was sent to other organisations identified by OEH in correspondence to NGH Environmental. In each instance, the closing date for submission was 14 days from receipt of the letter.

As a result of this process, four groups contacted the consultant to register their interest in the proposal. The groups who registered interest were Buudang, Murong Gialinga Aboriginal & Torres Strait Islander

Corporation, Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation.

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

Stage 2. On the 19th of December 2016, an Assessment Methodology document for the Beryl Solar Farm was sent to the four registered parties as noted above and the Mudgee LALC as required by OEH. 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. Comments were received from Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation.

The main points raised in the comments received from the Wellington Valley Wiradjuri Aboriginal Corporation on the methodology were in relation to:

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

The main points raised in the comments received from the Warrabinga Native Title Claimants Aboriginal Corporation on the methodology were requests for further information on:

- The proposal, specifically the proposed earthworks;
- Landforms;
- The closest site to the project area; and
- Previous surveys.

These comments were addressed by NGH in reply letters sent to the Wellington Valley Wiradjuri Aboriginal Corporation on the 30th of January 2017 and the Warrabinga Native Title Claimants Aboriginal Corporation on the 9th of February 2017. No further correspondence was received regarding the letters from NGH Environmental that addressed the comments on the methodology from either group. No response or registration of interest in the project was received from the Mudgee LALC.

The Wellington Valley Wiradjuri Aboriginal Corporation has requested that any information they provided in regards to the project area was not shared. Therefore, the letters received as noted above have not been included in this report or appendix. As a similar courtesy, we have not included the response received from the Warrabinga Native Title Claimants Aboriginal Corporation.

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.

Cultural information about to the project area was received from the Wellington Valley Wiradjuri Aboriginal Corporation however they have requested that the information provided is not shared. Therefore, the cultural information received has not been included in this report.

No other response regarding cultural information was received.

At this stage, the fieldwork was organised and all four registered parties were asked to participate in one of the two days of fieldwork. The fieldwork was carried out in late February 2017 with a representative from all four of the registered parties participating for a day of the survey.

Stage 4 In March 2017 a draft version of this *Aboriginal Cultural Heritage Assessment Report* for the proposal (this document) was forwarded to Buudang, Murong Gialinga Aboriginal & Torres Strait Islander Corporation, Warrabinga Native Title Claimants Aboriginal Corporation and the Wellington Valley Wiradjuri Aboriginal Corporation inviting comment on the results, the significance assessment and the recommendations. A minimum of 28 days was allowed for responses to the document.

2.1 ABORIGINAL COMMUNITY FEEDBACK

ADD

3 BACKGROUND INFORMATION

3.1 REVIEW OF LANDSCAPE CONTEXT

3.1.1 Geology and Topography

The landscape context assessment is based on several classifications that have been made at national and regional level for Australia. The national IBRA system identifies the proposal area as located within the South-Western Slopes Bioregion and the Inland Slopes Subregion (IBRA v.7 2012). The dominant IBRA subregion affected by the project is the Inland Slopes Subregion.

The bioregion lies wholly in the eastern part of the Lachlan Fold Belt which consists of a complex series of north to north-westerly trending folded bodies of Cambrian to Early Carboniferous sedimentary and volcanic rocks. Granites are common and mostly located in large scale up-folded bodies of rock. Granite landscapes occur either as central basins surrounded by steep hills formed on contact metamorphic rocks, or as high blocky plateau features with rock outcrops and tors (NSW National Parks and Wildlife Services 2003).

The Dubbo Geological map (1:250,000 SI/55-4) indicates that geology underlying the project area consists of the Quaternary and Tertiary Cainozoic geological sequences as shown in Figure 4 and detailed below (Colquhoun et al 1997). The two large seams of basalt identified within the project area are indicated by the orange Tb layer in Figure 4.

- **Qa** Alluvium, gravel, sand, silt and clay.
- **Tb** Tholeiite, alkali basalts and alkali ultramafic.
- **Cza** High level alluvium, gravel, sand, silt and clay.



Figure 4. Dubbo Geological map of project area (extracted from Colquhoun et al 1997).

The proposal area is encompassed by three Mitchell Landscape, The Talbragar – Upper Macquarie Terrace Sand, Dubbo Basalts and Cope Hills Granite. Two other Mitchell Landscapes, the Gulgong Ranges and the Macquarie – Turon Gorges, are also located near the project area. The Mitchell Landscape descriptions are provided in Table 1 below and shown in Figure 5.

Table 1 Description of the Mitchell Landscape relevant to the proposal (DECC 2002)

Mitchell Landscape
Talbragar – Upper Macquarie Terrace Sand Sandy Quaternary alluvial sediments on the floodplains and terraces of the Talbragar River, general elevation 350 to 500m, local relief 30 to 40m. Red-brown and red-yellow earthy sands with some yellow texture-contrast soils on the valley margins. River red gum (<i>Eucalyptus camaldulensis</i>) along the channels, yellow box (<i>Eucalyptus melliodora</i>) and rough-barked apple (<i>Angophora floribunda</i>) with white cypress pine (<i>Callitris glaucophylla</i>) on the plain.
Dubbo Basalts Slightly elevated plains and low hills on flat lying Tertiary basalt and trachyte flows, roughly parallel to the present course of the Talbragar and Macquarie Rivers. General elevation 300 to 330m, local relief 10m. Shallow stony red-brown clay loam and clay, self-mulching and with moderate fertility. Open white box (<i>Eucalyptus albens</i>), yellow box (<i>Eucalyptus melliodora</i>) and rough-barked apple (<i>Angophora floribunda</i>) with diverse grasses.
Gulgong Ranges Strike ridges with steep slopes and long debris aprons on complexly folded steep dipping Silurian lithic sandstone, quartzite and phyllite, Devonian sandstone, siltstone, shale, rhyolite and dacite. General elevation 550 to 980m, local relief 350m. Shallow stony red and yellow texture-contrast soils with stony uniform loams on steep slopes. Large areas of dense black cypress pine (<i>Callitris endlicheri</i>) on slopes, red stringybark (<i>Eucalyptus macrorhyncha</i>) and white gum (<i>Eucalyptus rossii</i>) on ridges. Blakely's red gum (<i>Eucalyptus blakelyi</i>), narrowleaved peppermint (<i>Eucalyptus radiata</i>) and white box (<i>Eucalyptus albens</i>) on lower slopes grading to yellow box (<i>Eucalyptus melliodora</i>).
Cope Hills Granite Undulating and rolling hills on Carboniferous granite and granodiorite, general elevation 500 to 740m, local relief 150m. Gritty gradational red earth and red texture-contrast soils. Forest of yellow box (<i>Eucalyptus melliodora</i>), Blakely's red gum (<i>Eucalyptus blakelyi</i>), red stringybark (<i>Eucalyptus macrorhyncha</i>), apple box (<i>Eucalyptus bridgesiana</i>), mountain gum (<i>Eucalyptus dalrympleana</i>) and black cypress pine (<i>Callitris endlicheri</i>).
Macquarie – Turon Gorges Steep sided, deep gorge tract with incised meanders of the Macquarie and Turon Rivers below extensive tablelands of the Ophir-Hargraves Plateau landscape. Incised across the structural grain of north-south trending tightly folded Devonian dacite, crystal tuff, quartzite and slates. General elevation 500 to 700m, local relief to 150m. Shallow stony soils on semi-stable scree slopes and yellow texture-contrast soils on lower angle slopes. Open woodland of yellow box (<i>Eucalyptus melliodora</i>), red box (<i>Eucalyptus polyanthemus</i>) and Blakely's red gum (<i>Eucalyptus blakelyi</i>) on lower areas, red stringybark (<i>Eucalyptus macrorhyncha</i>), broadleaved peppermint (<i>Eucalyptus dives</i>) and candlebark (<i>Eucalyptus rubida</i>), on higher slopes. River oak (<i>Casuarina cunninghamiana</i>) dominates the channel.

Cudgong River lies approximately 750m to the south of the site, and Wialdra Creek is situated approximately 150m to the north. No rivers or permanent streams are present within the site. Two small ephemeral drainage lines are located within the north-eastern and south-western portions of the site. The former is predominantly a second order stream draining north into Wialdra Creek (approx. 1.35 km north of the site boundary), and the latter is a first order stream draining west into Cudgong River (approx. 900 m

west of the site boundary). Both these drainage lines are predominantly dry. There are several man made dams occurring within the project area.

The project area has two areas of naturally occurring bedrock outcrops which may have provided a source of stone material for Aboriginal people. However, both outcrops have been subjected to various degrees of intensive quarrying since European arrival in the area. A section in the central portion of the project area was also noted to be subjected to some form of sand mining with no outcrops of bedrock observed in this section.

Soils within the proposal area are typically a reddish brown sandy loam. The 1:250,000 Dubbo Soils Landscape series sheet indicates that four soil landscapes occur within the proposal site as shown in Figure 6 and detailed below in Table 2. These include Craigmore, Home Rule, Mebul and Nanima. All these soil types have a moderate to very high erosion hazard when disturbed (Murphy and Lawrie 1998).

Table 2 Description of the soil landscapes of the Dubbo 1:250 000 sheet relevant to the proposal (Murphy and Lawrie 1998)

Soil landscapes of the Dubbo 1:250 000 sheet	
Craigmore	
• These soils are found on high terrace ranging in elevation between 460 and 475m above sea level. • The landscape consists of non-calciic soils and red earths. • Erosion hazard is low unless in areas with minimal ground cover.	
Home Rule	
• These soils are found on undulating low rises ranging in elevation between 420 and 500m above sea level. • Slopes are gently inclined 4 – 8%. • The landscape consists of siliceous sands, bleached sands and earthy sands overlying yellow sodic soils. • Erosion hazard is high especially in areas with minimal ground cover and drainage depressions are susceptible to gully erosion.	
Mebul	
• These soils are found on undulating low hills ranging in elevation between 400 and 540m above sea level. • Slopes range from 2 –15%. • The landscape consists of chocolate soils and euchozerns. • Erosion hazard is high especially in areas with minimal ground cover.	
Nanima	
• These soils are found on rolling low hills ranging in elevation between 300 and 550m above sea level. • Slopes are gently inclined 5 – 20%. • The landscape consists of non-calciic brown soils, red-brown earths, euchrozems and Terra Rossa soils. • Erosion hazard is low to moderate especially in areas with minimal ground cover.	

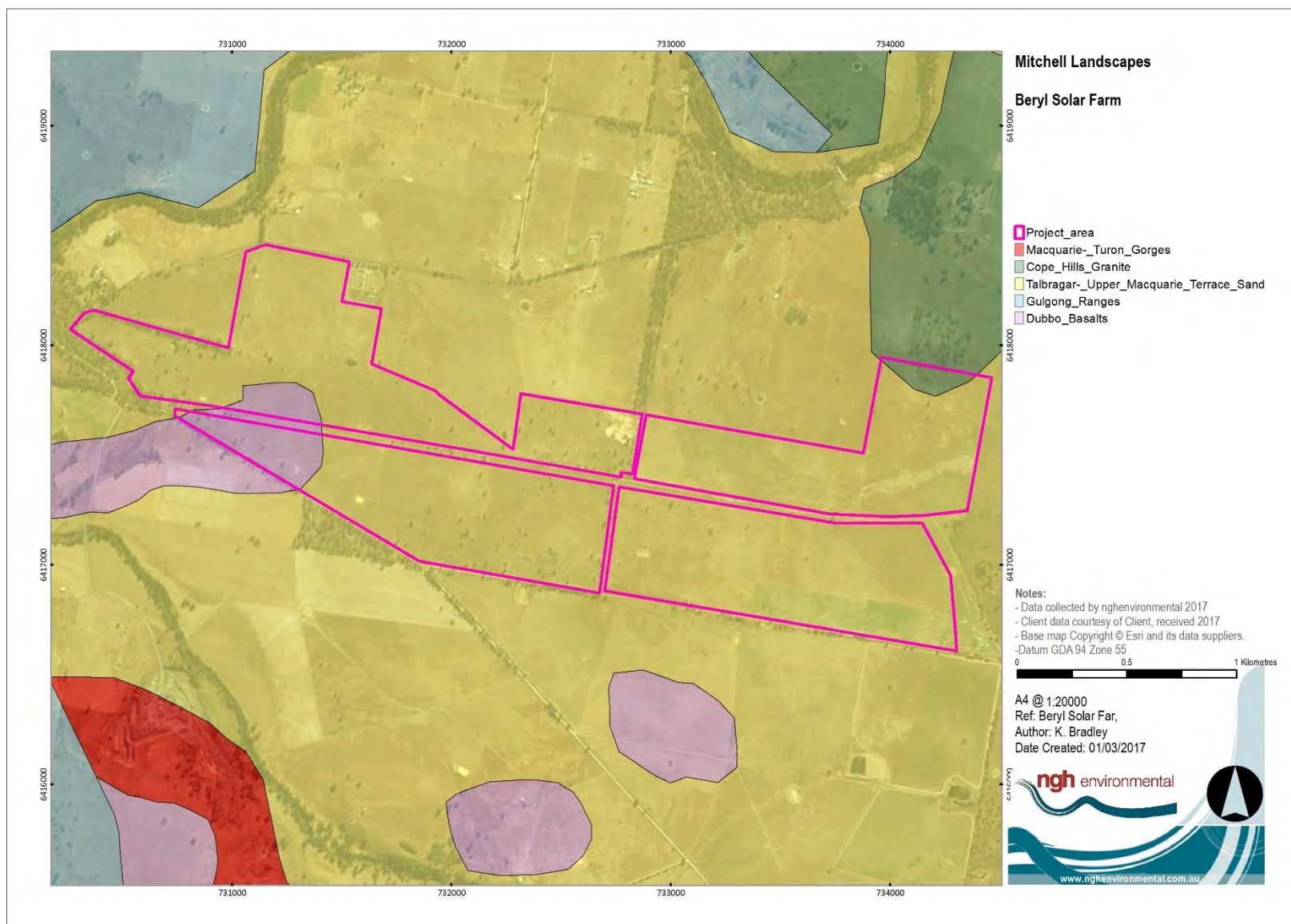


Figure 5. Location of Mitchell landscapes.

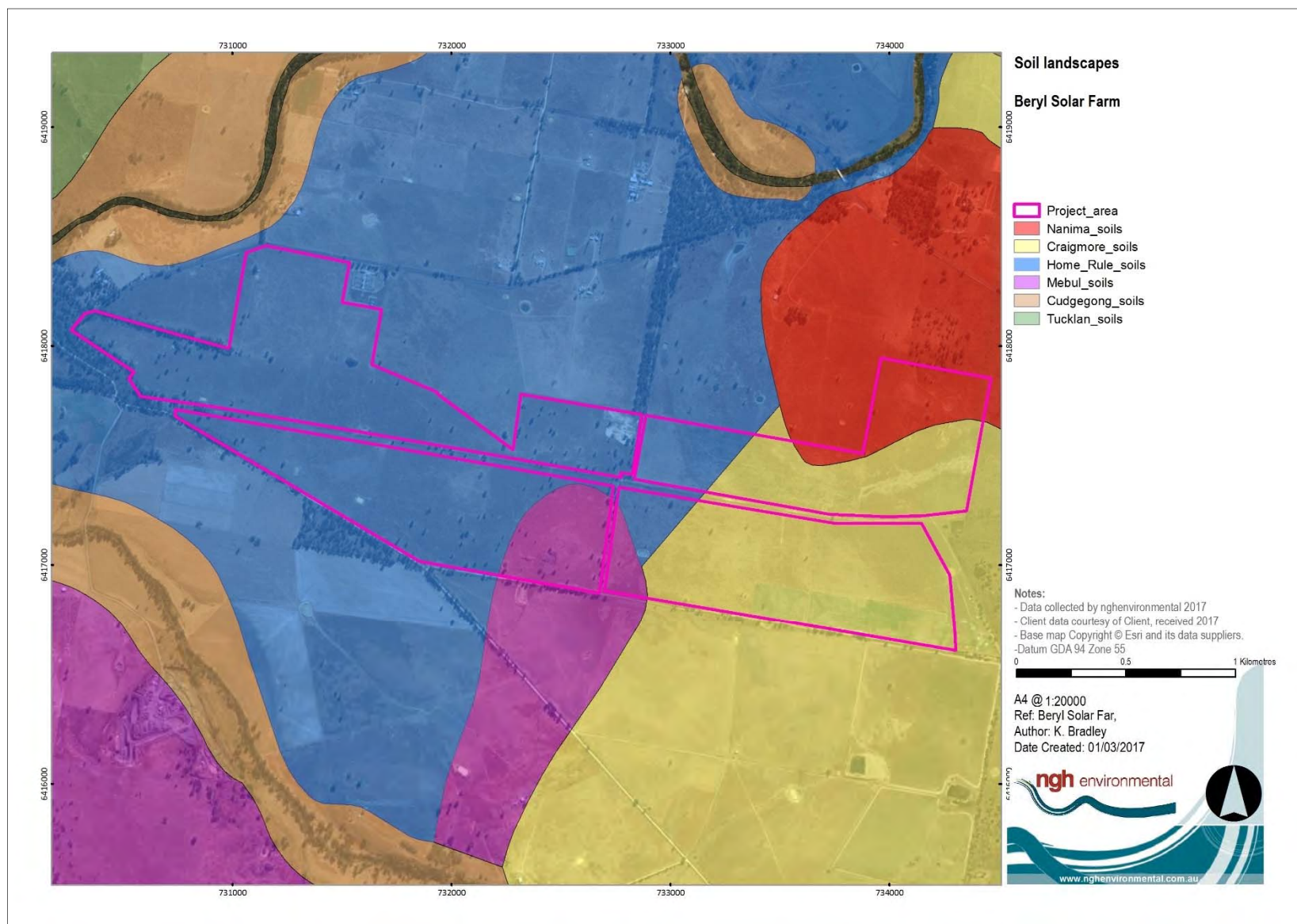


Figure 6. Location of soil landscapes from the Dubbo 1:250 000 sheet

3.1.2 Flora and Fauna

The biodiversity assessment carried out by NGH Environmental (2017) identified two distinct plant community types within the proposal area. These included:

1. White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland
2. Cleared areas (exotic dominated pasture)

The dominant tree species within the development area consisted of the Rough-barked Apple (*Angophora floribunda*), although this species is mixed/co-dominant with Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*E. blakelyi*) in woodland patches immediately surrounding the site. This suggests the Yellow Box and Blakely's Red Gum have historically been selectively removed (for the timber/firewood) from the whole property, including the north-south laneways. The understorey vegetation included a relatively sparse midstorey vegetation layer comprised primarily of younger/regrowth Rough-barked Apple, Yellow Box and Blakely's Red Gum, with very few native shrubs observed across the site. The groundcover vegetation characteristics included patches of native perennial grasses, particularly across the western half of the site, whilst most the eastern half of the site was dominated by exotic pastures.

The vegetation in the eastern half of the project area was dominated by exotic pastures or planted non-local flora species that are typically grazed on a regular basis. The groundcover in this area is mainly exotic with common grazing species including (but not limited to) Barley Grass (*Hordeum leporinum*), Ryegrass species (*Lolium sp*), Brome species (*Bromus sp*), numerous Clover species (*Trifolium sp*), Paspalum (*Paspalum dilatatum*), Sheep Sorrel (*Acetosella vulgaris*), Delicate Hairgrass (*Aira elegantissima*), and numerous Fescue species (*Vulpia sp*). Numerous weed species are also present in these areas including (but not limited to) Capeweed (*Arctotheca calendula*), Smooth Catsear (*Hypochaeris glabra*), Flatweed (*Hypochaeris radicata*), and Stagger Weed (*Stachys arvensis*).

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

3.1.3 Historic Landuse

The proposal area has a history of intensive agricultural and pastoral use. Most the area has been utilised for grazing and crop production since European settlement in the 1820's. The location of the proposed Beryl Solar Farm is predominately within paddocks currently used to graze livestock (sheep and cattle). Areas within the proposed Beryl Solar Farm have also been subject to a range of quarrying activities by the land owners. According to the landowner, the far western portion along a basalt ridge has been subject to prospecting for diamonds following the commencement of mining by the Australia Diamond Mines Company of Melbourne close to the junction of Wyaldra Creek and the Cudgegong River. The basalt outcrop to the south has also been subject to intensive hard rock quarrying. There is also evidence of surface sand and gravel extraction in a small area in the central part of the proposal area. The exact dates of the quarry activity within the property is currently unknown. The impacts from farming and quarry activities over many decades has meant that any cultural material within the proposal area has been extensively disturbed and potentially destroyed.

The construction of the existing powerlines through the project area has also caused disturbance to the project area. There are also several man-made dams within the project area that have modified the ground. The ground has also been modified for the construction of the raised embankment of the former railway line which passes through the centre of the proposal site in an east-west direction.

Overall, the proposal area would be categorised as disturbed through consistent farming practices, quarrying practices, land clearing and development.

3.1.4 Landscape Context

Most archaeological surveys are conducted in a situation where there is topographic variation and this can lead to differences in the assessment of archaeological potential and site modelling for the location of Aboriginal archaeological sites. However, as already noted, the terrain is generally undulating within the Talbragar – Upper Macquarie Terrace Sand Mitchell Landscape, with a low hill in the north-eastern corner. The project area has also been significantly disturbed in three areas by quarrying activities. Electricity transmission lines and a raised east-west embankment of the former railway line have also disturbed the area.

The only other differences observed within the landscape were two drainage channels that cross the project area and the two large rock outcrops that have been subject to European quarrying activities. Areas in close proximity to a water source are likely to have been a major focus for Aboriginal people. However, prior to European land modifications, this area as a whole may have provided resources, shelter, water and food for Aboriginal people.

The different Dubbo Sheet soils and the Mitchell landscapes were not readily identifiable within the survey area and were not used as means of landscape differentiation. The landforms for the survey was therefore determined to be two units, undulating plains and the slopes of low rolling hills. This landform division is based on topographic maps of the project area and visual inspection during field survey.

3.2 REVIEW OF ABORIGINAL ARCHAEOLOGICAL CONTEXT

3.2.1 Ethnohistoric Setting

Cultural areas are difficult to define and “must encompass an area in which the inhabitants have cultural ties, that is, closely related ways of life as reflected in shared meanings, social practices and interactions” (Egloff *et al.* 2005:8). Depending on the culture defining criteria chosen - i.e. which cultural traits and the temporal context (historical or contemporary) - the definition of the spatial boundary may vary. In Australia, Aboriginal “marriage networks, ceremonial interaction and language have been central to the constitution of regional cultural groupings” with the distribution of language speakers being the main determinate of groupings larger than a foraging band (Egloff *et al.* 2005:8 & 16).

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

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

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

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

Identification and differentiation of such sites are difficult in the field. A family group and their antecedents and descendants occupying a particular campsite repeatedly over a long period of time may leave a similar pattern of archaeological signatures as a large group camped over a shorter period of time.

European settlers started arriving in the district in the 1820s. At this point the Aboriginal population was in decline, due to disease such as small pox and influenza as well as dispossession from traditional lands and acts of violence against the Aboriginal people meant there was great social upheaval and partial disintegration of the traditional way of life. This meant that access to traditional resource gathering and hunting areas, religious life and marriage links and access to sacred ceremonial sites were disrupted or destroyed.

However, despite these disruptions, Aboriginal people continued to maintain their connections to sites and the land in the early days of European settlement. Where Aboriginal people were moved to places like missions, people could maintain at least some form of association with country and maintain traditional stories.

Early settlers and others who wrote about the Wiradjuri people and customs differentiated between the origin of some groups, referring to people as the Lachlan or Murrumbidgee tribes, or the Levels tribe for those between the two major rivers (Woolrych 1890). The extent of the Wiradjuri group means that there were many different environments that were exploited for natural resources and food. Like everywhere in Australia, Wiradjuri people were adept at identifying and utilising resources either on a seasonal basis or all year round.

Terrestrial animals such as the possum was noted by many early observers as a prime food source and the skins were made into fine cloaks that evidently were very warm (Evans 1815, Oxley 1820, Mitchell 1839). Kangaroos were also eaten and their skins made into cloaks as well. A range of reptiles and other mammals were food sources. Fish and mussels would have been prevalent from the rivers and creeks and insects were also a common food type, in particular grubs and ants and ant eggs (Pearson 1981, Fraser 1892). Birds including emus were common as a food source, often being caught in nets made from fibres of various plants such as flax, rushes and kurrajong trees. Bird hunts were also often undertaken as group activities, with emus, ducks and other birds targeted through groups of people flushing them out and driving them into pre-arranged nets (Ramson 1983).

Plant foods were equally as important and mostly consisted of roots and tubers, such as *Typha* or Cumbungi whose tubers were eaten in late summer and the shoots in early spring. Other edible plants from the

Wiradjuri region include the Yam Daisy or *Murnong*, eaten in summer and autumn, the Kurrajong seeds and roots, Acacia seeds and other rushes (Gott 1982).

Some of the early settlers and pastoralists, surveyors, explorers, administrators and others observed traditional Aboriginal activities, including ceremonies, burial practices and general way of living, and recorded these in letters, journals and books. These early records of Aboriginal lifestyle and society within the region assist in understanding parts of the traditional Aboriginal way of life, albeit already heavily disrupted at the time of the observations and through the eyes of largely ignorant and uninformed observers.

The early observations also note that some weapons and tools were carried, some made from wood such as spears, spear throwers, clubs, shields, boomerangs, digging sticks, bark vessels and canoes. Other materials were observed in use such as stone axes, shell and stone scrapers and bone needles.

In an archaeological context, few of these items would survive, particularly in an open site context. Anything made from bark and timber and animal skins would decay quickly in an open environment. However, other items, in particular those made of stone would survive where they were made, placed or dropped. Shell material may also survive in an archaeological context. Sources of raw materials, such as the extraction of wood or bark would leave scars on the trees that are archaeologically visible, although few trees of sufficient age survive in the modern context. Outcropping stone sources also provide clues to their utilisation through flaking, although pebble beds may also provide sources of stone which leave no archaeological trace.

3.2.2 AHIMS Search

The Aboriginal Heritage Information Management System (AHIMS) is maintained by OEH and provides a database of previously recorded Aboriginal heritage sites. A search provides basic information about any sites previously identified within a search area. However, a register search is not conclusive evidence of the presence or absence of Aboriginal heritage sites, as it requires that an area has been inspected and details of any sites located have been provided to OEH to add to the register. As a starting point, the search will indicate whether any sites are known within or adjacent to the investigation area.

A search of the AHIMS database was conducted over an area approximately 22km east-west x 22km north-south centred on the proposal area, was undertaken on the 15th of November 2016. The AHIMS Client Service Number was: 254143. There were 79 Aboriginal sites and no declared Aboriginal Places recorded in the search area. Figure 7 shows the locations of the AHIMS sites in relation to the assessment area and Table 3 shows a breakdown the of the site types.

Table 3 Breakdown of previously recorded Aboriginal sites in the region.

Site Type	Number
Artefact (1 or more)	58
Artefact (1 or more) and PAD	8
Modified tree	6
Stone Quarry and artefact	3
PAD	2
Grinding Groove	1
Art and PAD	1
TOTAL	79

None of the sites are located within the current proposal area. The closest sites to the project area was recorded as an open artefact site (AHIMS # 36-2-0016) located approximately 500m north of the assessment area. The information provided on the site card was poor and information relating to the landform of the site and size is not detailed. However, the site was noted at the time of its recording to be a campsite and said to still be frequented. Bondi point artefacts were also noted to be present. The site card lists R. Hawkins as the informant for the site. No other information pertaining to this site is currently available.

3.2.3 Regional Archaeological Models

Aboriginal people have occupied what we now know as the Australian continent for at least 40,000 years and perhaps 60,000 years and beyond (Hiscock 2007, Mulvaney and Kamminga 1999). While no regional synthesis of the archaeology has been completed for the Beryl area research studies have been undertaken in the Upper Macquarie River region by Pearson (1981) and Koettig (1985). The following is a summary of the finding from these studies.

Pearson (1981) analysed a series of sites which tended to be biased towards larger and more noticeable sites identified by local residents. During this study, he excavated three rockshelters (Botobolar 5, Granites 1 and Granites 2) which provided a record of regional Aboriginal occupation in the area to 5,000 years before present. Based on his finding Pearson categorised these sites as either occupation sites or non-occupation sites (sites that are generally for a single purpose ie. scarred trees, grinding grooves and burial sites) and built an archaeological model based on location. The model developed by Pearson is summarised below.

- Distance to water from sites varied from 10 to 500m, with larger sites found closer to a water source.
- Good soil drainage and an outlook over a water source were important to location.
- Ceremonial and stone arrangement sites were located away from campsites.
- Quarry sites were located in areas with desirable stone source qualities and reasonably accessible.

Koettig (1985) continued to build on the archaeological understanding of this region by conducting a comprehensive and systematic study of the Dubbo region, which although over 70km to the west, is relevant as one of only a few side-ranging archaeological studies. Koettig investigated all topographic landform units and creek orders through sample survey to clarify locations and site types. The study arrived at the following conclusions:

- Aboriginal sites may be expected throughout all landscapes.
- Artefact scatters, scar trees and grinding grooves are the most frequently occurring site types.
- The location and size of sites were determined by various factors; predominately environmental and social factors around the proximity to water, geological formations and the availability of food resources.

Koettig suggested that larger and constantly occupied sites are likely to occur along permanent watercourses, while more sporadic occupation would have occurred along ridge tops or temporary water courses.

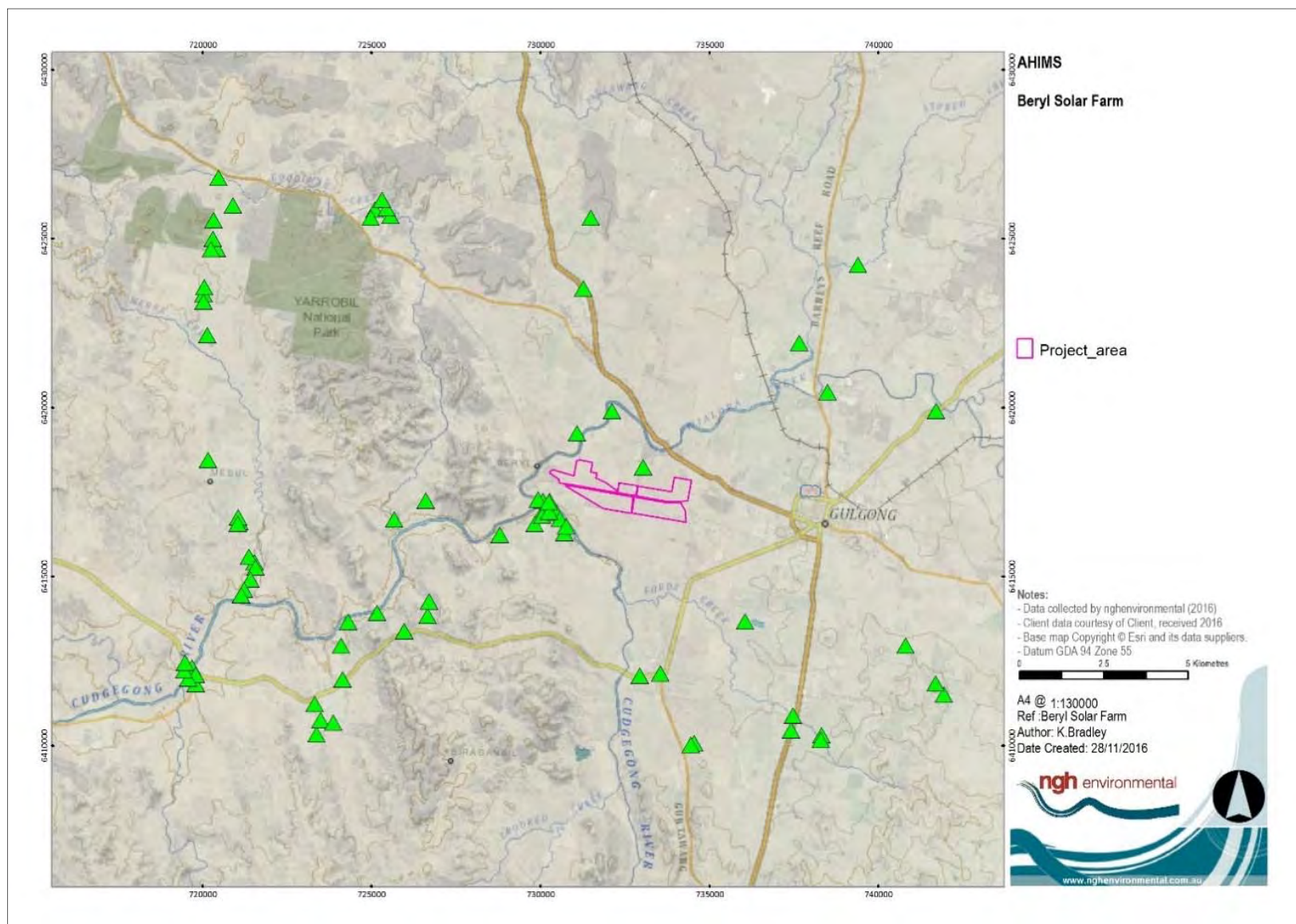


Figure 7. Location of AHIMS sites

3.2.4 Previous archaeological studies

The following are summaries of those archaeological survey reports that have been completed in the Beryl area and in relative proximity to the current assessment area.

Cubis (1981) surveyed a 35km proposed route for a 132 kV transmission line between the Beryl and Ulan substations. A total of ten sites were recorded during the survey. The site types included isolated finds and artefact scatters.

Brayshaw (1987) surveyed the land for a haul road and a 125mx 125m area for proposed hard rock basalt quarry on the bank of the Cudgegong River at Beryl, 9km west of Gulgong. Six open sites (CR1-CR6) and an isolated find were recorded. The dominate lithology was quartz with lesser amounts of chert, mudstone and basalt. Brayshaw noted that the minimal use of basalt at the sites was unusual given the presence of basalt outcrops within the project area. Two of the sites were located on ridge tops while the others were all located on the river flats and adjacent slopes. Sites were located up to 240m away from the river.

Smith (1987) surveyed additional land near the proposed hard rock basalt quarry on the southern bank of the Cudgegong River at Beryl, 9km west of Gulgong. Six open sites and quartz quarry site (CR7-13) were recorded. The sites recorded by Smith were all located within 5 to 500m of the Cudgegong River. While three of the sites were located amongst basalt outcrops the outcrops did not appear to be utilised. However, the two sites recorded in association with quartz outcrops appeared to be utilised. The dominant lithology recorded at the sites was quartz. Smith noted an average site density of three sites per square kilometre in the area by combining her results with Brayshaw's. The areas surveyed by Smith and Brayshaw are shown in relation to the current assessment area in Figure 8 below.

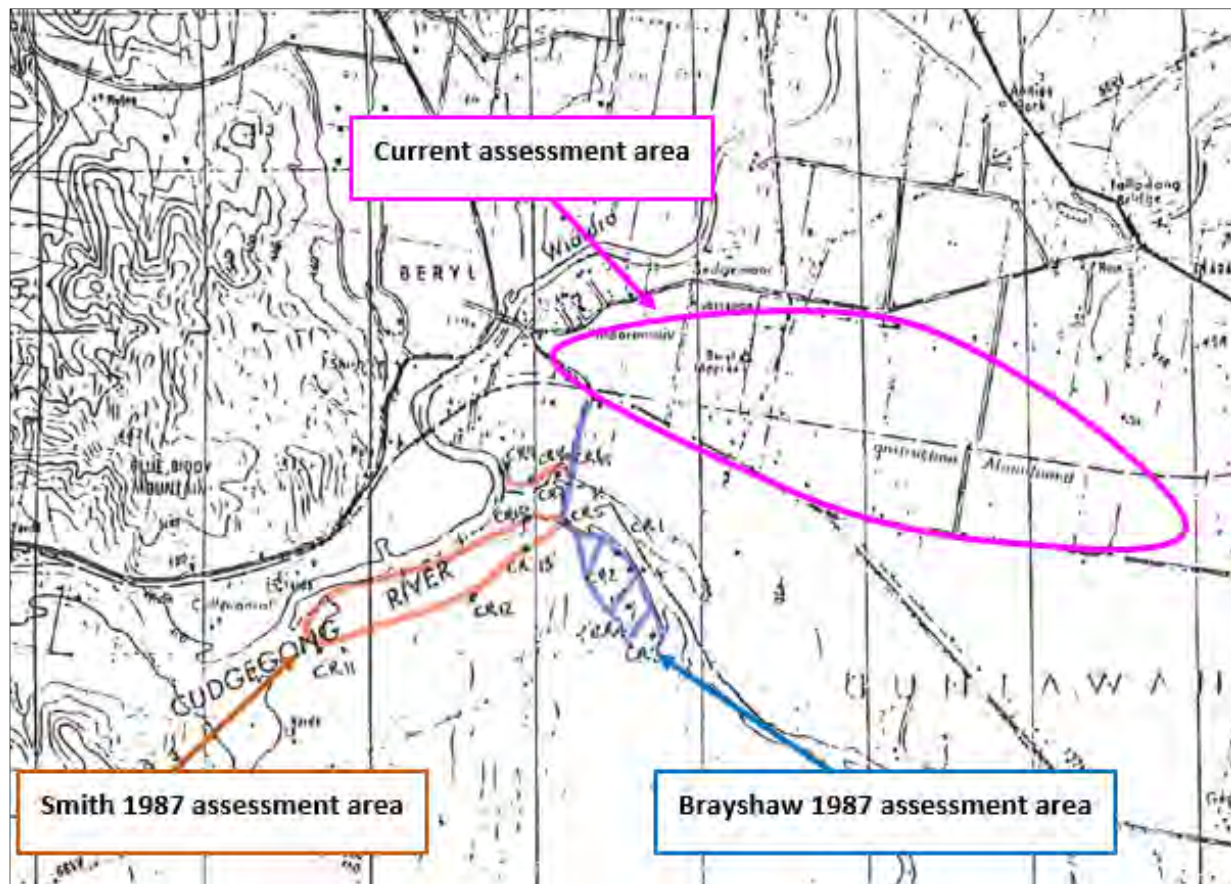


Figure 8. Overlay of Brayshaw (1987) and Smith (1987) survey areas in relation to the current assessment area (image modified from Smith 1987: Figure 2).

Purcell (2002) conducted a broad regional cultural heritage study of the Brigalow Belt South Bioregion in NSW. This bioregion extends from Dubbo north to Moree but its southern boundary is approximately 15km north of the current project area. Over the course of the study Purcell recorded 110 oral history interviews, located 1,110 Aboriginal sites, documented 60 traditionally used plant species and mapped landforms that have Aboriginal cultural heritage values. Of the 1,110 Aboriginal sites recorded during this assessment 893 existed on the site register prior to the study.

The field survey portion of Purcell's study primarily targeted government owned land such as state forests and a landform mapping project was undertaken to assist with the development of a predictive model for Aboriginal site distribution across the bioregion. Water localities were noted to be the major contributing element influencing the distribution of sites among landforms with sites expected to be concentrated near water localities. The landform types were classified into four key groups as shown in Table 4 below. The study indicated that Aboriginal sites have been recorded more frequently on high contour and alluvial landforms. The majority of the sites recorded were within 100-400 m of water.

In 2012 OzArk conducted a survey for the proposed duplication of the existing 66kv powerline from Beryl Substation to the Dunedoo Substation. Due to an administration error in uploading the report only the ecological assessment for this project is available via AHIMS rather than the Heritage Assessment report. Unfortunately, due to this error the Oz Ark report is not publicly available and was unable to be reviewed as part of this assessment. NGH has informed OEH of this error in the AHIMS database.

Table 4 Breakdown of landforms mapped by Purcell in the Brigalow Belt South Bioregion.

Landforms	Description	Likelihood of Aboriginal sites
Alluvial	Low lying areas associated with a variety of water features including rivers, creeks, channels, billabongs, swamps and lakes. Landforms include alluvial fans, alluvial terrace, alluvium, channel, floodplain, flood channel, gilgai, wetland/swamp and palaeo channels.	Aboriginal sites occur frequently
Deep stable sand	Landform types include yellow sand sheets and sand monkey. Water is scarce.	Aboriginal sites occur less frequently
Terrace group	Landform types consist of terrace with scalds, terrace with overland flow, terrace and clay pans. Each variety of terrace adjoins a landform associated with an alluvium landform.	Areas where terrace and floodplains overlap will have a high potential for sites
Higher contour	Landforms that are elevated and consist of rocky ground, rocky ravines, colluvial slope, soil mantled slope, bench and talus.	High frequency of sites when associated with alluvial landforms or creek lines

Since the 1980's a number of surveys have been conducted for the Moorlarbeen, Wilpingjong and Ulan coal mines near Ulan, approximately 25km east of the current assessment area. The following are summaries of those archaeological survey reports that have been completed.

The Moorlarbeen coal mine is located 25km east of Gulgong and is adjacent to the Wilpingjong and Ulan mines. A number of surveys for the project have been conducted by from 2006 till 2013 (Hamm 2008, 2009, Kuskie 2013 and Niche 2015). Hamm's 2006 assessment of the proposed mine area noted that concentrations of Aboriginal sites occurred on the alluvial flats associated with water courses. A number of sites have been recorded in the subsequent surveys including isolated artefacts, artefact scatters, rock

shelters, rock shelters with art, modified trees, grinding grooves and PADs. Quartz generally dominates the artefact assemblages with lesser numbers of tuff, silcrete, quartzite, chert, mudstone, chalcedony and volcanics. Flakes and flaked pieces dominated the assemblage with cores, hammer stones and backed artefacts also recorded (Kuskie 2015).

A series of test excavations and salvage programs have also been undertaken for the Moorlarbeen coal mine Stage 1 Main infrastructure area and Open Cut 1 area with approximately 13,700m² subject to controlled mechanical exposure and 271 m² excavated by hand. The salvage and excavation programs for the Stage 1 Main infrastructure area and Open Cut 1 area resulted in the recovery of 2,643 artefacts and the identification of 35 new artefact sites (Hamm and Foley 2010).

A number of surveys for the Ulan Coal Mine have been conducted from 1980 till 2015 (as summarised in Kuskie 2013 and Niche 2015). The surveys resulted in the identification of a number of sites including isolated finds, artefact scatters, rock shelters, PADs, quarry, grinding grooves, rock shelters with art and modified trees being recorded. Quartz is the dominate lithology recorded. Kuskie (2009) noted that the archaeological evidence collected in the Ulan Coal Mine area indicates that the Aboriginal utilisation of the study area was generally of a low intensity and most likely relates to the limited presence of higher order watercourse within the analysis area.

A series of test excavations and salvage programs have been undertaken over the course of the Ulan Coal Mine project including Haglund's salvage excavation of the rock shelter site AHIMS# 36-3-177 that resulted in the recovery of 765 artefacts from 20m² of excavated deposit. The artefact density of the objects recovered was very high at 139 artefacts/m³. The rock shelter site Spring Gully 5 has also been subject to extensive salvage excavation and has returned a radiocarbon date of 4,147 ±60 years before present. A total of 10,002 artefacts were recovered from 37m³ of excavated deposit. Kuskie also conducted the test excavation of three rock shelters (IS# 104, 105 and 1420) recovering a total of 2,896 artefacts from 3m³ of excavated deposit. An Aboriginal fire place was also identified within the rock shelter #105 that has been radiocarbon dated to 3,200 to 3,500 year ago (Kuskie 2015:34-35).

The Wilpingjong coal mine was surveyed from 2005 to 2015. A number of Aboriginal sites have been recorded including artefact scatters, isolated finds, rock shelter with artefacts, PADs, art and modified trees. Quartz was the dominate lithology in the area followed by tuff with lesser numbers of chert, volcanic, jasper, rhyolite and quartzite artefacts. Complete and broken flakes were the dominate artefacts recorded (Kuskie 2015; Niche 2015). A number of salvage programs and excavations have occurred, including the baseline recording and monitoring of rock art sites (Kuskie 2015).

Surface collections, controlled mechanical exposure (surface scrapes) and mechanically excavated test pits have been conducted at a number of sites within the Wilpingjong coal mine project area. The test excavation of site WCP33 the southern portion of Pit 5 excavated ten 0.5x0.5m test pits by shovel. A total of 20 artefacts were recorded with quartz the dominate lithology. The test excavation of site WCP2016 recovered 97 artefacts and the site was noted to have a low artefact density of artefacts with 8.1 artefacts per m². Test excavation was also conducted at site WCP92 in Pit 7 with only two artefacts recovered from eleven 1m x 1m pits. However, mechanical surface scrapes of approximately 7,950m² and the hand excavation of the site WCP1 has been noted to have recovered a number of artefacts with the report still in preparation (Kuskie 2015:26-29)

3.2.5 Summary of Aboriginal land use

The results of previous archaeological surveys in the Beryl region show that there are sites and artefacts present throughout the landscape. There is a dominance of artefacts either as isolated finds or in clusters as artefact scatters.

There appears to be a pattern of site location that relates to the presence of potential resources for Aboriginal use. The Aboriginal site modelling for the region to date suggests that while Aboriginal sites may be expected throughout all landscapes the most archaeologically sensitive areas occur in proximity to water. The most likely site type to be encountered within the Beryl Solar Farm project area would be stone artefacts and scarred trees where old growth trees remain.

A detailed understanding of the Aboriginal land use of the region is in reality lacking, as few in depth studies have been completed and no sites have been dated. It is possible however, to ascertain that proximity to water sources and raw materials was a key factor in the location of Aboriginal sites. It is also reasonable to expect that Aboriginal people ventured away from these resources to utilise the broader landscape but the current archaeological record of that activity is currently limited.

3.2.6 Archaeological Site Location Model

Based on the results of the previous archaeological investigations in the local Beryl area, and through extrapolation of Wiradjuri sites from the region it is possible to provide the following model of site location in relation to the proposed Beryl Solar Farm area.

Stone artefact scatters – representing camp sites can occur across the landscape, usually in association with some form of resource or landscape unit. Within the project area, there are no high order, permanent drainage channels, although the close proximity of the junction of the Wyaldra Creek and Cudgegong River is noted. However, due to the lack of permanent water in the project area large campsites are unlikely to occur.

Burials – are generally found in elevated sandy contexts or in association with rivers and major creeks. No such features exist with the project area and therefore such sites are unlikely to occur.

Scarred Trees – these require the presence of mature trees and are likely to be concentrated along major waterways and around swamps areas. There are patches of remnant vegetation across the project area. Therefore, this feature could occur.

Hearths/Ovens – are identified by burnt clay and stone used for heat retainers. None are recorded in the district but they could occur either independently or in association with other Aboriginal cultural features such as campsites, often in association with resource locations. Such places are not obvious within the project area and this feature is therefore unlikely to occur.

Stone resources – are areas where people used natural stone outcrops as a source material for flaking. This requires geologically suitable material outcropping so as to be accessible. The project area contains natural outcropping basalt therefore such sites could occur although, it has been noted that the outcropping stone in the project area has been quarried since European arrival in the area which may have destroyed or disturbed any evidence of Aboriginal quarrying.

Shell Middens – are the agglomeration of shell material disposed of after consumption. Such places are found along the edges of significant waterways, swamps and billabongs. The proposal area contains no significant waterways, swamps and billabongs and this feature is therefore unlikely to occur

Isolated Artefacts – are present across the entire landscape, in varying densities. As Aboriginal people traversed the entire landscape for thousands of years, such finds can occur anywhere and indicate the presence of isolated activity, dropped or discarded artefacts from hunting or gathering expeditions or the ephemeral presence of short term camps.

In summary, the topography and landscape features within the proposed Beryl Solar Farm project area indicate that this area would likely have been part of the Wiradjuri landscape, particularly with the junction of Wyaldra Creek and Cudgegong River so close to the project area. Therefore, the project area could potentially be attractive to Aboriginal people to concentrate activity and therefore has a higher possibility of providing an archaeological signature. Subsequently, given that Aboriginal people have lived in the region for tens of thousands of years, there is potential for archaeological evidence to occur throughout the area, this is most likely to be in the form of stone artefacts.

3.2.7 Comment on Existing Information

The AHIMS database is a record of those places that have been identified and had site cards submitted to OEH. It is not a comprehensive list of all places in NSW as site identification relies on an area being surveyed and on the submission of site forms to AHIMS. There are likely to be many areas within NSW that have yet to be surveyed and therefore have no sites recorded. However, this does not mean that sites are not present.

Within the Beryl district there have only been a few archaeological investigations. The information relating to site patterns, their age and geomorphic context is little understood.

The robustness of the AHIMS survey results are therefore considered to be only moderate for the present investigation. There are likely to be sites that exist that have yet to be identified although the scale of farming and quarrying development has altered the natural landscape in some places. This activity has also greatly disturbed the archaeological record and there are unlikely to be many places that retain *in situ* archaeological material due to the scale of the quarrying activities and agricultural and pastoral development. The current study is the most comprehensive assessment of this locality and therefore the results outlined in this report are the most thorough and up to date available.

With regard to the limitations of the information available, archaeologists rely on Aboriginal parties to divulge information about places with cultural or spiritual significance in situations where non-archaeological sites may be threatened by development. To date, no such places have been identified within the archaeological reports carried out within the broader Beryl area. No such places have been identified through the consultation process for the Beryl Solar Farm proposal area.

4 ARCHAEOLOGICAL INVESTIGATION RESULTS

4.1 SURVEY STRATEGY

The intention for the heritage survey was to cover as much of the ground surface as possible, given that the project was going to disturb approximately 206 hectares, within the 332 hectare proposal site. Although the actual ground impact from the construction method was likely to be low, the placement of solar arrays across the landscape has the potential to cover any cultural heritage sites.

The strategy therefore was to walk a series of transects across the landscape to achieve maximum coverage. Because landform was generally a cleared undulating plain with exotic dominated pasture used for grazing livestock, transects were spaced evenly with the survey team spread apart at 20m intervals, walking in

parallel lines. The cleared nature of the paddocks made this an ideal survey strategy. The team were able to walk in parallel lines, at a similar pace, allowing for maximum survey coverage and maximum opportunity to identify any heritage features. The size of the survey team was a maximum of four people which allowed an 80m tract of the project area to be surveyed with each transect. At the end of each transect, the team would reposition along a new transect line at the same spacing and walk back on the same compass bearing.

We believe that the survey strategy was comprehensive and the most effective way to identify the presence of Aboriginal heritage sites. Discussion were held in the field during each day between the archaeologists and Aboriginal community representatives to ensure all were satisfied and agreed with the spacing and methodology.

The proposal area was divided into two sections as shown in Figure 9 and detailed below:

- The solar farm development proposal area (undulating plain) -comprising of 206 hectares which would be developed.
- Area not proposed for development within the project area –approximately 80 hectares comprising of low slopes and undulating plain.

The survey was undertaken by the team on the 21st and 22nd of February 2017. Notes were made about visibility, photos taken and any possible Aboriginal features identified were inspected, assessed and recorded if deemed to be Aboriginal in origin.

All mature trees within or adjacent to the development footprint were also inspected for evidence of Aboriginal scarring (c.f Long 2005).

4.2 SURVEY COVERAGE

The solar farm area comprised primarily of a cleared undulating plain with little topographic variation except towards to the slope of the low hill in the north-eastern corner of the project. The two drainage lines across the project area formed minor depressions and the ground near the agricultural dams and quarrying sites had been modified. The entire project area had been subject to clearing and ploughing activities. The landforms were therefore divided into two units based on the solar farm proposal; the solar farm development areas and the area outside the development plan within the project area.

Survey transects were undertaken on foot and traversed all the project area including the proposed powerline easement to the substation. Visibility within the project area was variable however the project area as a whole generally had a low grass cover. The effective visibility in the paddocks ranged from 80% in exposures to less the 5% in areas of dense thistles near the hard rock quarry to the south of the project area (Plate 4). The average effective visibility was 15% but overall was quite good.

It was noted that the stones in several the paddocks had been mechanically collected and placed in piles (Plate 10). These piles of stone were inspected for any evidence of Aboriginal objects.

Table 5 below shows the calculations of effective survey coverage and plates 1-10 show examples of the transects and disturbed area within the proposal area.

Between the survey participants, over the course of the field survey, approximately, 100 km of transects were walked across the proposed solar farm development area. Allowing for an effective view width of 5m each person, this equates to a surface area examined of 46ha. However, allowing for the visibility restrictions, the effective survey coverage is reduced to 6.9 ha, or 3.3% of the project area.

The survey coverage for the area outside the development footprint within the project area was 12.9 ha of the 126 ha area, but allowing for visibility restrictions, the effective survey coverage was 1.9 ha or 1.5% .

Overall, it is considered that the surface survey of the Beryl Solar Farm project area had sufficient and effective survey coverage. The results identified are considered a true reflection of the nature of the Aboriginal archaeological record present within the proposal area.

	
Plate 1 View north towards low hill in north-eastern corner of project area.	Plate 2 View west along northern boundary towards location of Beryl Solar IF 1.
	
Plate 3 View north towards substation with powerlines in frame.	Plate 4 View south towards hard rock quarry, note poor visibility due to dense thistle vegetation.
	
Plate 5 View west towards far western portion of project area.	Plate 6 View south of area quarried for diamonds in far west of project area, note prospecting depressions and mounds.

	
Plate 7 View north of hard rock quarry pit showing piles of quarried rock.	Plate 8 View north-east of area subject to sand quarrying, note spoil mound deposits in background.
	
Plate 9 View east along abandoned rail corridor, noting area for rail raised above natural ground level.	Plate 10 View south of pile of rocks collected mechanically from field in far east of project area with L. Foley inspecting for Aboriginal objects.
	
Plate 11 View west of farm dam, note ground visibility.	Plate 12 View of animal tracks, note ground visibility.

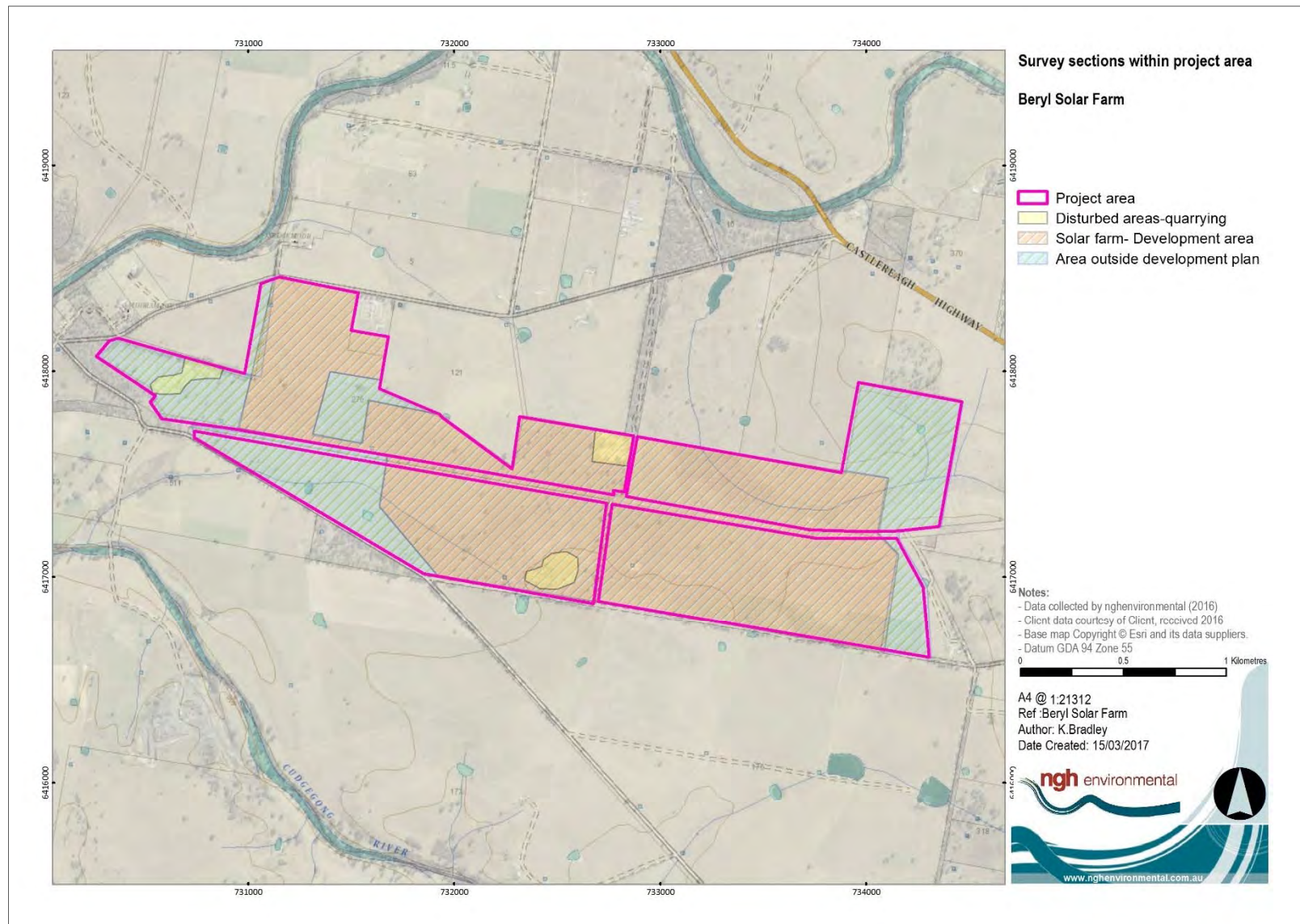


Figure 9. Survey sections within project area.

Table 5. Transect information.

Survey Section	Number of Survey Transects	Topography	Exposure type	Project Area ha	Surveyed area (length m x width m)	Survey Area m2	Visibility	Effective coverage (area x visibility) m2	Project Area surveyed (ha)	Percentage of Project area effectively surveyed	Archaeological result
Solar farm development area	36	Undulating plain	Vehicle tracks, animal tracks, eroded and disturbed ground soil mounds, quarried areas.	206	23,000 x 20	460,000	15% average	69,000	6.9	3.3	4 isolated finds 1 artefact scatter
Area outside development plan within project area	16	Undulating plain and slopes of rolling hills	Vehicle tracks, animal tracks, eroded and disturbed ground soil mounds.	126	5,550x20 1,800x 10	129,000	15% average	19,350	1.9	1.5	Nil

4.3 SURVEY RESULTS

Despite the variable visibility encountered during the survey, there were six stone artefacts found across the proposal area that were recorded as five site occurrences. The archaeological features have been recorded as an artefact scatter and four isolated finds. The details of the sites are outlined below; their location is shown in Figure 10 with the artefact characteristics provided in Table 6

Beryl Solar Farm IF1

This site consisted of a single artefact on a minor slope in a cleared paddock. The artefact was a bifacial flaked hand axe manufactured from tuff. The deposits consisted of a yellowish brown sandy silt and visibility within the area was 15%. The area has been subject to disturbance from ploughing in the past and the site was on the edge of a concentration of river pebbles associated with a first order drainage depression. The axe was noted by the Aboriginal representatives onsite to be relatively large for the area as it measured 135mm in length.



Beryl Solar Farm IF2

This site consisted of a single artefact on the flat in a cleared paddock. The artefact was a multi-platform core of tuff. A total of four platforms and nine negative scars were recoded with step terminations noted. The artefact had been partially bifacial flaked at one end and was noted by the Aboriginal representatives onsite to be axe like in shape. The artefact had 20% terrestrial cortex and was located on a yellowish brown sandy silt deposits. Visibility within the paddock was approximately 15%.



Beryl Solar Farm IF3

This site consisted of a single artefact on the gentle basal slope of a ploughed cleared paddock. The artefact was a multi-platform core of quartz. Two platforms and four negative scars were recorded with the artefact noted to have 60% pebble cortex. The artefact was located on reddish brown silty soil approximately 150m west of the Beryl substation.



Plate 17. View south, pole shows artefact location.



Plate 18. Close up of Beryl Solar Farm IF 3.

Beryl Solar Farm IF4

This site consisted of a single artefact on the lower basal slope of a ploughed and cleared paddock. The artefact was an edge-ground axe manufactured from a volcanic material with some anvil damage. The axe had split in half; it is unclear if this damage was the result of ploughing activities. The artefact was located on reddish brown sandy loam deposits and visibility within the area was 15%. The site was located approximately 30m south of Beryl Road.



Plate 19. View east, pole shows artefact location.



Plate 20. Close up of Beryl Solar Farm IF 4.

Beryl Solar Farm AS1

This site consisted of two artefacts approximately 5m apart from each other on the lower basal slope of a ploughed and cleared paddock. The area was noted to be disturbed with broken pieces of house bricks scattered nearby. The artefacts were a flake and broken flake of quartz. The artefacts were located on a reddish brown sandy loam deposits and visibility within the area was approximately 20%. The site was located approximately 30m south of Beryl Road and 40 m west of the site Beryl Solar Farm IF 4.

	
Plate 21. View east, poles show artefact locations.	Plate 22. Close up of quartz broken flake from Beryl Solar Farm AS1.
	
Plate 23. View north-west, pole shows artefact location.	Plate 24. Close up of quartz flake from Beryl Solar Farm AS1.

Table 6. Artefact characteristics

AHIMS #	Site Name	Easting/Northing (Zone 55)	Artefact Type	Raw Material	Dimensions (mm)	Comments
36-2-0473	Beryl Solar Farm IF 1	733453/ 6417569	Axe	Tuff	135x 90 x 32	Bifacial flaked axe.
36-2-0472	Beryl Solar Farm IF 2	733005/ 6417165	Core	Tuff	118 x 46 x 55	Four platforms and nine negative scars with step fractures, 20% rough terrestrial cortex, partially bifacial flaked at one end.
36-2-0471	Beryl Solar Farm IF 3	731385/ 6418330	Core	Quartz	35 x 91 x 60	Two platforms and four negative scar, 60% water worn riverine cortex.
36-2-0470	Beryl Solar Farm IF 4	731214/ 6418411	Axe	Volcanic	80 x 59 x 18	Edge-ground axe with some anvil damage, artefact has split.
36-2-0469	Beryl Solar Farm AS1	731174/ 6418420	Flake	Quartz	20 x 12 x 5	Broad platform with feather termination and tertiary stage of reduction.
		731172/ 6418417	Broken flake	Quartz	20 x 12 x 5	Feather termination.

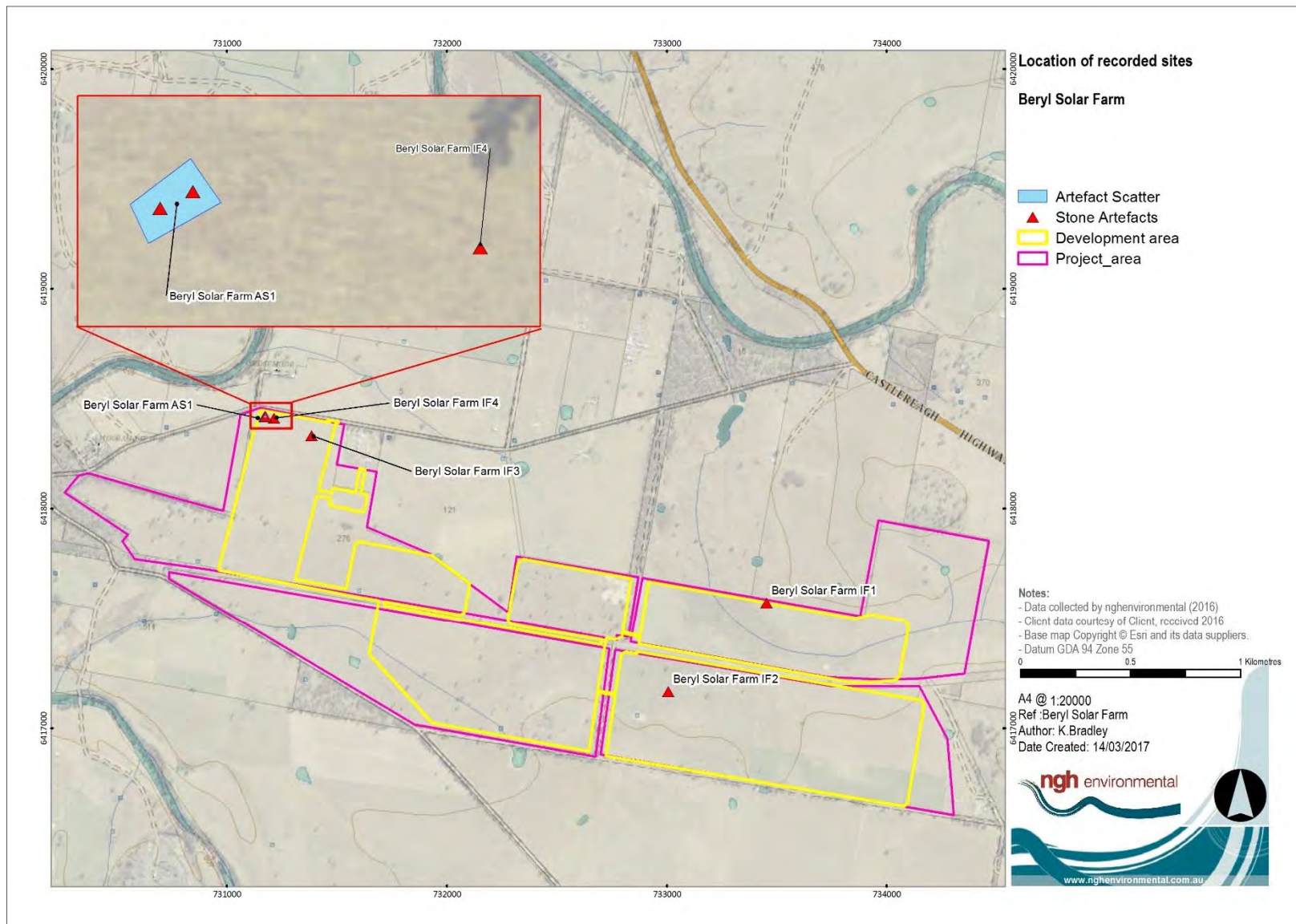


Figure 10. Location of recorded sites.

4.4 DISCUSSION

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 the areas closest to a water source were likely to contain sites given the modelling for the region. The survey results have confirmed this prediction with stone artefacts recorded. The absence of scarred trees within the project area is likely the result of clearing activities with few mature trees remaining within the assessment area.

The sites are all located within 450m of a watercourse with a noticeable cluster of artefacts (Beryl Solar Farm AS1 and Beryl Solar Farm IF 4) recorded in the north-western corner of the project area approximately 250m south-east of Wialdra Creek. These results indicate that while sites can occur throughout the landscape, even in areas highly disturbed by farming activities, there is a dominance of Aboriginal cultural material recorded near a water source.

The sites identified in this assessment are in close proximity to either permanent or ephemeral water sources and are representative of the opportunistic use and movement of people through the landscape. They are most likely representative of the use of major water course and the associated back country. The area was likely used intermittently over a period of time for camping, hunting and gathering resources. This is evident by the presence of stone artefacts in low densities. Based on this assumption, there is every chance that there are similar stone artefacts across similar landscapes in the Beryl area.

While the sites themselves and the distribution of cultural material provide an indication that the area was used more than once, artefacts manufactured from quartz, tuff and volcanic material is common for the general region. The presence of cores and flakes indicates that tool manufacture probably occurred onsite, although the presence of the bifacial axe and the edge ground axe may imply some tools were brought to the site. The presence of a large bifacial hand axe (Beryl Solar Farm IF 1) suggested a multi-staged approach to manufacturing artefacts, including the sourcing of material and then shaping and manufacture of the desired product.

The use of a volcanic material for the manufacture of the edge-grounded axe is common for the region however it should be noted that no grinding grooves have been recorded on AHIMS within the Beryl area. This suggests that edge-grounded axes in the Beryl area may have been shaped and sharpened elsewhere or that simply that this site type is yet to be identified and recorded in the area. Exposed sandstone bedrock near Ulan, approximately 25 km north-east of the current assessment area, has sites with grinding grooves used for the shaping and maintenance of ground- edge axes (Kuskie 2009:143; Kuskie 2015:80).

While two large basalt outcrops were located within the project area, neither showed any evidence of Aboriginal quarrying although it is possible that European quarrying activities have since destroyed or removed any evidence of the Aboriginal utilisation of these outcrops. Nevertheless, these results do support the observations previously made by Brayshaw (1987) and Smith (1987) that while sites could be located amongst the basalt outcrops, the outcrops themselves did not appear to be utilised.

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. However, they are likely to be small scatters or isolated artefacts and consideration must also be given to the level of disturbance of any such sites. Based on the land use history of the proposal area, and an appraisal of the results from the field survey, there is negligible potential for the presence of intact subsurface deposits with high densities of objects or cultural material within the solar farm and powerline easement areas.

5 CULTURAL HERITAGE VALUES AND STATEMENT OF SIGNIFICANCE

The assessment of the significance of Aboriginal archaeological sites is currently undertaken largely with reference to criteria outlined in the ICOMOS Burra Charter (Marquis-Kyle & Walker 1994). Criteria used for assessment are:

- *Social or Cultural Value*: In the context of an Aboriginal heritage assessment, this value refers to the significance placed on a site or place by the local Aboriginal community – either in a contemporary or traditional setting.
- *Scientific Value*: Scientific value is the term employed to describe the potential of a site or place to answer research questions. In making an assessment of Scientific Value issues such as representativeness, rarity and integrity are addressed. All archaeological places possess a degree of scientific value in that they contribute to understanding the distribution of evidence of past activities of people in the landscape. In the case of flaked stone artefact scatters, larger sites or those with more complex assemblages are more likely to be able to address questions about past economy and technology, giving them greater significance than smaller, less complex sites. Sites with stratified and potentially in situ sub-surface deposits, such as those found within rock shelters or depositional open environments, could address questions about the sequence and timing of past Aboriginal activity, and will be more significant than disturbed or deflated sites. Groups or complexes of sites that can be related to each other spatially or through time are generally of higher value than single sites.
- *Aesthetic Value*: Aesthetic values include those related to sensory perception, and are not commonly identified as a principal value contributing to management priorities for Aboriginal archaeological sites, except for art sites.
- *Historic Value*: Historic value refers to a site or place's ability to contribute information on an important historic event, phase or person.
- *Other Values*: The Burra Charter makes allowance for the incorporation of other values into an assessment where such values are not covered by those listed above. Such values might include Educational Value.

All sites or places have some degree of value, but of course, some have more than others. In addition, where a site is deemed to be significant, it may be so on different levels or contexts ranging from local to regional to national, or in very rare cases, international. Further, sites may either be assessed individually, or where they occur in association with other sites the value of the complex as a whole should be considered.

Social or cultural value

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.

Feedback about the cultural value of the sites from Larry Foley who represented both Buudang and Murong Gialinga Aboriginal & Torres Strait Islander Corporation over the course of the fieldwork indicated that all sites hold cultural value to the local Aboriginal community.

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

Scientific (archaeological) value.

The research potential of the sites located during this assessment is considered to be low. While the presence of the sites can be used to assist in the development of site modelling for the local landscape, their scientific value for further research is limited.

While the artefacts themselves are intrinsically interesting in terms of their base technical information their current lack of temporal context and the absence of information about local resources makes further conclusions about land use difficult. Their scientific value for further research is also limited due to the sparse distribution of the artefacts, disturbed nature of the landscape and the subsequent movement of objects by clearing and ploughing activities. The stone axes are generally considered of higher value due to their relative rarity compared to typical flaking material of cores and flakes. Axes are an indicator of a different tool use and activity, being mostly for the removal of wood from trees that could have been used for a variety of purposes such as carrying dishes, shields, spears and shelter as well as extraction of food such as possums and honey from hollows. The presence of at least two definite axes in the one locality would indicate that such woodworking activities was a high priority in the area.

The only other potential area of research would be to analyse the edge-ground axe (Beryl Solar Farm IF4) and bifacial hand axe (Beryl Solar Farm IF1) to see if there are any residues present that could indicate what materials were ground or cut. However, this is likely to be difficult as the items would have been moved around by pastoral and agricultural activity and may have been compromised through contact with cereal crops and livestock. They may be useful in analyses of artefact distribution if the quarry source was ever identified.

Aesthetic value.

There are no aesthetic values associated with the archaeological site per se, apart from the presence of Aboriginal artefacts in the landscape. The modified and heavily disturbed landscape within the solar farm development area however detracts from this aesthetic setting.

Other Values

There are no other known heritage values associated with the project area. The area may have some educational value (not related to archaeological research) through educational material provided to the public about the Aboriginal occupation and use of the area, although the archaeological material is within private property and there is little for the public to see.

6 PROPOSED ACTIVITY

6.1 HISTORY AND LANDUSE

It has been noted above in Section 3.1.3 that historically the solar farm proposal area has been impacted through land use practices specifically quarrying, clearing, ploughing and grazing.

The implications for this activity is that the archaeological record has been compromised in terms of the potential for scarred trees to remain. The implication for stone artefacts is that they may have been damaged or moved but they are likely to be present and remain in the general area they were discarded by Aboriginal people.

Despite these impacts, Aboriginal artefacts remain in the area, indicating the presence of past Aboriginal people and providing indications of their use of this landscape.

6.2 PROPOSED DEVELOPMENT ACTIVITY

As noted above in section 1.2, the proposal involves the construction of a solar farm and includes a transmission line on Lot 21/DP 1173059 that will extend to the existing Beryl substation on Lot 1/ DP 523876. The development will result in disturbance of approximately 206 ha of the 332ha proposal site within Lot 20/DP 1173059 and Lot 1/DP 1012926.

Disturbances will largely be in the preparation of the ground for the solar farm. Piles would be driven or screwed into the ground to support the solar array's mounting system, which reduces the potential overall level of ground disturbance.

PV modules would be installed on single axis tracking or fixed mounting structures across the site

Trenches would be dug for the installation of a series of underground cables linking the arrays across the proposal site.

Some internal access tracks would also be required, and typically these would comprise a compacted layer of gravel laid on stripped bare natural ground.

Some ancillary facilities would also be required including parking facilities, staff amenities and offices.

A perimeter fence and a vegetation buffer would also be constructed around the solar farm.

An overhead power line would be installed to connect the solar farm to the existing Beryl substation.

The proposed construction timetable is 12 months duration and the operational life of the solar farm is estimated to be 30 years. After the initial 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 development activity will therefore involve disturbance of the ground during the construction of the solar farm and the transmission line to the adjacent substation. Once established however, there would be minimal ongoing disturbance of the ground surface.

The final details and timing of the proposed construction activity have yet to be finalised but it is anticipated that construction could commence in 2017.

6.3 ASSESSMENT OF HARM

As described in this report, five archaeological sites were located within the project area. The following table provides a summary of the degree of harm and the consequence of that harm upon the heritage value of each site resulting from the proposed works for the solar farm and transmission line to the Beryl substation.

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

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

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

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

Table 7 Identified risk to known sites

Site name	Site integrity	Type of harm	Degree of harm	Consequence of harm	Recommendation
Beryl Solar Farm IF 1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 2	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 3	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm IF 4	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage object prior to development of project.
Beryl Solar Farm AS1	Poor – 100+ year history of agricultural and pastoral use	Direct	Complete	Minimal loss of value	Salvage objects prior to development of project.

6.4 IMPACTS TO VALUES

The values potentially impacted by the development are any social and cultural values attributed to the artefacts and the sites by the local Aboriginal community. The extent to which the loss of the sites or parts of the sites would impact on the community is only something the Aboriginal community can articulate.

The impact to values for this development are summarised in Table 7 above

The impact to the scientific values if the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS1 were to be impacted by the current proposal is considered low. However, the intrinsic values of the artefacts themselves may be affected by the development of the site. Any removal of the artefacts, or their breakage would reduce the low scientific value they retain.

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

7 AVOIDING OR MITIGATING HARM

7.1 CONSIDERATION OF ESD PRINCIPLES

Consideration of the principles of Ecologically Sustainable Development (ESD) and the use of the precautionary principle was undertaken when assessing the harm to the sites and the potential for mitigating impacts to the sites recorded within the Beryl Solar Farm proposal area. The main consideration was the cumulative effect of the proposed impact to the sites and the wider archaeological record. The precautionary principle in relation to Aboriginal heritage implies that development proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

In broad terms, the archaeological material located during this investigation is similar to what has been found previously within the Beryl region. Currently there is no clear regional synthesis of the nature, number, extent and content for archaeological sites within the Mid-Western Regional Council LGA. Nevertheless, given the size of the geographical area, it is certain that there would be similar artefacts present within the region.

The result of this Aboriginal heritage assessment has confirmed the proposed model of site location and site distribution, whereby sites could be expected to occur across the landscape and in particular in proximity to a water source, even in ploughed areas.

The implications for ESD principles is that other artefacts are likely to be present in the district.

As noted above, the archaeological values of the sites, considering the scientific, representative and rarity values was deemed to be low. It is believed therefore that the proposed impacts to the sites through the development would not adversely affect the broader archaeological record for the local area or the region.

The principle of inter-generational equity requires the present generation to ensure that the sites and diversity of the archaeological record is maintained or enhanced for the benefit of future generations. We believe that the diversity of the archaeological record is not compromised by development of this particular solar farm proposal.

We therefore consider, that while the current development proposals will impact five sites, all with stone artefacts, the overall cumulative impact on the archaeological record for the region is likely to be minimal.

It is argued that the cumulative impacts of the proposal are not enough to reject outright the development proposal.

7.2 CONSIDERATION OF HARM

Avoiding harm to the five sites is technically possible through avoidance. However, their position, scattered across the landscape would pose serious design constraints on the solar farm proposal.

Based on the assessment of the artefacts, and in consideration of discussions with the Aboriginal representatives during the field survey, it is not considered necessary to prevent all development at this location. The sites have been shown to be highly disturbed with little remaining scientific value. Aboriginal cultural value has been determined by the local Aboriginal community to be generally low enough to not prevent the development proposal proceeding.

The sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS1 are situated within the development footprint area of the proposed solar arrays, tracks,

cables and office parking. The most likely cause of harm to the artefacts will be through ground preparation activities such as vegetation clearance, installation of the posts and solar arrays.

The question remains about possible occurrence of artefacts and cultural material within the balance of the solar farm site. It is possible, and considered likely that additional artefacts will be present. Without knowing their exact locations, it is difficult to manage the impacts. We do not consider that the risk of such disturbances means the development should be abandoned. The archaeological material identified in the survey, and potentially present in the balance of the development site is not of sufficient value to reject the development proposal.

Mitigation of harm to cultural heritage sites generally involves some level of detailed recording to preserve the information contained within the site. Mitigation can be in the form of minimising harm, through slight changes in the development plan or through direct management measures of the sites and Aboriginal objects.

It is argued here that mitigation in the form of alteration is not feasible or warranted within the solar farm development area in this situation for the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS 1. However, the five sites are conducive to salvage as a mitigation strategy as requested by the Aboriginal community representative Larry Foley during the field survey.

As identified above, it is recommended that the five sites recorded within the proposed Beryl Solar Farm development area (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS1) are salvaged by an archaeologist with representatives of the registered Aboriginal parties prior to the proposed development commencing. The artefacts should be collected and moved to a safe area within the property that will not be subject to any ground disturbance.

The Aboriginal community representative Larry Foley noted during the field survey his preference for the artefacts to be relocated to another surface location rather than to be buried.

8 LEGISLATIVE CONTEXT

Aboriginal heritage is primarily protected under the NPW Act and as subsequently amended in 2010 with the introduction of the *National Parks and Wildlife Amendment (Aboriginal Objects and Places) Regulation 2010*. The aim of the NPW Act includes:

The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including but not limited to: places, objects and features of significance to Aboriginal people.

An Aboriginal object is defined as:

Any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with the occupation of that area by persons on non-Aboriginal extraction and includes Aboriginal remains.

Part 6 of the NPW Act concerns Aboriginal objects and places and various sections describe the offences, defences and requirements to harm an Aboriginal object or place. The main offences under section 86 of the NPW Act are:

- A person must not harm or desecrate an object that the person knows is an Aboriginal object.

- A person must not harm an Aboriginal object.
- For the purposes of this section, "circumstances of aggravation" are:
 - o that the offence was committed in the course of carrying out a commercial activity, or
 - o that the offence was the second or subsequent occasion on which the offender was convicted of an offence under this section.
- A person must not harm or desecrate an Aboriginal place.

Under section 87 of the NPW Act, there are specified defences to prosecution including authorisation through an Aboriginal Heritage Impact Permit (AHIP) or through exercising due diligence or compliance through the regulation.

Section 89A of the Act also requires that a person who is aware of an Aboriginal object, must notify the Director-General in a prescribed manner. In effect this section requires the completion of OEH AHIMS site cards for all sites located during heritage surveys.

Section 90 of the NPW Act deal with the issuing of an AHIP, including that the permit may be subject to certain conditions.

The EP&A Act is legislation for the management of development in NSW. It sets up a planning structure that requires developers (individuals or companies) to consider the environmental impacts of new projects. Under this Act, cultural heritage is considered to be a part of the environment. This Act requires that Aboriginal cultural heritage and the possible impacts to Aboriginal heritage that development may have are formally considered in land-use planning and development approval processes.

Proposals classified as State Significant Development or State Significant Infrastructure under the EP&A Act 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. However, the Department of Planning and Environment is required to ensure that Aboriginal heritage is considered in the environmental impact assessment process. The Department of Planning and Environment will consult with other departments, including OEH prior to development consent being approved.

The Beryl Solar Farm proposal is a State Significant Development and will therefore be assessed via this pathway, which does not negate the need to carry out an appropriate level of Aboriginal heritage assessment or the need to conduct Aboriginal consultation in line with the requirements outlined by the OEH *Aboriginal cultural heritage consultation requirements for proponents 2010* (OEH 2010b).

9 RECOMMENDATIONS

The recommendations are based on the following information and considerations:

- Results of the archaeological survey;
- Consideration of results from other local archaeological studies;
- Results of consultation with the registered Aboriginal parties;
- The assessed significance of the sites;
- Appraisal of the proposed development, and
- Legislative context for the development proposal.

It is recommended that:

1. If complete avoidance of the five recorded sites within the proposal area (Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS1) is not possible, the artefacts 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.
2. 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.
3. Once the sites Beryl Solar Farm IF 1, Beryl Solar Farm IF 2, Beryl Solar Farm IF 3, Beryl Solar Farm IF 4 and Beryl Solar Farm AS1 are salvaged, the proposed work can proceed with caution within the development footprint.
4. The development proposal should now be able to proceed without any additional archaeological investigation.
5. First Solar should prepare an Unexpected Finds Protocol (UFP) to address the potential for finding additional Aboriginal artefacts during the construction of the Solar Farm. The UFP will outline the procedure to deal with construction activity. Preparation of the UFP should be undertaken in consultation with the registered Aboriginal parties.
6. 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.
7. 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 parties and may include further field survey.

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APPENDIX A ABORIGINAL COMMUNITY CONSULTATION

Consultation Log of Beryl Solar Farm project.

Organisation	Contact	Action	Date Sent	Reply Date	Replied by	Response
OEH	Phil Purcell	Letter sent via email	15/11/2016	16/11/2016	letter via email	Phil provided list of additional possible Aboriginal stakeholder to contact regarding the project.
NTScorp	information@ntscorp.com.au	Letter sent via email	15/11/2016			
National Native Title Tribunal		online seach- no claim or determination over area	15/11/2016			
Office of Registrar <i>Aboriginal Land Rights Act</i>	adminofficer@oralra.nsw.gov.au	Letter sent via email	15/11/2016	18/11/2016	letter via email	Register of Aboriginal Owners and the project area described does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the Aboriginal Land Rights Act 1983 (NSW). Suggest that you contact LALC. Originally noted Broken Hill LALC in error but corrected to Mudgee LALC
Central Tablelands	admin.ct@lls.nsw.gov.au	Letter sent via email	15/11/2016	16/11/2016	via email	Informed that key contact in area is the Mudgee LALC email: mudgeelalc@bigpond.com
Mid-western shire council	council@midwestern.nsw.gov.au	Letter sent via email	15/11/2016			
Mudgee LALC	mudgeelalc@bigpond.com	Letter sent via email	15/11/2016			
Local Newspaper		The Mudgee Guardian	18/11/2016			closing date 2nd December 2016
OEH list of potential stakeholders						
Bill Allen		Letter sent via post	17/11/2016			
Binjang Wellington Wiradjuri heritage Survey	Dorothy Stewart	Letter sent via post	17/11/2016			
Darlina Verrills		Letter sent via post	17/11/2016			
David Maynard		Letter sent via post	17/11/2016			

Organisation	Contact	Action	Date Sent	Reply Date	Replied by	Response
Buudang	Larry Foley	Letter sent via post	17/11/2016	20/11/2016	Letter via post	registered for project.
Dhuuluu-Yala Aboriginal Corporation	Chairperson	Letter sent via post	17/11/2016			return to sender
Jean Thornton		Letter sent via post	17/11/2016			
Jodie Mckinnon		Letter sent via post	17/11/2016			
Katrina Mckinnon		Letter sent via post	17/11/2016			
Lyn Syme	North-East Wiraduri	Letter sent via post	17/11/2016			
Mingaan Aboriginal Corporation	Helen Riley	Letter sent via post	17/11/2016			
Mooka	Neville Williams	Letter sent via post	17/11/2016			
Murong Gialinga Aboriginal & Torres Strait Islander Corporation	Debbie Foley	Letter sent via post	17/11/2016	20/11/2016	Letter via post	Registered for project
North- Eastern Wiradjuri		Letter sent via post	17/11/2016			
Paul Brydon		Letter sent via post	17/11/2016			
Trevor Robinson		Letter sent via post	17/11/2016			letter returned to sender no longer at this address
Wamarr Cutural Consultants	Craig Riley	Letter sent via post	17/11/2016			
Warrabinga Native Tittle Claimants Aboriginal Corporation	The Board of Directors	Letter sent via post	17/11/2016	25/11/2016	letter via email	Registered for project Requests map of project location. KB sent map of general project area on 28/11/2016
Wellington Valley Wiradjuri Aboriginal Corporation	Chairperson	Letter sent via post	17/11/2016	22/11/2016	letter via email	registered for project
Wiradjuri Council of Elders	Robert Clegg	Letter sent via post	17/11/2016			
Wiradjuri Interim Working Party		Letter sent via post	17/11/2016			letter returned to sender no longer at this address

Organisation	Contact	Action	Date Sent	Reply Date	Replied by	Response
Wiradjuri traditional Owners Central West Aboriginal Corporation	Chairperson	Letter sent via post	17/11/2016			
Methodology						
Mudgee LALC		letter via email	19/12/2016			methodology sent though yet to register for project
Buudang		letter via email	19/12/2016	27/12/2016	via email	supplied insurances and rates, no comment on the methodology received
Murong Gialinga Aboriginal & Torres Strait Islander Corporation		letter via email	19/12/2016	27/12/2016	via email	supplied insurances and rates, no comment on the methodology received
Warrabinga Native Tittle Claimants Aboriginal Corporation		letter via email	19/12/2016	27/01/2017	via email	supplied rates and insurances and comments on the methodology. Comments to be addressed by NGH
Warrabinga Native Tittle Claimants Aboriginal Corporation		phone call	23/01/2017			KB called to ensure received methodology over Christmas period, Kristen informed that email server crashed over Christmas period and unable to recover all emails, asked KB to resend methodology for comment. KB forwarded original methodology email and noted closing date for comments 27th Jan
Wellington Valley Wiradjuri Aboriginal Corporation		letter via email	19/12/2016	5/01/2017	via email	supplied rates and insurances and comments on the methodology. Comments to be addressed by NGH
Warrabinga Native Tittle Claimants Aboriginal Corporation		letter via email	27/01/2017		email	had a number of questions regarding the methodology and the project. NGH to respond.
Wellington Valley Wiradjuri Aboriginal Corporation	Brad Bliss	MB sent letter via email	30/01/2017			NGH sent letter in response to queries and providing clarification on methodology.
Warrabinga Native Tittle Claimants Aboriginal Corporation		email	31/01/2017			provided new insurance details
Murong Gialinga		email	31/01/2017			provided revised rates

Organisation	Contact	Action	Date Sent	Reply Date	Replied by	Response
Warrabinga Native Tittle Claimants Aboriginal Corporation		KB sent letter via email	9/02/2017			NGH sent letter in response to queries and providing clarification on methodology.
OEH informed of registered parties	Phil Purcell	via email	30/01/2017			4 x registered parties and 3 x return to sender letters
Fieldwork 21-22 Feb 2017						
Buudang	Larry Foley	On site 21/02/2017				
Murong Gialinga Aboriginal & Torres Strait Islander Corporation	Larry Foley	On site 22/02/2017				
Warrabinga Native Tittle Claimants Aboriginal Corporation	Tayle Pennell	On site 21/02/2017				
Wellington Valley Wiradjuri Aboriginal Corporation	Shanae Martin	On site 22/02/2017				

Public Notice placed in The Mudgee Guardian on 18 November 2016.

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Fairfax Media

QUOTES & REVIEWS
DOWDY INSURANCE
PHONE 0427 724 744

FOR SALE Caravan Vacant
1976 Rego X16706, rego till
May 2017, good tyres, new
spare, good condition, LED
lights inside. Contact Brian
0438 323 909

Sofa, Lounge, Pine
Wardrobe, Desk
Tel: 0408 289 475

SPAINLINE Rep in area next
week. Pallets, Cladding,
Rooms, Carpets. As on TV
6372 6996. BL63737C
www.spainline.com.au

Garage Sales

83 Short Street, Mudgee 8-10am to 2pm.
Household items plus Hardwood Timber, Art, Cedar
Doors and Windows, Sofa-bed, King-Bed, Mattresses,
Cave-fort Bath, Antique Kitchen Dresser, Wooden
Chests. All must go. Ph: 0402 715 879 for enquiries on
bigger items.

14 Constantia Road,
Mudgee, Drills, Tools, Books

SAM Saturday / Sunday
85 Rodgers Street, Kandos
Upholstery, Beds, Toys, CDs,
Records and lots more

Barn start - 10 Rheinberger
Avenue, Fencing, Gear,
Household Items, Kids
Toys, Books, to much to list

Sat 7am, 111 McMurrays
Lane, Windyey, 3x3
Garden Shed, Spinning
Wheel, Weed Spray Shield,
Furniture, lots more
Tel: 6373 8151

Saturday 19/11/16
8am - 1pm
Household items, Eric
Bric, Mallet and Wool

Produce

ALL GRADES of supreme hay
available 0438-226-684
business hours.

Public Notices

DENTURES / RELINES / REPAIRS
Leon Dobrinski Denture Clinic
is now in attendance Mudgee
Medical Centre,
145 Church Street,
Barn to 12pm Wednesdays
1380 134 486

RESTORE SIENT FOR JUST \$25
DONATE HERE
0800 2512 2512
Paul & Christine

The Housing Plus Annual General Meeting will
be held at 3:00pm on Thursday 24 November
2016 at
Quality Inn Ambassador, 174 Bathurst Road,
ORANGE NSW 2800
All Welcome to attend.
RSVP by Monday 21 November 2016 to the
Executive Assistant via
emma@housingplus.com.au

Rylstone Kandos Aged & Disabled Association Inc.
Annual General Meeting
ADA Cottage
ADA Community Services
Annual General Meeting to be held at The Globe Hotel,
Rylstone, on Thursday 9th December 2016,
commencing at 6.30pm.
All interested persons are invited to attend.

Expression of Interest - Christmas Venue Host
Mudgee Chamber of Commerce will soon be having their Christmas Function for
members.
The Chamber would like to hear from venues in Mudgee who are interested in
hosting the event.
The criteria is:
• **Availability:** Access to venue from 5.30pm until 9.30pm
• **Access:** A level access or lift option is essential
• **Space:** For a minimum 40 people
• **Catering:** Please quote on finger food and supply a suggested menu together with
a price per head.
• **Alcohol:** A licensed venue is preferred.
The event will be a casual get together and a chance to network between members.
We would like to hold the event on Thursday 8 December.
This EOI is open to members of Mudgee Chamber of Commerce and any potential
New MCC Members. Please email EOI to info@mudgeechamber.com.au. EOI closes
on Wednesday 23 November 4:00pm. For further information, please call Kim
Grubbe 0403 130 899.

Notification for registration of interest for Aboriginal stakeholders
NGH Environmental has been contracted by First Solar Pty Ltd to undertake an
Aboriginal Cultural Heritage Assessment (ACHA) for the proposed Beryl Solar Farm.
This assessment area comprises of land at the proposed location of the solar farm
on Lot 2/ DP 1173059 and Lot 1/ DP 1012226, with transmission lines extending to
the adjacent existing Beryl Substation on Lot 1/ DP 523876 in the Mid-Western
Regional Council, Local Government Area.
The proponent (First Solar Pty Ltd) is proposing to construct a utility scale solar farm
including panels, electrical reticulation, substation, internal access tracks, site office
and perimeter fencing.
The purpose of this consultation, particularly with Aboriginal people, is to assist the
proponent in the preparation of the ACHA and to be involved in consultation should
the proponent need to apply for an Aboriginal Heritage Impact Permit (AHIP), and
further to assist the Director General of the Office of Environment and Heritage in
consideration and determination of such an application.
In order to fulfil the requirements set out in the CEH Aboriginal Cultural Heritage
Consultation Requirements for Proponents 2010, NGH Environmental is seeking
interested Aboriginal parties who hold cultural knowledge of the assessment area to
register their interest in the consultation process for the project and to assist in the
determination of cultural significance of any Aboriginal objects or places located there.
Registrations should be provided in writing to:
NGH Environmental Pty Ltd
PO Box 62
FYSHWICK ACT 2609
Or via email to:
nghe@ngheenvironmental.com.au
or via email to:
nghe@ngheenvironmental.com.au
All correspondence must be received by the **2nd December 2016**
Those registering an interest will be contacted to discuss the project further. Those
who do register are advised that their details will be provided to OEH and the Local
Aboriginal Land Council, unless they specifically advise in writing that their details
are not to be forwarded.

RAIL MOTOR TRAIN RIDES
Gulgong to Dunedoo
& Ulan
19th & 20th November
6373 3625
0458 555 929
kingpeter2950@gmail.com
MUDGEES MINIATURE RAILWAY

AGM
of
Mudgee Disability
Support Service Inc.
will be held on
Monday 21st November
at Mudgee C.W.A Hall
Market Street
from 5pm
63723848
All Visitors welcome

**AGM, Mudgee Region Mud-
dragons annual meeting to
be held Wednesday 23rd
November at 6:00pm at
Lawson Park Hotel**

**PINBALL RECORDS &
TROPHIES** Mr Dykes
Morimer Centre
0411 097 956

Tradition Sunday 4th
December, streets affected
are Short, Lawson and
Morimer 8am to 11am.

Assistant Manager (Development Role)
Cassilis NSW
An exciting opportunity has arisen for a reliable,
self-motivated person seeking long-term em-
ployment to assist in the management of a
large beef grazing property in the Upper Hunter
area of NSW, Australia. This property is close to
the NSW towns of Merriwa and Coolah.
The successful applicant will have:
• 5-7 years relevant experience
• Experience in road building and maintenance
including previous experience in operating a
bulldozer and grader, yard building, fencing,
water reticulation, machinery operation in
steep country, woody weed control and
renovation/maintenance of property houses.
• Sound communication and mechanical skills.
• Sound knowledge of pasture improvement
programs.
• Proven ability to manage staff and communi-
cate effectively.
• Accurate record keeping skills & computer
knowledge.
• Ability to work unsupervised, as part of a
team and to manage staff with a high level of
integrity and respect.
• Ambition to take on higher managerial
responsibility as your career progresses.
An excellent remuneration package will be on
offer to the right candidate including a
four-bedroom home with well-developed
gardens, breeze air and wood heating that will
be supplied with employment. For more
information, please contact our Farm Manager
Trevor Nash on +61 418 459 551 or go to
www.betrols.com.au To apply directly, please
send your application to **tr@betrols.com.au**

adzuna

APPENDIX B AHIMS SEARCH



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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-2-0075	Gooree Vneyards GV1	AGD	55	734420	6409890	Open site	Valid	Modified Tree (Carved or Scarred) :	Scarred Tree	4434
	Contact	Recorders	Mr.David Maynard							
36-2-0040	DM/OC1 - "Puggoon"	AGD	55	731150	6423350	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Stephanie Garling							
36-3-0135	CR10;	AGD	55	729950	6416750	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0136	CR11;	AGD	55	728670	6416050	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0137	CR12;	AGD	55	729700	6416370	Open site	Valid	Stone Quarry : -, Artefact : -	Quarry	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0138	CR13;	AGD	55	729920	6416610	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0139	CR8;	AGD	55	729950	6417050	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0028	Gulgong;	AGD	55	741820	6411318	Open site	Valid	Stone Quarry : -, Artefact : -	Quarry	1299
	Contact	Recorders	Isabel McBryde							
36-3-0047	Stubbo Creek 3;	AGD	55	739276	6424042	Open site	Valid	Artefact : -	Open Camp Site	234
	Contact	Recorders	L Cubis							
36-3-0048	Slapdash Creek 1;	AGD	55	737542	6421727	Open site	Valid	Artefact : -	Open Camp Site	234
	Contact	Recorders	L Cubis							
36-3-0140	CR9;	AGD	55	729800	6417100	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-3-0141	CR7;	AGD	55	730150	6417050	Open site	Valid	Artefact : -	Open Camp Site	1236
	Contact	Recorders	Laura-Jane Smith							
36-2-0013	Spring Ridge;	AGD	55	724971	6425674	Open site	Valid	Artefact : -	Open Camp Site	1299
	Contact	Recorders	R Hawkins,Hawkins							
36-2-0014	Two Mile Flat;	AGD	55	725544	6416502	Open site	Valid	Artefact : -	Open Camp Site	1299
	Contact	Recorders	Moore,R Hawkins,Hawkins							
36-2-0015	Puggoon;	AGD	55	731367	6425435	Open site	Valid	Artefact : -	Open Camp Site	1299
	Contact	Recorders	R Hawkins,Hawkins							
36-2-0016	Beryl;	AGD	55	732922	6418057	Open site	Valid	Artefact : -	Open Camp Site	1299
	Contact	Recorders	R Hawkins,Hawkins							

Report generated by AHIMS Web Service on 15/11/2016 for Kirsten Bradley for the following area at Lat, Long From : -32.422, 149.3336 - Lat, Long To : -32.2713, 149.5725 with a Buffer of 50 meters. Additional Info : Background for assessment. Number of Aboriginal sites and Aboriginal objects found is 79
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Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-3-0090	CR 1	AGD	55	730350	6416693	Open site	Valid	Artefact : -	Open Camp Site	1125,1504,102 800
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0091	CR 2	AGD	55	730458	6416531	Open site	Valid	Artefact : -	Open Camp Site	1125,1504,102 800
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0092	CR 3;	AGD	55	730586	6416108	Open site	Valid	Artefact : -	Open Camp Site	1125,102800
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0093	CR 4;	AGD	55	730637	6416306	Open site	Valid	Artefact : -	Open Camp Site	1125,1504,102 800
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0094	CR 5;	AGD	55	730133	6416731	Open site	Valid	Artefact : -	Open Camp Site	1125,1504,102 800
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0095	CR 6;	AGD	55	730128	6417026	Open site	Valid	Artefact : -	Open Camp Site	1125
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0145	Potts Hill site;	AGD	55	741570	6411650	Open site	Valid	Stone Quarry : -, Artefact : -	Quarry	
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0155	JOS DAVIS BRIDGE;	AGD	55	741590	6419720	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	1333
	<u>Contact</u>									
	<u>Recorders</u>									
36-3-0233	WILINDA 1 W1	AGD	55	740680	6412780	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	<u>Contact</u>									
	<u>Recorders</u>									
36-2-0097	Stony Creek 5 SC5	AGD	55	726540	6413650	Open site	Valid	Artefact : -		
	<u>Contact</u>									
	<u>Recorders</u>									
36-2-0098	Stony Creek 4 SC4	AGD	55	726580	6414080	Open site	Valid	Artefact : -		
	<u>Contact</u>									
	<u>Recorders</u>									
36-2-0099	Stony Creek 3 SC3	AGD	55	726480	6417070	Open site	Valid	Artefact : -		
	<u>Contact</u>									
	<u>Recorders</u>									
36-2-0101	Wialdra Creek 1. WC1	AGD	55	731990	6419720	Open site	Valid	Artefact : -		
	<u>Contact</u>									
	<u>Recorders</u>									
36-2-0104	YBCR-ST1	AGD	55	719670	6411642	Open site	Valid	Modified Tree (Carved or Scarred) : 2		98915

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Extensive search - Site list report

Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact Murong Gialinga Aboriginal an	Recorders		Doctor,Jodie Benton				Permits		
36-2-0105	YBCR-PAD1	AGD	55	719560	6412130	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		98915,99037,9 9042,102443
	Contact Murong Gialinga Aboriginal an	Recorders		Doctor,Jodie Benton				Permits	1920,2060,2061	
36-2-0106	YBCR-OS2 with PAD	AGD	55	719669	6411920	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		98915,99037,9 9042,102443
	Contact Murong Gialinga Aboriginal an	Recorders		Doctor,Jodie Benton				Permits	1920,2060,2061	
36-2-0107	YBCR-OS1 with Pad	AGD	55	719449	6411791	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : 1		98915
	Contact Murong Gialinga Aboriginal an	Recorders		Doctor,Jodie Benton				Permits		
36-2-0102	Stoney Creek 1	AGD	55	725840	6413200	Open site	Valid	Artefact : -		
	Contact	Recorders		Mr.David Maynard				Permits	1845	
36-2-0103	Stoney Creek 2	AGD	55	725840	6413200	Open site	Valid	Artefact : -		
	Contact	Recorders		Mr.David Maynard				Permits		
36-2-0108	YBCR-OS3	AGD	55	719329	6412034	Open site	Valid	Artefact : 2		99038
	Contact	Recorders		Doctor,Jodie Benton				Permits	2060,2061	
36-2-0109	YBCR-OS4	AGD	55	719355	6412267	Open site	Valid	Artefact : 4		99038
	Contact	Recorders		Doctor,Jodie Benton				Permits	2060,2061	
36-2-0119	BBS; Dubbo LALC; "Makuba Shukran"	AGD	55	725433	6425487	Open site	Valid	Artefact : 30		99169
	Contact	Recorders		Phil Purcell,Dubbo LALC				Permits		
36-2-0112	BBS; Dubbo LALC; property	AGD	55	724850	6425437	Open site	Valid	Artefact : 30		99169
	Contact	Recorders		Leila McAdam,Dubbo LALC				Permits		
36-2-0116	BBS; Dubbo LALC; property 1	AGD	55	725331	6425711	Open site	Valid	Artefact : 20		99169
	Contact	Recorders		Phil Purcell,Dubbo LALC				Permits		
36-2-0111	BBS; Dubbo LALC; " Makuba Shuka"	AGD	55	725180	6425960	Open site	Valid	Artefact : 22		99169
	Contact	Recorders		Phil Purcell,Dubbo LALC				Permits		
36-2-0137	Pig and Wistle Creek 3 (PWC3)	AGD	55	733420	6411946	Open site	Valid	Artefact : 2		
	Contact T Russell	Recorders		Mr.David Maynard				Permits	3546	
36-2-0138	Pig and Wistle Creek 2 (PWC2)	AGD	55	732820	6411883	Open site	Valid	Artefact : -		
	Contact T Russell	Recorders		Mr.David Maynard				Permits	3546	
36-3-0676	Thornbury AS1	AGD	55	735930	6413490	Open site	Valid	Artefact : 2500		
	Contact	Recorders		Mr.John Appleton				Permits		

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Extensive search - Site list report

Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-2-0140	WC IF 1	AGD	55	730960	6419061	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.David Maynard.Murong Gialinga Aboriginal and Torres Strait Islander Corporat							
36-3-0674	Magpie AS1	AGD	55	738200	6410120	Open site	Valid	Artefact : 50		
	Contact	Recorders	Mr.John Appleton							
36-3-0675	Magpie AS2	AGD	55	738180	6409980	Open site	Valid	Artefact : 20		
	Contact	Recorders	Fred Appleton							
36-2-0076	Goore Vineyards GV2	AGD	55	734330	6409840	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	4434
	Contact	Recorders	Mr.David Maynard							
36-2-0288	SAC 48	GDA	55	721529	6415418	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0272	Grinding Groove 16	GDA	55	721073	6416624	Open site	Valid	Grinding Groove : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0274	IF 14	GDA	55	720886	6425987	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0275	IF 15	GDA	55	720319	6425539	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0276	IF 16	GDA	55	720412	6424701	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0277	IF 17	GDA	55	720013	6423366	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0278	IF 18	GDA	55	720129	6422149	Open site	Valid	Artefact : 1		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0279	SAC 39	GDA	55	720289	6424996	Open site	Valid	Art (Pigment or Engraved) : 1, Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0280	SAC 40	GDA	55	720242	6424682	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Doctor.Tim Owen							
36-2-0281	SAC 41	GDA	55	720045	6423564	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		

Report generated by AHIMS Web Service on 15/11/2016 for Kirsten Bradley for the following area at Lat, Long From : -32.422, 149.3336 - Lat, Long To : -32.2713, 149.5725 with a Buffer of 50 meters. Additional Info : Background for assessment. Number of Aboriginal sites and Aboriginal objects found is 79

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Extensive search - Site list report

Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0282	SAC 42	GDA	55	720023	6423137	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0284	SAC 44	GDA	55	720151	6418448	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0285	SAC 45	GDA	55	721039	6416749	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0286	SAC 46	GDA	55	721034	6416565	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0287	SAC 47	GDA	55	721362	6415584	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen					<u>Permits</u>		
36-2-0312	Lower Piambong Rd (LP39)	GDA	55	723357	6410334	Open site	Valid	Artefact : 27		
	<u>Contact</u>	<u>Recorders</u>	Mr.David Maynard, Miss.Christine Maynard					<u>Permits</u>	3336	
36-2-0313	Lower Piambong Rd (LP40)	GDA	55	723482	6410757	Open site	Valid	Artefact : 77		
	<u>Contact</u>	<u>Recorders</u>	Mr.David Maynard					<u>Permits</u>	3336	
36-2-0314	Lower Piambong Rd (LP41)	GDA	55	723304	6411232	Open site	Valid	Artefact : 11		
	<u>Contact</u>	<u>Recorders</u>	Mr.David Maynard, Miss.Christine Maynard					<u>Permits</u>	3336	
36-2-0320	Hughes Road Lower Piambong Road IA	AGD	55	723738	6410500	Open site	Valid	Artefact : 2		102331
	<u>Contact</u>	<u>Recorders</u>	Miss.Christine Maynard, Metropolitan Local Aboriginal Land Council					<u>Permits</u>	3500	
36-3-2582	Castlereagh Hwy Scarred Tree 1	GDA	55	737405	6410456	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	<u>Contact</u>	<u>Recorders</u>	OzArk Environmental and Heritage Management, Mr.Toivo Kim Tuovinen					<u>Permits</u>		
36-3-2595	Magpie Lane IFML1	GDA	55	737462	6410892	Open site	Valid	Artefact : 1		102441
	<u>Contact</u>	<u>Recorders</u>	Mr.David Maynard					<u>Permits</u>		
36-2-0370	CBR - OS - 32	GDA	55	720461	6426794	Open site	Valid	Artefact : 1		
	<u>Contact</u>	<u>Recorders</u>	Mr.Neville Baker					<u>Permits</u>		
36-2-0389	CBR - OS - 25	GDA	55	721554	6415264	Open site	Valid	Artefact : 1		

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Extensive search - Site list report

Your Ref/PO Number : Beryl Solar Farm

Client Service ID : 254143

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders		Mr.Neville Baker				Permits		
36-2-0390	CBR - OS - 24	GDA	55	721400	6414920	Open site	Valid	Artefact : 1		
	Contact	Recorders		Mr.Neville Baker				Permits		
36-2-0391	CBR - OS - 23	GDA	55	721220	6414610	Open site	Valid	Artefact : 1		
	Contact	Recorders		Mr.Neville Baker				Permits		
36-2-0392	CBR - OS - 22	GDA	55	721134	6414455	Open site	Valid	Artefact : 1		
	Contact	Recorders		Mr.Neville Baker				Permits		
36-2-0331	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			102448
	Contact	Recorders		Miss.Christine Maynard				Permits	3478	
36-2-0332	GRG-2	GDA	55	724088	6412963	Open site	Valid	Artefact : -		102448
	Contact	Recorders		Miss.Christine Maynard				Permits	3478	
36-2-0333	GRG-3	GDA	55	724296	6413664	Open site	Valid	Artefact : -		102448
	Contact	Recorders		Miss.Christine Maynard				Permits	3478	
36-2-0334	GRG-4	GDA	55	725154	6413927	Open site	Valid	Artefact : 1		102448
	Contact	Recorders		Miss.Christine Maynard				Permits	3478	
36-3-3091	Old Barneys AFT 1	GDA	55	738486	6420460	Open site	Valid	Artefact : -		
	Contact	Recorders		Niche Environment and Heritage,Ms.Clare Anderson				Permits		

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APPENDIX F VISUAL IMPACT ASSESSMENT



Visual Impact Assessment

BERYL SOLAR FARM



MARCH 2017

Document Verification

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Beryl Solar Farm

Project Number: 16-347

Project File Name: Beryl via 141116

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1 INTRODUCTION

NGH Environmental completed a Visual Impact Assessment of the proposed Beryl Solar Farm, proposed to be located approximately 4 kilometres (km) south of Beryl in central eastern New South Wales (refer Appendix A.1, regional location). This report has been prepared on behalf of the proponent, First Solar Pty Ltd, to assess the potential visual impacts of the proposed solar array and electrical transmission infrastructure.

As visual amenity values and visual impacts can be subjective, the assessment includes a transparent, systematic evaluation with reference to existing guidelines, to address subjectivity as much as possible.

1.1 PROJECT OVERVIEW

The Beryl Solar Farm would be a commercial scale solar photovoltaic (PV) plant which would produce up to 70 megawatt-ampere (MVA) of electricity. It would be connected directly to the Beryl substation located adjacent to the northern boundary of proposed solar farm site.

First Solar (Australia) Pty Ltd proposes to develop approximately 206ha of the 332ha proposal site (refer to Appendix A.2). The Beryl Solar Farm would include the following elements:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

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 workers transportation. Once the plant has been commissioned a small car park would remain for the minimal staff required and occasional visitors.

Environmental assessment in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is required for the proposed solar farm. The Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DPE) on 9 December 2014, specify the impacts to be considered in the environmental assessment, including visual impacts.

1.2 SITE LOCATION

The proposed solar farm site is located approximately 4km south of the Beryl locality and 6km north-west of the town of Gulgong (refer Appendix A.1). Beryl is a small rural locality, accessed from the Castlereagh Highway in the Mid-Western Regional Local Government Area (LGA). The Mid-Western Regional LGA is located in eastern NSW approximately 300km from Sydney. Nearby towns in the area include Gulgong (6km), Mudgee (45km), Rylstone (94km) and Kandos (115km). The Castlereagh Highway is an important regional transport corridor near to the site.

The proposed Beryl Solar Farm location is on the edge of a rural residential area, in an area of moderate scenic quality and in close proximity (<1km) of some residences; 31 residences have been counted from aerial imagery within 1 km, including 5 rural residential locations, and 69 residences have been counted within 5km, including 2 urban and 6 rural residential locations¹.

1.3 OBJECTIVES OF THIS REPORT

This Visual Impact Assessment includes a full assessment of the visual impacts associated with the proposed Beryl Solar Farm. Specifically, it includes an assessment of:

- 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 addresses the SEARs for the proposed Beryl Solar Farm, dated 25 January 2017, which require:

An assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.

Specifically, this report includes:

- An assessment of the potential visual impacts of reflectivity and glare (Section 4).
- An evaluation and discussion of potential visual impacts (Section 5.2). The evaluation uses representative viewpoints of residences and view corridors.
- A discussion of significant vistas in the locality (Section 3.3), with reference to community values and perceptions.
- A draft landscaping plan (mitigation measures in Section 6).

Air traffic is not considered in this report but it is noted that, as discussed in Section 4, glare and reflectivity are not considered an impact for air craft.

¹ Error can occur, with small houses and sheds being incorrectly counted.

1.4 TERMINOLOGY

Terminology used in this report includes:

Study area	Defined as within 16km of the proposed solar farm site.
Solar farm site / site	The lot boundaries within which the solar farm development is proposed, excluding offsite infrastructure such as transmission lines and connections.
Project	All infrastructure and activities required for the construction, operation and decommissioning of the solar farm.
Landscape Character Unit (LCU)	LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to categorise the existing scenic quality of the receiving environment and consider the ability of the environment to absorb visual change at the landscape scale.
Viewer sensitivity	Viewer sensitivity is subject but can be assumed based on factors such as whether the view relates to recreational or work environments, or whether the view is experienced continuously or intermittently.
Landscape Management Zone (LMZ)	LMZs are derived by combining scenic quality with viewer sensitivity and proximity to the proposed infrastructure at the landscape scale. A three-tiered management hierarchy sets out appropriate management objectives for each zone.
Zone of Visual Influence (ZVI)	ZVI modelling uses GIS modelling and topography to determine areas which would be shielded from views of infrastructure at the proposed solar site. It does not take into account other existing or proposed screening features such as vegetation or built structures.

2 METHODOLOGY

2.1 OVERVIEW

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.

These methods are detailed below.

2.2 BACKGROUND INVESTIGATIONS, MAPPING AND MODELLING

Background investigations included identifying key landscape features within the landscape that may be affected by the visual impacts of the proposed solar farm. This was done using existing literature and aerial photos.

Mapping and modelling were undertaken to:

- Identify and classify LCUs within 16km of the proposed solar farm. This was done based on aerial imagery and later validated with field inspection. LCUs are a way to summarise differences in landscape amenity and the sensitivity of different areas within the landscape to visual impacts.
- Define areas in which the infrastructure may be visible, using ZVI modelling. A map identifying the ZVI (or viewshed) of the proposed solar farm was produced. This method uses topographic information to determine areas in which views of infrastructure may be visible. The infrastructure was modelled as a 3m high rectangular block, equivalent to the project boundaries. Topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours. Modelling does not take into account screening that may be provided by existing vegetation or structures.
- Identify key viewpoints such as major travel routes, public recreation areas, potential receivers (dwellings and other structures), and built up areas. This step excluded areas deemed not to be visible from the ZVI modelling.
- Understand the feasibility of screening to mitigate visual impacts.

The results were used to inform the field survey.

2.3 FIELD SURVEY

With reference to the mapping and modelling, field reconnaissance and ground truthing was undertaken to:

- Verify and document the existing LCUs in the study area (16km).
- Identify representative viewpoints within the LCUs, including foreground, middle ground and background viewpoints.
- Understand the likely sensitivity of the LCUs to views of the proposed solar farm.

Fieldwork consisted of driving along publicly accessible roads, investigating and documenting dominant visual character elements and potential views to the proposed infrastructure. Photographs were taken at representative locations. No residences were specifically targeted however, nearby roadside viewpoints have been tagged 'residential' where they occur near a residence.

Fore ground representative view point locations are provided in Appendix A.3. All representative viewpoints are shown in Appendix B.

The property involved in the project is not represented by a specific viewpoint. Impacts on involved residences are not considered in this assessment.

2.4 COMMUNITY CONSULTATION

Community consultation specific to this assessment of visual impacts was required to:

- Understand how the community values existing visual amenity in the study area.
- Document the perceptions of the community to the proposed development.

Community consultation is being undertaken as part of the Development Application process, in accordance with a Community Consultation Plan. As part of the plan, respondents are being surveyed on their views regarding solar farm development and local visual amenity. The feedback form questions are included in Appendix C. The results are used in the impact assessment and are summarised in Section 3.4.2.

2.5 IMPACT ASSESSMENT

The impact assessment methodology used in this Visual Impact Assessment is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project.

Key steps undertaken to assess the visual impact are as follows:

- Define LMZs for the representative viewpoints, based on:
 - o The scenic quality of the study area's LCUs.
 - o The expected sensitivity at representative viewpoints.
 - o The proximity of each representative viewpoint.
- Evaluate the degree of contrast the solar farm would result in at representative viewpoints in consideration of the management objectives of the relevant LMZ.
- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

Criteria for scenic quality, sensitivity, proximity, contrast and visual impact are included in the assessment, in Section 5.

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.

3 EXISTING ENVIRONMENT

3.1 BERYL LOCALITY

Beryl is a small rural locality approximately 9km north-west of Gulgong. The proposed solar farm is approximately 4km south of Beryl. The locality of Beryl is accessed from the Castlereagh Highway. Several houses, three businesses, a quarry and additional working farms are located in the locality. No shops or other services are located in Beryl.

The visual outlook around Beryl is typical of many places of rural NSW. It is characterised by mainly cleared low land areas, dissected by creeks and rivers, where riparian corridors are largely retained. Surrounding forested hills and ranges rise up to contain the low lands, occurring as disconnected remnants to the north, west and south.

The Beryl locality's visual landscape is dominated by large parcels of cleared agricultural land with scattered trees; extensive grazing of horses and cattle is the predominant agricultural activity. Large lot rural residences as well as clusters of smaller lot residential subdivisions occur. Sheds, tanks and farm machinery contribute to the rural character. House and garden plantings around houses contribute to the residential character. The proposed solar farm site is currently worked agricultural land (grazing).

There was no data available from the Australian Bureau of Statistics (ABS) on population, businesses or number of dwellings in the Beryl locality, although approximately 31 residences are located within 1km of the proposed solar farm site. Appendix A.3, B.1 and B.2 show the location of the nearest residences to the proposed solar farm site.

3.2 GULGONG

The residential outskirts of Gulgong are less than 3km from the proposed solar farm site boundaries.

Gulgong has a population of approximately 1,900 people. The population of Gulgong was 2,383 in the 2011 Census (ABS 2011). The main employment source in Gulgong is coal mining at 16.6% (ABS 2011). The second highest source is education at 6.6%, supermarket and grocery stores 4.2% and sheep, beef cattle and grain farming at 3.3% (ABS 2011). The median weekly income for residents of Gulgong was 40% less than the Australian average in 2011 (ABS 2011).

Services in Gulgong include banks, supermarkets, post office, real estate, trades people, machinery and farming services, accommodation, cafes and restaurants, fire station (Gulgong Chamber of Commerce 2016).

Gulgong's main streets have a consistent historic character. Retail and residential building colours, materials and design reflect this. Narrow streets and well maintained street landscaping contribute to this effect. The Henry Lawson Centre, Centennial Hotel, Commercial Hotel and numerous retail shops and services are located in the town centre, the majority are the original buildings. There are currently 130 buildings, within the town of Gulgong, listed under National Trust classification, many still have the original verandas and iron-lace balconies (Destinations NSW 2016).

Today the town is renowned for its arts and crafts and is world famous for its clay/pottery (Mid-Western Regional Council 2015, Destinations NSW 2016). There is an abundance of community and sporting facilities and clubs in Gulgong including RSL Club, Youth Council, branch library, Billy Dunn Oval, Victoria Oval, Turf Club and Golf club (Destinations NSW 2016). Education facilities include the Gulgong Pre-school, Gulgong

Public School, Gulgong High School, All Hallows Catholic Primary School and the Red Hill Environmental Centre (Service NSW 2016).

3.3 SIGNIFICANT VISTAS

The Beryl locality contains no look outs, promoted scenic areas or formalised recreational infrastructure however, notable features that are likely to be valued for their visual character include:

- Views of the surrounding forested ranges and hill tops, hemming in the fertile alluvial landscape; occurring as disconnected remnants to the north, west and south of the proposed solar farm site, between 1 and 8km from the proposed solar farm site.
- Riparian corridors such as Wialdra Creek and Cudgegong River, including timber truss bridges and providing river access in a number of locations.
- Yarrobil National Park, accessed off Spring Ridge Road. The Yarrobil National Park is approximately 8km from the site. This National Park covers an area of 1846 ha and is an important part of the river catchment systems in the area (OEH 2014).
- The historic property of Guntawang, including race track and stables, accessed off Goolma Road, approximately 3km from the proposed solar farm site. The 280 ha property specialises in the natural rearing of thoroughbred horses.

Refer to Figure 3-6. Nearby, Gulgong's historic township offers:

- Formalised parks and lookout areas (including Flirtation Hill, which looks in the direction of the proposed solar farm site).
- Historic buildings.
- Scenic residential areas.



Figure 3-1 Scenic vistas in the study area

Left to right from top: Views of the surrounding forested ranges and hill tops, Riparian corridors and creek access, Yarrobil National Park, Guntawang property (source: Gutawang 2016), Gulgong's historic township.

3.4 COMMUNITY VALUES

3.4.1 General attitudes to solar infrastructure

A high percentage (77%) of Australian's believe that large scale solar farms could supply a significant source of Australia's energy requirements (IPSOS 2015). Attitudes in Australia are greatly divided about the visual impacts of large scale solar farms; 30% agree and 26% disagree that large-scale wind farms have a negative visual impact (IPSOS 2015). The large scale solar energy sector is still at a relatively early stage of development in Australia, however. While most members of the community are aware of large scale solar energy, many do not know a great deal about their impacts (IPSOS 2015), including visual impacts.

Three approaches to improving community understanding of the visual impacts of large scale installations include:

- Provision of images (from many angles) of large scale solar facilities, particularly in the early stages of a proposal.
- Understanding the similarities between highly supported domestic scale installations and large scale facilities.
- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for.

(Source: extracted from IPSOS 2015).

This report endeavours to address these issues.

3.4.2 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.

- Surrounding landowners are generally supportive of the project.
- Residents in the locality were generally supportive and showed interest in the consultation process.
- One resident raised concerns regarding the impacts of glare and heat of the proposal on his property.
- Visual screening as a means to minimise views of infrastructure was discussed at the open house event.
- One resident raised concerns regarding the potential impact to the value of adjacent land (currently used for grazing and cropping).

Important local values to the respondents of the feedback forms included:

- To be living in a close community
- Country lifestyle
- The peace and quiet.

The visual landscape values considered important to respondents included:

- The farming landscape
- Views of elements including trees, sky, hills, large paddocks and cattle.

One of the concerns raised by members of the community was potential for visual impacts.

3.5 LANDSCAPE CHARACTER UNITS

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to summarise differences in the receiving environment that may affect the visual impact of the proposed solar farm at different locations.

Four key LCUs were identified within 16km of the proposed solar farm site:

- Agricultural (most commonly, grazing lands).
- Native vegetation remnants (includes roadside corridors, riparian areas and surrounding ranges).
- Rural residential (mostly large RU1 Primary Production lots but including some smaller R5 Village lots to the north and west of the site).
- Urban (Gulgong town centre and residential areas).

The scenic quality was rated in each LCU as follows:

- A high scenic quality rating describes areas with outstanding, unusual or diverse features.
- A moderate scenic quality rating applies to areas with the features and variety normally present in the character type.
- A low scenic quality rating is given for areas lacking features and variety.

The four LCUs identified within 16km of the proposed solar farm site are characterised in Table 3-1 in terms of their scenic quality and illustrated in the following plates.

Table 3-1 Landscape Character Units within 16km of the Beryl Solar Farm

Landscape Character Unit	Key visual features and scenic quality
Agricultural	Visual features The pastures with scattered trees are of low relief to undulating, dissected by riparian and road side remnants, bounded by surrounding hills and ranges. Pastures are brilliant green through beige and brown with the season, limited cropping occurs in the locality. Irrigation from the waterways and the fertile alluvial soils produce a lush looking landscape. Scattered trees are often very mature with thick grey brown trunks and forest green to olive foliage. The colour of surrounding ranges would change during the day from grey-green to deeper grey-blue-green. The provide a strong visual contrast to the low relief pastures. Unsealed roads and bare paddocks are light beige-orange-salmon. Most local roads are however, sealed. Local roads, and even Castlereagh Highway, have frequent minor bends. This produces relatively short sight lines and frequently changing rural views. Small rises and remnant vegetation increase this effect.

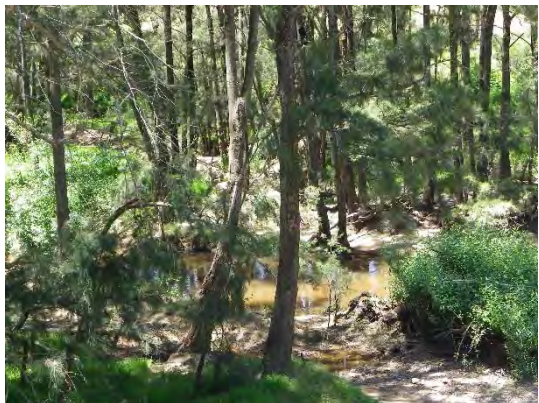
Landscape Character Unit	Key visual features and scenic quality
	In contrast, long straight sections of electricity transmission line along roadsides and through paddocks produce a repeated linear element. They approximate the height of local eucalypts at about 20m. Residences within this landscape are sparsely distributed and commonly associated with additional landscape plantings. Some higher density areas occur to the immediate south-east of the solar site and to the immediate north (south of the Wialdra Creek). Property gates are often sign posted with property names and tree lined avenues on private access roads. Other infrastructure includes sheds, farm machinery and low open fences. Scenic quality Scenic quality is moderate. Natural landscape elements (ranges and alluvial flats) have visually pleasing elements and contrast. View locations are varied, given the short sightlines and framing influence of local topography and remnant vegetation. However, built elements are clearly production related and include low density supporting infrastructure; linear fences, powerlines, roads and agricultural buildings and rural houses. This LCU is common in the study area, but has features and variety. The proposed solar farm site is located within this LCU, but is on the edge of the rural residential LCU.
Native vegetation remnants	Visual features Remnant native vegetation, occurring along roadsides such as Annie's Rock Road, and extending to riparian corridors such as Wialdra Creek and Cudgegong River, and into surrounding ranges and hill tops, acts to break up views of pastures and other agricultural features. The river corridors particularly, snake through the lower landscape, limiting view extent in many parts of the landscape. The pattern is low and curving, contrasting with straighter road sections, fences and transmission lines. The vegetation is usually lacking midstorey and often mature and gnarled appearance. Due to the height of trees in these remnant (approximately 15-22m), viewed at distance from an elevated position, the landscape appears more vegetated than it is, with light green pasture patches visible through the dense dark greens of the taller woodland remnants. Scenic quality Scenic quality is low. Forms are generally uniform, lacking variety, but are organic rather than straight, and of low elevation and provide a pleasing visual contrast to the agricultural LCU. Colour variation is low. The extent of the remnants acts to reduce sight lines and view extent, framing shorter duration views. This LCU is common in the study area.
Rural residential	Visual features Rural residential allotments are mostly large RU1 Primary Production lots but including some smaller R5 Village lots to the north and west of the site. In these areas, the modified gardens, tree lines entrances, farm dams, residences and associated domestic and rural buildings dominate the surrounding agricultural scenic character. Built forms are varied. Roofs, cladding, water tanks and sheds are not consistent but reds, greys, browns and greens predominate. Vehicles, yards and gardens produce a residential character. These areas are often separated from the surrounding expansive

Landscape Character Unit	Key visual features and scenic quality
	agricultural areas with rectilinear fencing, creating small boxed in allotments within the broader landscape. Streets and access roads are usually unsealed and feature vegetation, either native remnants or planted feature trees or avenues. Scenic quality Scenic quality is considered moderate. These areas have variety in colour and form. Built elements and landscaping contribute to the character type. This LCU is not common in the study area.
Urban	Visual features Gulgong's main streets have a consistent historic character. Retail and residential building colours, materials and design are sympathy with the settlement period: red brick, cream and ochre timber, red, green and white details, red and green iron rooves. Residential and commercial frontages feature well maintained gardens, often prolifically flowering, as well as period character fences. Abundant street and yard trees area present in the town. Views to the surrounding ranges are sometimes visible through long tree lines streets. Streets are sealed and often incorporate curbing and footpaths. The linear form is broken up in some sections by bends in road, particularly the very narrow main street. Scenic quality Scenic quality is considered high. These areas have variety in colour and form. They contribute to a unique historic character type. Elements include recreational aspects; parks and gardens. The character is important in defining the town and contributes to its local economy. This LCU is not common in the study area.

Agricultural LCU plates



Native vegetation remnants LCU plates



Rural residential LCU plates



Urban LCU plates



3.6 VIEWPOINT SENSITIVITY

3.6.1 Identifying viewpoints

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.

The ZVI modelling produced a set of maps that estimated the areas that would be shielded from views of infrastructure at the proposed solar farm site, based on topography (Appendix B). A height of 3m was used to model onsite infrastructure. This is realistic approximation of the height of panels and PV containers, which may actually be 2.3m and 3.4m, respectively. Viewpoints were not selected in areas predicted to be shielded from views of the solar farm. Twenty-two representative viewpoints were identified within the ZVI and are mapped in Appendix B.

3.6.2 Rating proximity and assessing sensitivity of viewpoints

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.

Criteria for proximity are as follows:

- o Foreground 0 – 1 kilometres
- o Middle ground 1 – 5 kilometres
- o Background 5 – 16 kilometres

Criteria for sensitivity are as follows:

- o High sensitivity:
 - high use routes or areas, or
 - routes or areas of national or state significance, or
 - areas with high scenic quality
- o Moderate sensitivity:
 - moderate use routes or areas, or
 - routes or areas of regional or local significance, or
 - areas with moderate scenic quality
- o Low sensitivity:
 - low use routes or areas, or
 - routes or areas of low local significance, or
 - areas with low scenic quality

Sensitivity also considers view duration; for access roads and working farms this would be less than for residential and recreational areas.

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

- Generally, within the Agricultural LCU, whether viewed from pastures, roadside or residences, these viewpoints were assessed to be of low sensitivity. These are low use roads in a production dominated landscape. View extents are often limited or broken up by existing native vegetation remnants and house plantings. Sensitivity to contrast is expected to be low. The exception to this may be elevated residences that are oriented to take in the pastoral view.
- Where viewpoints within the Native vegetation remnants LCU have a recreational component, such as creek access or lookouts, or where residences occur, a moderate sensitivity has been assigned. In other areas, these are considered low sensitivity, reflecting low use and a low level of 'uniqueness'. Further, view extents are often limited or broken up by existing native vegetation in these areas.
- Generally, rural residential viewpoints have been assigned a moderate sensitivity. In areas, a village character is developing and they are considered to have some local significance.
- Residential and recreational viewpoints in urban areas were assigned high sensitivity. These are located in high use areas and the unique historic character of the Gulgong township has local significance.

The sensitivity of each viewpoint is tabulated below. The location of each viewpoint is shown in Appendix B.

Table 3-2 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	View location	Proximity	Scenic quality	Sensitivity
1	Agricultural	Road	Foreground	Moderate	Low
2	Agricultural	Residential	Middle ground	Moderate	Low
3	Agricultural	Road	Foreground	Moderate	Low
4	Agricultural	Residential	Middle ground	Moderate	Low
5	Agricultural	Road	Middle ground	Moderate	Low
6	Agricultural	Road	Middle ground	Moderate	Low
7	Agricultural	Road	Middle ground	Moderate	Low
8	Remnant	Creek	Foreground	Low	Moderate
9	Remnant	Residential	Middle ground	Low	Moderate
10	Remnant	Road	Foreground	Low	Low
11	Remnant	Road	Foreground	Low	Low
12	Remnant	Road	Foreground	Low	Low
13	Remnant	Road	Middle ground	Low	Low
14	Remnant	Recreation	Middle ground	Low	Moderate
15	Rural residential	Road	Foreground	Moderate	Moderate
16	Rural residential	Residential	Middle ground	Moderate	Moderate
17	Rural residential	Residential	Foreground	Moderate	Moderate
18	Rural residential	Residential	Foreground	Moderate	Moderate
19	Rural residential	Residential	Foreground	Moderate	Moderate
20	Rural residential	Road	Foreground	Moderate	Moderate
21	Urban	Recreational	Middle ground	High	High
22	Urban	Residential	Middle ground	High	High

4 VISUAL CHARACTERISTICS OF KEY INFRASTRUCTURE COMPONENTS

The key infrastructure components of the proposed Beryl Solar Farm, with reference to the stage of the project and the potential visual amenity impacts they may generate are discussed below and referenced in the visual impact assessment, Section 5.

4.1 INFRASTRUCTURE COMPONENTS

The key infrastructure for proposal would include:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

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.

These components are discussed in terms of their visual impacts potential below.

4.1.1 Construction components

Construction impacts would be temporary, confined to approximately 12 months. Visual impacts could be generated during this time by:

- Establishment of construction compounds
- Potential for construction waste
- Construction traffic and equipment
- Creation of bare ground

Development of site compound areas, site offices and stock piles, located within the site boundaries, would include steel structures. These can generate reflectivity and glare although would be a similar look to existing farm sheds. Material stockpiles may detract from visual amenity, particularly if dispersed across broad areas. Laydown areas for steel posts and rails may produce reflectivity and glare.

Construction litter (such as packaging materials and food/drink packaging from onsite staff), if not controlled, could affect nearby properties.

Construction traffic would increase visual impacts and could add to dust generation on unsealed local roads. It is expected that all construction traffic would be confirmed to the sealed Beryl Road, off the Castlereagh Highway, and thereby limit impacts of construction traffic. Onsite parking areas would be visible from surrounding properties and roads including Beryl Road and Spring Ridge Road.

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.

Areas of bare soil created through grading access tracks, establishing the substation bench, trenching cables and excavation of footings for inverter stations could contribute to dust and detract from visual amenity until they are rehabilitated. The ground disturbance from pile foundations would be less than 1% (approximately 1ha) of the total site area. These areas would be visible to surrounding properties and from Beryl Road and Spring Ridge Road (and potentially the low use Perseverance Lane).

While no broad scale land levelling is proposed, it is expected that the combined effect of the onsite construction activities will have an adverse impact on the amount of ground cover, producing dust and detracting from the visual amenity of the site. Dust is manageable and maintaining ground cover beneath the panels once construction is completed is an objective of the proposal; any disturbed areas would be restored to grassed ground cover post construction.

4.1.2 Operational components

Operational impacts centre on the look of the solar farm, once construction is complete. The main visible infrastructure would be:

- The solar arrays
- Inverters
- Substation
- Access tracks
- Security fencing
- Overhead transmission line

The up 2.7m high solar modules would be installed on a single-axis tracker in rows aligned in north south arrangement (approximately 3600 tracker units). The tracker will have an estimated tracking range of 120 degrees, or +/- 60 degrees from the horizontal.

Inverters (up to forty) are most likely to be housed in containers. These metal structures would be evenly spaced across the site – approximately 12m x 2.5m x 2.9m.

An additional substation would be located adjacent to the existing Beryl substation. The excavated bench would be gravel and security fencing would be required. The area is likely to be up to 30m x 30m.

Internal solar farm access tracks would be 6m wide and constructed of compacted but unsealed gravel.

Perimeter security fencing would be required for the substation and solar array sites. The fencing would be up to 2.3m high and likely to require barbed strands near to the top.

A new overhead transmission line would be constructed over a length of approximately 300 metres from the new on site substation north to the existing TransGrid Beryl Substation. The new line would be constructed in a similar manner to the existing on site transmission lines utilising either timber or concrete poles, cross member, insulators and strung conductor.

Glare and glint

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

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

- Steel array mounting - array mounting would be steel or aluminium.
- Construction site offices, sheds.
- Containerised PV boxes.

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

With the exception of the power poles, infrastructure would be of low height, up to approximately 3m. In a low relief landscape, relatively easily screened as part of the project. Examples of the look of some of the key infrastructure components are provided in Figure 4-1 below; taken from other similar projects.



a) Driven piles (these may also be screwed into the ground).



b) Operational array.



c) Containerised inverter



d) Substation



e) Internal access tracks



f) Perimeter fencing



g) Overhead 66kv transmission line – similar to existing design onsite.

Figure 4-1 Images representative of infrastructure components proposed

5 IMPACT ASSESSMENT

The visual impact assessment was undertaken considering:

- The infrastructure components, described in Section 4.
- Their potential to be viewed from representative viewpoints.
- The degree of contrast they would have within identified LMZs.

LMZs were assigned to each viewpoint and the contrast at that viewpoint was evaluated, as described below.

5.1 DEFINITION OF LANDSCAPE MANAGEMENT ZONES

Visual LMZs were assigned to each viewpoint. The zones were derived by combining scenic quality (from the LCU, Section 3.2), viewer sensitivity and the distance to the proposed solar farm site (from Section 3.3). Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 5-1.

Table 5-1 Visual Landscape Management Zone decision matrix

Scenic quality	Proximity / sensitivity							
		Foreground High	Middle ground High	Background High	Foreground Moderate	Middle ground Moderate	Background Moderate	Foreground Low
	High	A	A	A	A	B	B	B
	Moderate	A	B	B	B	B	C	C
	Low	B	B	B	B	C	C	C

Each zone has associated objectives to guide management of visual change and to help evaluate proposed project impacts. These are shown in Table 5-2:

Table 5-2 Visual Landscape Management Zone management objectives

Management priority	Management objectives
A	Maximise retention of existing visual amenity. Landscapes are least able to absorb change. Developments may lead to a major change.
B	Maintain existing visual amenity, where possible. Protect dominant visual features. Developments may be allowed to be visually apparent.
C	Less importance for retaining existing visual amenity. Landscapes are able to absorb change. Developments may be allowed to dominate but should reflect existing forms and colours where possible.

5.2 VISUAL IMPACT ASSESSMENT AT REPRESENTATIVE VIEWPOINTS

5.2.1 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.

For the proposed solar farm, this rating is given considering the generally low height of infrastructure, and its likely visible horizontal extent from the viewpoints. This also considers topography and intervening vegetation that may affect the proposed solar farm's visibility from the viewpoints.

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 5-3 below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating. The result summary is presented in Section 5.2.2.

Representative photos (including panoramas for selected locations) of the existing views are provided below. The location of panoramic photos is provided in Appendix B.3. In the panoramas below, the visual extent of the 'worst case infrastructure layout'² is shown as follows:

- Green is the estimated visible extent of arrays, excluding shielding by trees/infrastructure: this is the extent of the array most likely to be observable.
- Yellow areas are likely to be shielded by trees/infrastructure: infrastructure in this area is unlikely to be visible.
- Red is the estimated extent of the solar farm site boundary within the view field.

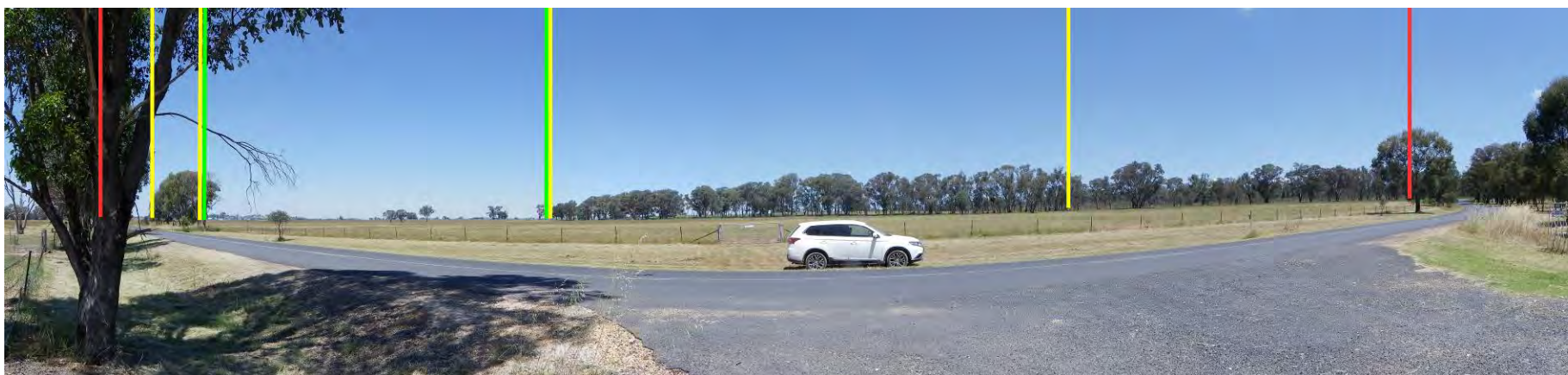
² This is the infrastructure footprint prior to reducing the western extent of the array. The most up to date layout is provided in Appendix A of this report however, panorama extents were based on the earlier layout and are in this case conservative; actual view extents would be less from some locations.

Table 5-3 Visual impact at representative viewpoints with reference to the Beryl Solar Farm, in order of highest impact

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
17	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to existing vegetation. Views would be broken up to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
18	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to the location of existing vegetation and placement of infrastructure. Views would be screened to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's north-east corner would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
19	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited by topography and existed vegetation. Views would be screened to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
20	Rural residential	Road	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure from the closest receiver at this location (which backs onto the solar site) may be expansive. Views would be broken up to a minor extent by existing buildings and vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. Mitigation is recommended but not required. Additional vegetation planting on the site's northern boundary would minimise views further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
1	Agricultural	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working in paddocks) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. No mitigation required



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
11	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working on properties) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. No mitigation required



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
10	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The horizontal view of infrastructure would be limited. Views would be of short duration and screened by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. No mitigation required
3	Agricultural	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The infrastructure would be dominant and noticed from this location. Views would be attenuated by distance. The landscape can absorb change. The contrast is acceptable. No mitigation required
12	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views would be of short duration and screened to a minor extent by existing roadside vegetation. The landscape can absorb change. The contrast is acceptable. No mitigation required

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
21	Urban	Recreation	Middle ground	A Landscapes are least able to absorb change.	Low	Low	The view point is a high use area where the agricultural and rural character of the locality can be viewed. It is elevated and therefore provides a greater view of the proposed solar farm. However, at this distance, the site would not attract attention. Panels would be perceived as dull grey-blue, in keeping with the dark remnant vegetation and surrounding hill sites. The contrast is acceptable. No mitigation required



15	Rural residential	Road	Foreground	B Protect dominant visual features	Low	Low	The infrastructure would not be dominant from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views would be of short duration and screened to a minor extent by existing roadside vegetation. The contrast is acceptable. No mitigation required
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ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
16	Rural residential	Residential	Middle ground	B Protect dominant visual features	Low	Low	The infrastructure would not be dominant from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views, if discernible, would be of short duration and screened to a minor extent by existing roadside vegetation. The contrast is acceptable. No mitigation required
2	Agricultural	Residential	Middle ground	C Landscapes are able to absorb change	Low	Low	The infrastructure is unlikely to attract attention given the rise between the site and the viewpoint. Views would be attenuated by distance. The landscape can absorb change. The contrast is acceptable. No mitigation required.
4	Agricultural	Residential	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required
5	Agricultural	Road	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required
6	Agricultural	Road (local)	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required
7	Agricultural	Road	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required
9	Remnant	Residential	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be discernible, through existing vegetation. The contrast is not perceived. No mitigation required

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment	
13	Remnant	Road	Middle ground	C	Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived No mitigation required
22	Urban	Residential	Middle ground	A	Landscapes are least able to absorb change.	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required
8	Remnant	Creek access	Foreground	B	Protect dominant visual features	Indistinct	Low	The infrastructure would not be discernible, through existing riparian vegetation. The contrast is not perceived. No mitigation required
14	Remnant	Recreation	Middle ground	C	Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. No mitigation required

5.2.2 Results summary

The highest predicted impacts were identified for four rural residential viewpoints, one agricultural viewpoint and one remnant viewpoint. All are located in the foreground proximity; within 1km of the proposed solar farm site.

Table 5-4 Highest visual impact: summary

ID	LCU	Viewpoint	Visual impact
17	Rural residential	Residential	Medium
18	Rural residential	Residential	Medium
19	Rural residential	Residential	Medium
20	Rural residential	Road	Medium
1	Agricultural	Road	Medium
11	Remnant	Road	Medium

In all cases, these locations have expansive views of the proposed infrastructure and, while the landscapes can absorb some change and the contrast is considered acceptable, some further screening could be effective in further 'breaking up' views of the infrastructure. This would assist to protect the dominant visual features, which include native vegetation and planted landscaping. This is particularly warranted where residences and residential access ways are affected; view points 17, 18, 19 and 20.

In all cases, the contrast of the proposed infrastructure is considered acceptable, but mitigation is recommended. Proposed onsite screening locations are provided in Appendix D specifically aiming to address impacts from these locations.

Generally, the visibility of low lying infrastructure (less than 3m) is low. This is on account the generally flat terrain, meaning that the view diminishes rapidly with distance from the site. It is noted however, that local rises in some cases assist to screen the site (receivers to the north-east and south) and in some cases may expand the view of the site (elevated receivers to the north, north of Wialda Creek, looking down on the site). Generally, the visibility is further by existing roadside vegetation and native vegetation remnants, including the riparian corridors that surround the site to the north, west and south (refer to Appendix A.3). Impacts in all other locations have been assessed as low and acceptable. No mitigation has been recommended for these locations.

5.3 CUMULATIVE IMPACTS

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

5.3.1 Construction

During construction, the additional haulage traffic impact creates the greatest potential for cumulative visual impacts. The Castlereagh Highway is a high use road corridor and likely to carry a substantial proportion of heavy and oversized vehicles. The visual impact of increased traffic movements to the site would be predominantly limited to construction (approximately 12 months).

5.3.2 Operation

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.

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.

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

6 MITIGATION STRATEGY

A Visual Impact Management Plan is recommended to address the 'as built' visual impacts of the proposed solar farm. The plan would include:

- Onsite vegetation screening, guided by the proposed screening, provided in Appendix D. This would be aimed at 'breaking up' not blocking views of onsite infrastructure. Generally, the screen would be sparsely planted, in keeping with existing road corridor native vegetation, not creating an unnatural hedge effect.
- Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas).
- General methods to reduce visual impact. This would centre on the colour and form of infrastructure, to reduce the overall visual contrast of the project.
- Verification of predicted and actual impacts. This would improve the reliability of the measures and provide a trigger to undertake additional mitigation if required.

Guidance regarding these measures is provided below. 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 would be implemented post construction and in consultation with affected landholders (where relevant). It is noted that vegetation screens can take time to grow, grow differently than expected or expire before effective height is achieved. Furthermore, the as built infrastructure may differ from that assessed in this report, predicted impacts may be found to be different to actual impacts. For this reason, a verification process and monitoring requirements are included in the plan.

6.1 SCREENING

6.1.1 Screen location

The location of proposed onsite screening is provided in Appendix D.

6.1.2 Screen requirements

- Onsite plantings would be 1-2 rows deep and be located on the outside of the security fence, where feasible, so that it breaks up views of the fencing as well as onsite infrastructure.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. Species selection could be undertaken in consultation with affected near neighbours and a botanist or landscape architect, taking into account the impact of shading on the array.
- Planting should be undertaken as soon as practical in the construction process, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered.

- A post construction audit would be undertaken to assess the effectiveness of the screening layout with reference to the final constructed infrastructure and augment the former as required.
- 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.
- The aim of plant screens is to break up the view and not eliminate it. Relatively sparse plantings, rather than a formal 'hedge' effect, is considered more appropriate to the existing environment.

6.2 GENERAL MEASURES

The following measures are recommended to reduce the general visual impact of the development for all other receivers:

6.2.1 Design

- If feasible, underground rather than overhead power lines would be considered.
- If 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:
 - Buildings will non-reflective and in eucalypt green, beige or muted brown.
 - Pole mounts will be non-reflective.
 - Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.

6.2.2 Construction

- During construction, dust would be controlled in response to visual cues.
- Parking areas, material stock piles and other construction activities would be located as far as practical from nearby residences or screened (by existing vegetation or constructed screens) for the period of construction.
- 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).

7 CONCLUSION

This report has been prepared to assess the potential visual impacts of the proposed Beryl Solar Farm. A systematic evaluation has been undertaken to address subjectivity as much as possible. The report was informed by background investigations, mapping and modelling, field survey including reconnaissance, ground truthing and photography and the results of project-specific community consultation.

The proposed Beryl Solar Farm is located on the edge of a rural residential area, in an area of moderate scenic quality and in close proximity (<1km) of some residences; 31 residences have been counted from aerial imagery within 1 km, including 5 rural residential locations, and 69 residences have been counted within 5km, including 2 urban and 6 rural residential locations³.

The highest predicted impacts were identified for four rural residential viewpoints, one agricultural viewpoint and one remnant viewpoint. All are located in the foreground proximity; within 1km of the proposed solar farm site. In all cases, these locations have expansive views of the proposed infrastructure and, while the landscapes can absorb some change and the contrast is considered acceptable, some further screening could be effective in further 'breaking up' views of the infrastructure. In all cases, the contrast of the proposed infrastructure is considered acceptable, but mitigation is recommended specifically aiming to address impacts from these locations. Impacts in all other locations have been assessed as low and acceptable. No mitigation has been recommended for these locations.

General measures to reduce impacts for all receivers have also been recommended. These centre on use of design elements to reduce visual contrast, mitigation of construction impacts such as dust and traffic that may reduce visual amenity and mitigation of operation impacts, such as maintaining ground cover beneath the panels, to break up side on and back views of infrastructure and soften the appearance of the facility.

Large scale solar farms are still relatively new in Australia. While they enjoy support from many in the community, provision of information on expected visual impacts and involvement in mitigating impacts (for affected receivers) is considered very important to obtaining social license to operate. With the involvement of the affected landowners in the mitigation strategy set out in Section 6, the visual impacts of the proposed solar farm are considered acceptable and manageable.

³ Error can occur, with small houses and sheds being incorrectly counted.

8 REFERENCES

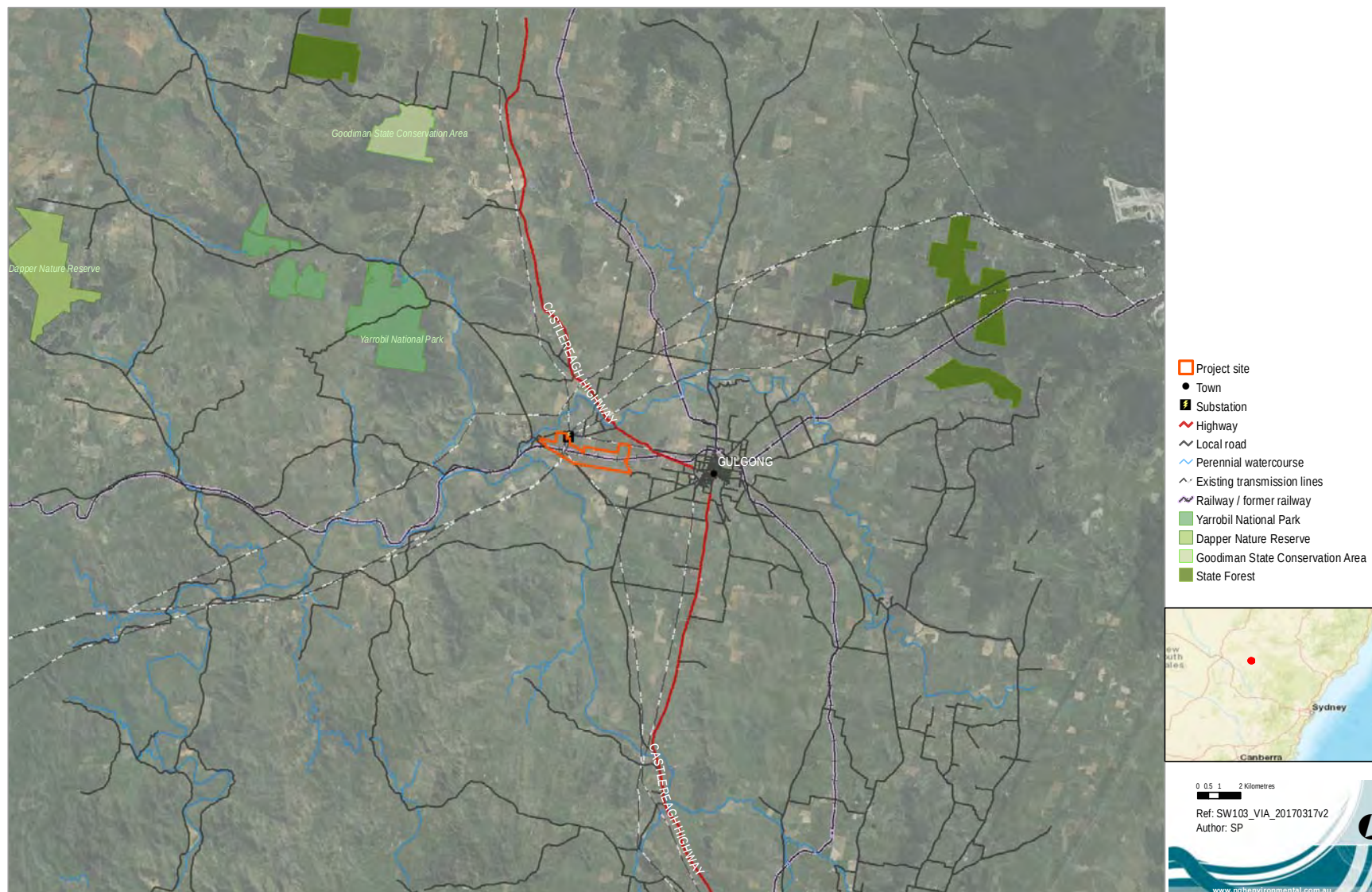
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APPENDIX A LOCATION AND PROPOSED INFRASTRUCTURE LAYOUT

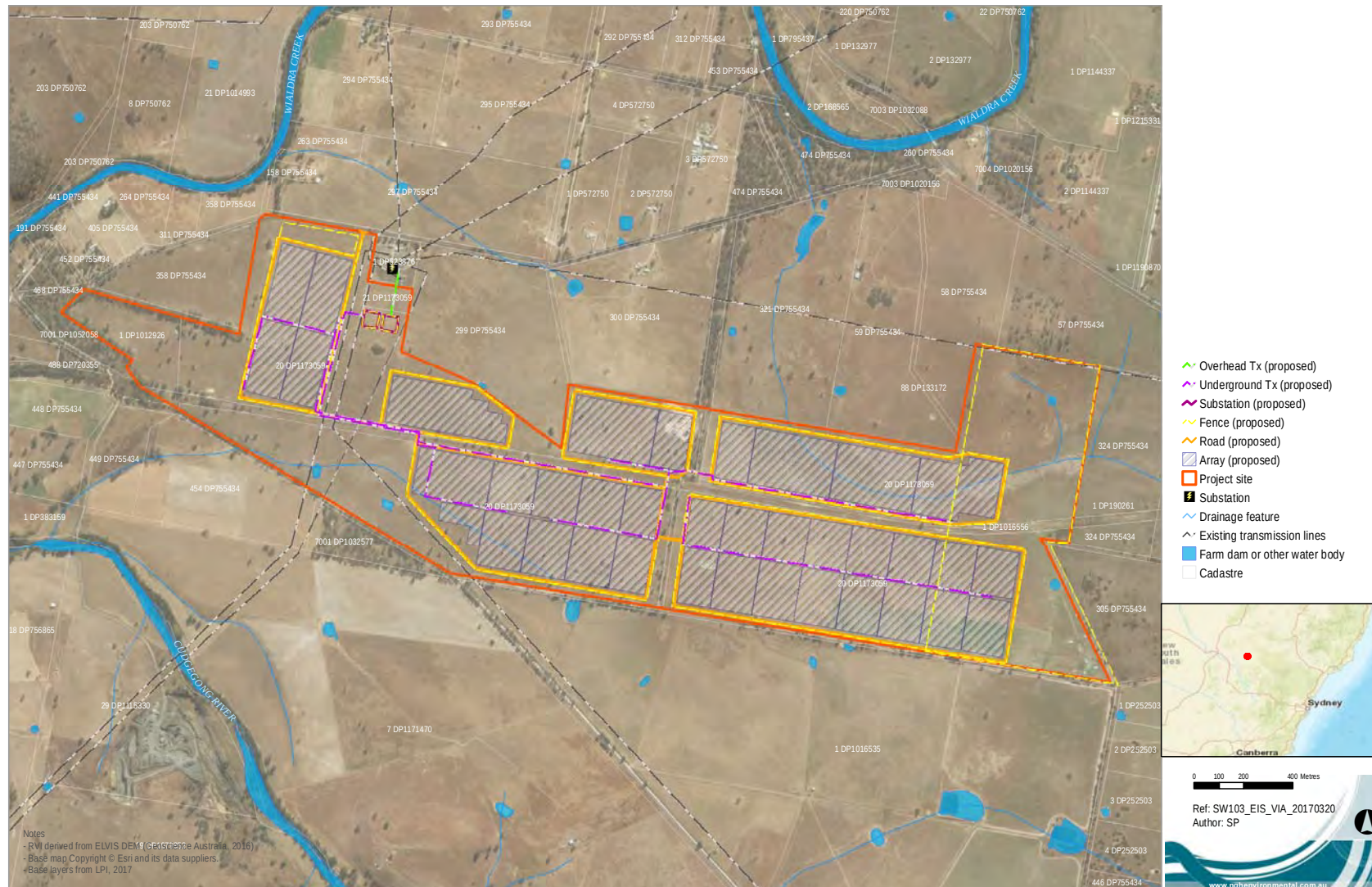
A1 Regional location of proposed solar farm site

A2 Proposed infrastructure

A.3 Location of representative viewpoints (and associated LCUs) foreground



A1 Regional location of proposed solar farm site



A2 Proposed infrastructure

APPENDIX B ZONE OF VISUAL INFLUENCE AND REPRESENTATIVE VIEW POINTS

B.1 ZVI foreground (1km) and midground (5km)

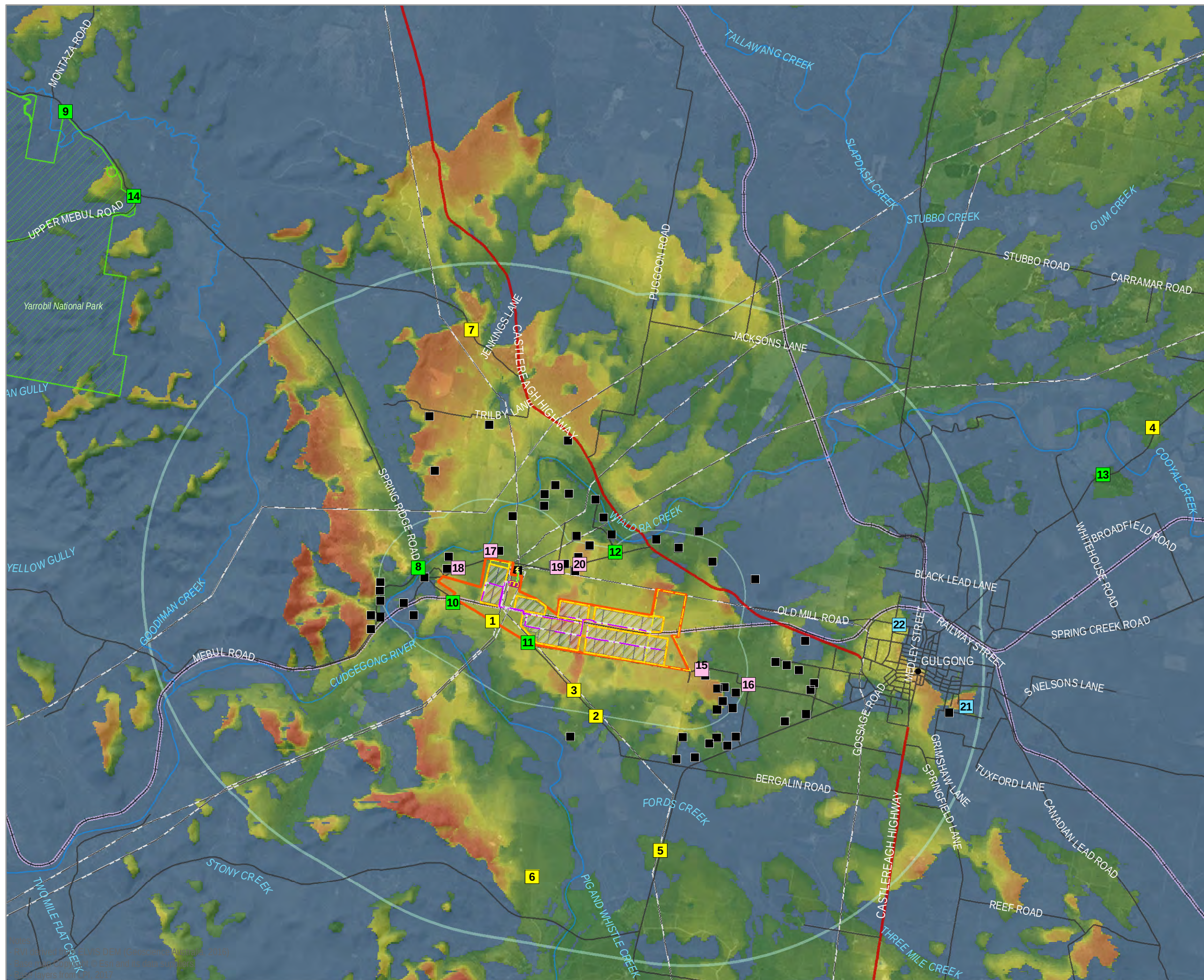
B.2 ZVI background (16km)

The ZVI (or viewshed) of the proposed solar farm was produced using topographic information.

A height of 3m was used to model onsite infrastructure. This is a realistic approximation of the height of panels and PV containers, which may actually be 2.3m and 3.4m, respectively. Topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours. The ZVI does not take into account screening such as vegetation or infrastructure and on this basis is considered a 'worst case' model.

Representative viewpoints assessed in this report are also shown for the study area on the ZVI maps.

B.3 Location of panoramic photos, shown in Section 5.2.



Landscape Character Unit (LCU)

- Residence
- Agricultural
- Remnant
- Rural residential
- Urban
- Overhead Tx (proposed)
- Underground Tx (proposed)
- Substation (proposed)
- Fence (proposed)
- Road (proposed)
- Array (proposed)
- Project site
- Substation
- Highway
- Local road
- Perennial watercourse
- Existing transmission lines
- Railway / former railway
- National Park / Reserve
- Foreground (1km)
- Midground (5km)

Relative Visibility Index

Not visible	16	32	48
Low visibility	17	33	49
2	18	34	50
3	19	35	51
4	20	36	52
5	21	37	53
6	22	38	54
7	23	39	55
8	24	40	56
9	25	41	57
10	26	42	58
11	27	43	59
12	28	44	60
13	29	45	61
14	30	46	62
15	31	47	63
High visibility			

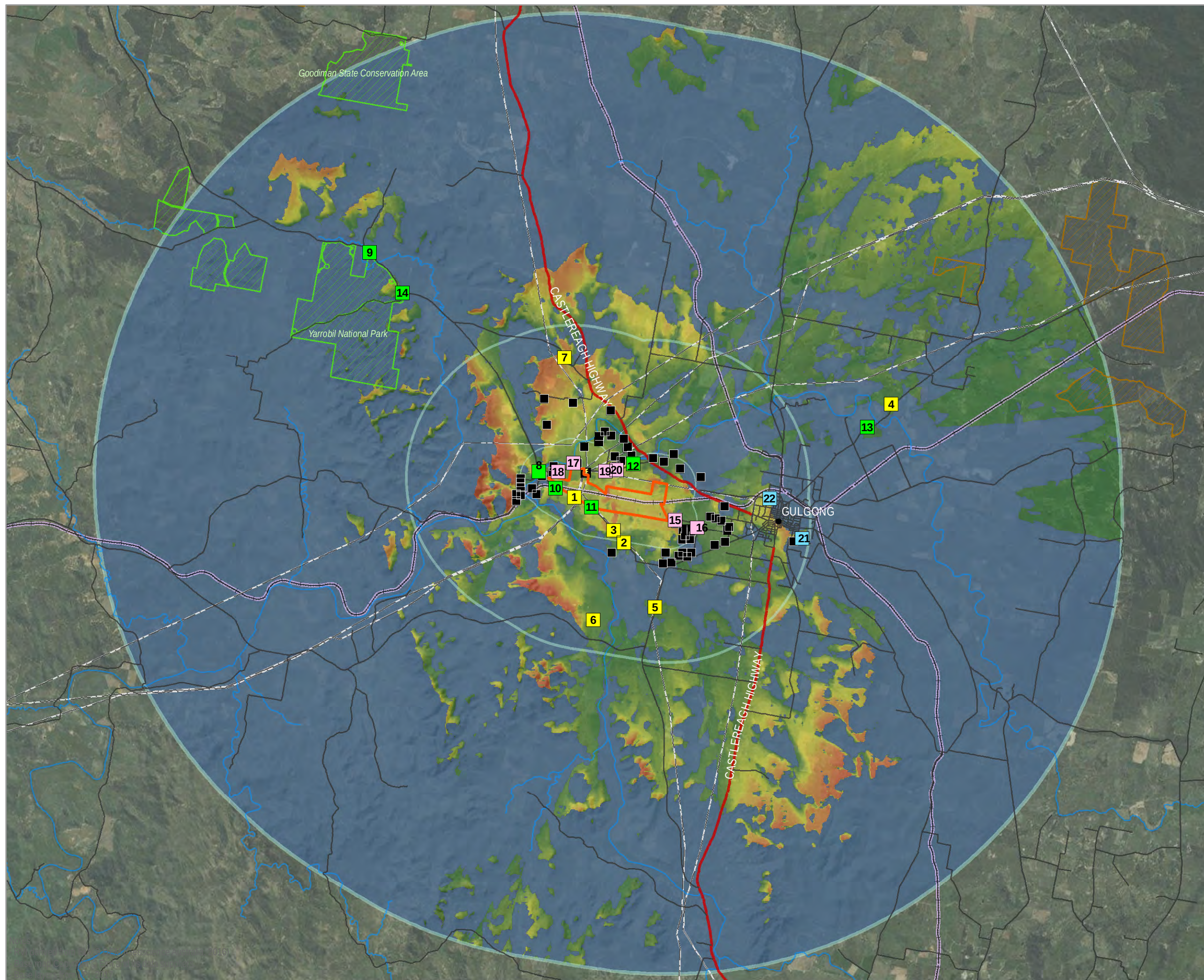
0 0.5 1 2 Kilometres

A3 @ 1:60000
Ref: SW103_VIA_20170320v2
Author: SP

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Landscape Character Unit (LCU)

- Residence
- Agricultural
- Remnant
- Rural residential
- Urban
- Project site
- ⚡ Substation
- Highway
- Local road
- Perennial watercourse
- Existing transmission lines
- ⋯ Railway / former railway
- ▨ National Park / Reserve
- ▨ State Forest
- Foreground (1km)
- Midground (5km)
- Background (16km)

Relative Visibility Index

■ Not visible	■ 16	■ 32	■ 48
■ Low visibility	■ 17	■ 33	■ 49
■ 2	■ 18	■ 34	■ 50
■ 3	■ 19	■ 35	■ 51
■ 4	■ 20	■ 36	■ 52
■ 5	■ 21	■ 37	■ 53
■ 6	■ 22	■ 38	■ 54
■ 7	■ 23	■ 39	■ 55
■ 8	■ 24	■ 40	■ 56
■ 9	■ 25	■ 41	■ 57
■ 10	■ 26	■ 42	■ 58
■ 11	■ 27	■ 43	■ 59
■ 12	■ 28	■ 44	■ 60
■ 13	■ 29	■ 45	■ 61
■ 14	■ 30	■ 46	■ 62
■ 15	■ 31	■ 47	■ 63
			■ High visibility

0 0.5 1 2 Kilometres

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Author: SP

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APPENDIX C COMMUNITY FEEDBACK FORM QUESTIONS

COMMUNITY FEEDBACK FORM: BERYL SOLAR FARM

Your feedback is important to develop a solar farm project that best suits the local area and community.

Your comments ensure local feedback is understood by the developers and assessment team.

Please send your feedback to (or seek further information directly, from):

Tom Best, First Solar Australia Pty Ltd
Level 3 16 Spring Street, Sydney, NSW 2000
berylsolarfarm@firstsolar.com

For further information about the project, please see the project website at berylsolarfarm.com.au

Your contact details: (this information will be treated as confidential)

Name: Address: Ph:

Circle which best describes how far you live from the proposed Beryl Solar Farm:

<1 km 1-2 km 2-5 km >5 kilometres Not a member of the local community

Tell us what you value about the local area:

What do you value most about the local area?

.....
.....
.....
.....

What views or landscape characteristics in the region and local area are important to you?

.....
.....
.....
.....

What do you like about solar farms?

.....
.....
.....
.....

Do you have any concerns about solar farms?

.....
.....
.....
.....

Do you have any specific concerns regarding the proposed solar farm at Beryl?

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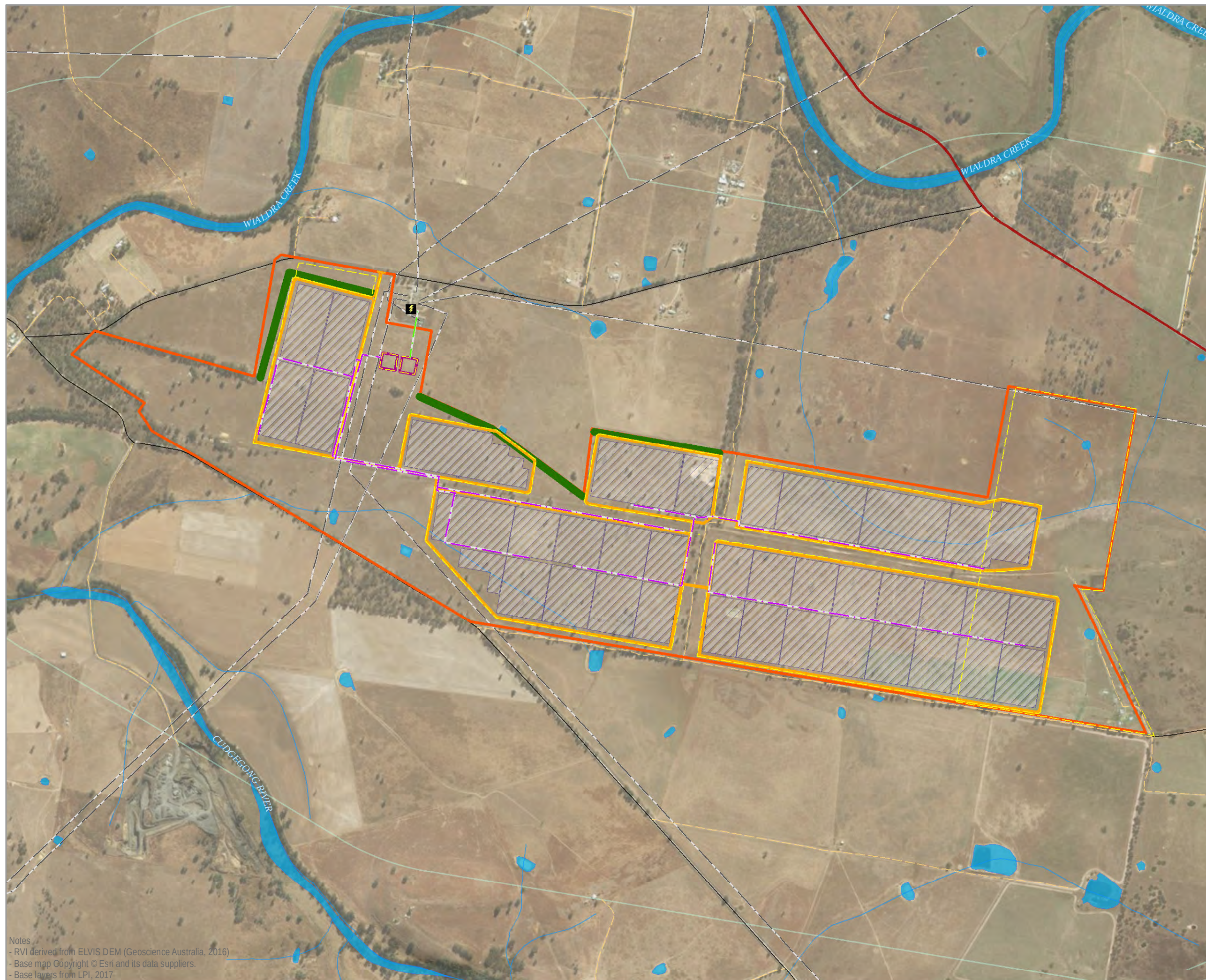
APPENDIX D PROPOSED ONSITE SCREENING

A vegetation buffer is part of the project description. A suggested location for the buffer is provided below, targeting specific sections of the project perimeter to minimise visual impacts. Screening effectiveness would also be audited post construction and augmented if required.

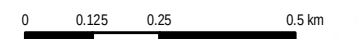
It is noted that:

- Onsite plantings would be 1-2 rows deep and be located on the outside of the security fence, where feasible, so that it breaks up views of the fencing as well as onsite infrastructure.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. Species selection could be undertaken in consultation with affected near neighbours and a botanist or landscape architect, taking into account the impact of shading on the array.
- Planting should be undertaken as soon as practical in the construction process, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered.
- A post construction audit would be undertaken to assess the effectiveness of the screening layout with reference to the final constructed infrastructure and augment the former as required.
- 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.

The aim of plant screens is to break up the view and not eliminate it. Relatively sparse plantings, rather than a formal 'hedge' effect, is considered more appropriate to the existing environment.



- Overhead Tx (proposed)
- Underground Tx (proposed)
- Substation (proposed)
- Fence (proposed)
- Road (proposed)
- Array (proposed)
- Screening (proposed)
- Project site
- ⚡ Substation
- Highway
- Local road
- Track
- Drainage feature
- Existing transmission lines
- Farm dam or other water body
- Foreground (1km)



A3 @ 1:14000
 Ref: SW103_VIA_20170320v2
 Author: SP



Notes
 - RVI derived from ELVIS DEM (Geoscience Australia, 2016)
 - Base map Copyright © Esri and its data suppliers.
 - Base layers from LPI, 2017

APPENDIX G NOISE ASSESSMENT

G.1 NOISE ASSESSMENT REPORT

G.2 DRAFT CONSTRUCTION NOISE MANAGEMENT PLAN

BERYL SOLAR FARM

Construction & Operational Noise & Vibration Assessment

22 March 2017

NGH Environmental

TJ431-01F02 Report (r4).docx

Document details

Detail	Reference
Doc reference:	TJ431-01F02 Report (r2).docx
Prepared for:	NGH Environmental
Address:	Suite 1, 216 Carp Street Bega NSW 2550
Attention:	Mr Nick Graham-Higgs

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
27.02.2017	Generate report	0	1	WC	MCH	MCH
03.03.2017	Update report		2	WC	MCH	MCH
16.03.2017	Update report		3	WC	MCH	MCH
22.03.2017	Update report		4	WC	MCH	MCH

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

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1 Introduction

Renzo Tonin & Associates was engaged to conduct an environmental noise and vibration assessment of the proposed Beryl Solar Farm located approximately five kilometres west of Gulgong, New South Wales as part of the Environmental Impact Statement (EIS) for the project. Noise and vibration impacts from the construction and operation phases of the project will be addressed in this report in accordance with relevant Council and EPA requirements and guidelines.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

2.1 Background Information

The Beryl Solar Farm project includes the construction and operation of a solar photovoltaic (PV) plant and associated infrastructure, with a capacity of approximately 95MW. The subject site located approximately six kilometres west of Gulgong, New South Wales, within the Mid-Western Regional Council Local Government Area (LGA).

2.2 Regulatory Requirements

Noise and vibration impacts are assessed in accordance with a number of policies, guidelines and standards, including:

- NSW 'Interim Construction Noise Guideline' (ICNG – Department of the Environment and Climate Change, 2009);
- NSW 'Industrial Noise Policy' (INP – EPA, 2000);
- 'Assessing Vibration: A Technical Guideline' (Department of the Environment and Climate Change, 2006); and
- NSW 'Road Noise Policy' (RNP – Department of Environment, Climate Change and Water, 2011)

2.3 Receiver Locations

The nearest affected receivers were identified through aerial maps as follows:

- **Receiver R1 – 360 Beryl Road, Gulgong**
Residential property located approximately 135m north of the project area.
- **Receiver R2 – 5 Holleys Lane, Gulgong**
Residential property located approximately 330m north of the project area.
- **Receiver R3 – 121 Beryl Road, Gulgong**
Residential property located approximately 465m north of the project area.
- **Receiver R4 – DP755434 Lot 59**
Storage shed on residential property located approximately 1,120m north of the project area.
- **Receiver R5 – 370 Castlereagh Highway, Gulgong**
Residential property located approximately 1,470m north of the project area.
- **Receiver R6 – 276 Perseverance Lane, Gulgong**
Residential property located approximately 290m east of the project area.
- **Receiver R7 – 176 Spring Ridge Road, Gulgong**
Cattle yard building on residential property located approximately 1,220m south of the project area.
- **Receiver R8 – 49 Woods Lane, Gulgong**
Residential property located approximately 710m south-west of the project area.
- **Receiver R9 – 577 Spring Ridge Road, Gulgong**
Residential property located approximately 495m west of the project area.
- **Receiver R10 – 5 Lobley Lane, Gulgong**
Residential property located approximately 470m west of the project area.

Figure 1 provides details of the site, surrounds and receiver locations

2.4 Hours of Operation

2.4.1 Construction

Construction will occur during the following standard hours of construction:

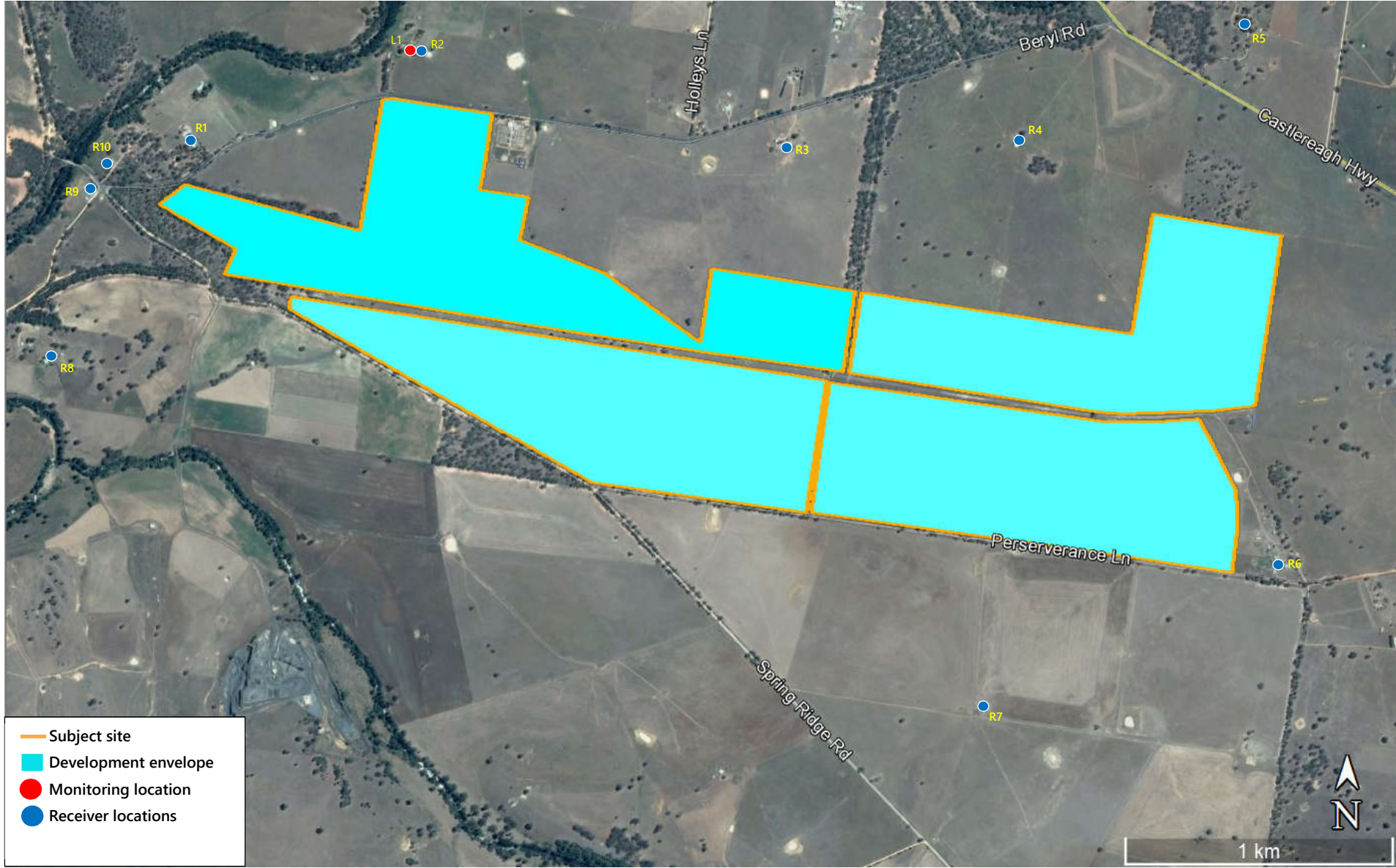
- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- No work on Sundays or public holidays

2.4.2 Operation

There will be staff on site during the following standard hours:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm

Figure 1 – Site, Surrounds and Receiver and Noise Monitoring Locations



3 Existing Noise Environment

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NSW 'Industrial Noise Policy' (INP – Environment Protection Authority NSW 2000) requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The NSW INP defines these periods as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

3.1 Noise Monitoring Locations

Noise monitoring is to be undertaken at the nearest or potentially most affected residential locations. In this case the nearest and potentially most affected location where noise monitoring was undertaken was as follows.

- **Location L1 – 5 Holleys Lane, Gulgong**
Noise monitor was installed in the 'free field' (ie. away from building facades).
Noise data represents the background and ambient noise environment for residences surrounding the project area.

To quantify the existing ambient noise environment, long-term (unattended) noise monitoring was conducted at Location L1 between Thursday 17th and Monday 21st November 2016.

Appendix A of this report presents a description of noise terms. Appendix B details the noise monitoring methodology and the graphical recorded outputs from long term noise monitoring are included in Appendix C. The graphs in Appendix C were analysed to determine an assessment background level (ABL) for each day, evening and night period in each 24 hour period of noise monitoring, and based on the median of individual ABLs an overall single Rating Background Level (RBL) for the day, evening and night period is determined over the entire monitoring period in accordance with the NSW INP.

3.2 Existing Background & Ambient Noise Levels

Existing background and ambient noise levels are presented in Table 3.1 below. The noise monitor was positioned outdoors in the 'free-field' (ie. away from building facades). Construction and operation noise from the site should be assessed away from the facade at the potentially most affected residential boundaries and therefore, the representative noise levels listed in Table 3.1 are directly applicable.

Table 3.1 – Measured Existing Background (L_{90}) & Ambient (L_{eq}) Noise Levels, dB(A)

Location	L_{90} Background Noise Levels			L_{eq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
L1 – 5 Holleys Lane Gulgong	28	30	29	45	51	49

The identified receivers surrounding the subject site are all classified as rural under INP guidelines. It was found that the background noise levels are representative of residences in a rural environment with daytime and night time background noise levels below 30dB(A).

Based on page 24 of the INP, 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 in Section 2.3 during the daytime and night time assessment periods.

4 Construction Noise Assessment

4.1 Construction Noise Management Levels

The NSW 'Interim Construction Noise Guideline' (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- *Use of L_{Aeq} as the descriptor for measuring and assessing construction noise*

NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- *Application of reasonable and feasible noise mitigation measures*

As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the length of the construction works proposed, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 4.1 reproduced from the ICNG, sets out the noise management levels and how they are to be applied for residential receivers.

Table 4.1 – Noise Management Levels at Residential Receivers

Time of Day	Management Level L_{Aeq} (15 min)	How to Apply
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 RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Table 4.2 presents the construction noise management levels established for the nearest noise sensitive residential receivers based upon the noise monitoring results presented in Table 3.1, the proposed construction hours and the above ICNG requirements. The receiver locations are marked in Figure 1.

Table 4.2 – Construction Noise Management Levels at Residential Receivers

Location Description	Day L_{A90} Background Noise Level (RBL)	Day Noise Management Level L_{Aeq} (15min)
All residential receivers	30 ¹	40

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

4.2 Construction Noise Sources

The following table lists typical plant and equipment likely to be used by the contractor to carry out the necessary construction works for the project.

Table 4.3 – Typical Construction Equipment & Sound Power Levels

Plant Item	Plant Description	Number of Items	L_{Aeq} Sound Power Levels, dB(A) re. 1pW Single Item
1	Small pile driving rig	3	114
2	Crane	1	110
3	Drum roller	1	109
4	Padfoot roller	1	109
5	Wheeled loader	1	109
6	Dump truck	2	108
7	30t Excavator	4	107
8	Grader	2	107
9	Chain trencher	1	104
10	Water truck	2	104
11	Telehandler	2	98
12	Forklift	2	90

The sound power levels for the majority of activities presented in the above table are provided by the client, based on maximum levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the ICNG, information from past projects and/or information held in our library files.

4.3 Construction Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 2017) noise modelling computer program. The program 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 takes 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 (soft); and
- Attenuation from barriers (natural and purpose built).

Noise levels at any receptors resulting from construction would depend on the above and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary substantially over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 4.4 presents noise levels likely to be experienced at the nearby affected receivers based on the construction activities and plant and equipment associated with the proposed development site. The noise level ranges represent the noise source being located at the furthest to the closest proximity to each receiver location.

Table 4.4 – Predicted $L_{Aeq,15min}$ Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Noise Management Level ¹		40	40	40	40	40	40	40	40	40	40
1	Small pile driving rig	<20-50	<20-48	<20-38	<20-36	<20-34	<20-47	<20-35	<20-34	<20-44	<20-45
2	Crane	<20-46	<20-44	<20-34	<20-32	<20-30	<20-43	<20-31	<20-30	<20-40	<20-41
3	Drum roller	<20-45	<20-43	<20-33	<20-31	<20-29	<20-42	<20-30	<20-29	<20-39	<20-40
4	Padfoot roller	<20-45	<20-43	<20-33	<20-31	<20-29	<20-42	<20-30	<20-29	<20-39	<20-40
5	Wheeled loader	<20-45	<20-43	<20-33	<20-31	<20-29	<20-42	<20-30	<20-29	<20-39	<20-40
6	Dump truck	<20-44	<20-42	<20-32	<20-30	<20-28	<20-41	<20-29	<20-28	<20-38	<20-39
7	30t Excavator	<20-43	<20-41	<20-31	<20-29	<20-27	<20-40	<20-28	<20-27	<20-37	<20-38
8	Grader	<20-43	<20-41	<20-31	<20-29	<20-27	<20-40	<20-28	<20-27	<20-37	<20-38
9	Chain trencher	<20-40	<20-38	<20-28	<20-26	<20-24	<20-37	<20-25	<20-24	<20-34	<20-35
10	Water truck	<20-40	<20-38	<20-28	<20-26	<20-24	<20-37	<20-25	<20-24	<20-34	<20-35
11	Telehandler	<20-34	<20-32	<20-22	<20-20	<20	<20-31	<20	<20	<20-28	<20-29
12	Forklift	<20-26	<20-24	<20	<20	<20	<20-23	<20	<20	<20-20	<20-21
Up to 3 (noisiest) plant operating concurrently		<20-52	<20-50	<20-40	<20-39	<20-36	<20-50	<20-38	<20-36	<20-46	<20-47

Notes: 1. Noise Management Level for day period

Based on the construction noise levels presented in the table above, the construction management levels at Receivers R1, R2, R6, R9 and R10 may be exceeded when construction works are conducted at closest proximity to the receivers. 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.

Further details on construction noise mitigation and management measures are provided in Section 4.4 below.

4.4 Construction Noise Mitigation and Management Measures

4.4.1 General Engineering Noise Controls

Implementation of noise control measures, such as those suggested in Australian Standard 2436-2010 "Guide to Noise Control on Construction, Demolition and Maintenance Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-2010, Appendix C, Table C1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table C2 in Appendix C presents typical examples of noise reductions achievable after treatment of various noise sources. Table C3 in Appendix C presents the relative effectiveness of various forms of noise control treatment.

Table 4.5 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 4.5 – 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	
		AS 2436	Renzo Tonin & Associates	AS 2436	Renzo Tonin & Associates
Distance	Doubling of distance between source and receiver	6	6	6	6
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	5 to 10	5 to 10	15	15
Acoustic Enclosures	Engine casing lagged with acoustic 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

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436.

Table 4.6 below identifies possible noise control measures, which are applicable on the construction plant likely to be used on site.

Table 4.6 – Noise Control Measures for Likely Construction Plant

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Small pile driving rig	✓	✗	✓	✓
Crane	✓	✓	✓	✗
Drum roller	✓	✗	✓	✗
Padfoot roller	✓	✗	✓	✗
Wheeled loader	✓	✗	✓	✗
Dump truck	✓	✗	✓	✗
30t Excavator	✓	✗	✓	✗
Grader	✓	✗	✓	✗
Chain trencher	✓	✗	✓	✓
Water truck	✓	✗	✓	✗
Telehandler	✓	✗	✓	✗
Forklift	✓	✗	✓	✗

4.4.2 Noise Management Measures

The following recommendations provide in-principle feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

In addition to physical noise controls, the following general noise management measures should be followed:

- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.

- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to 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.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.

Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable and to be negotiated with Council and the residents. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.

5 Operational Noise Assessment

5.1 Operational Noise Criteria

Noise impact from the general operation of the proposed solar farm is assessed against the NSW Industrial Noise Policy (INP). The assessment procedure in terms of the INP has two components:

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

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

5.1.1 Intrusiveness Criteria

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

Therefore, the intrusiveness criterion for residential noise receptors as summarised in the INP is as follows:

$$L_{Aeq, 15 \text{ minute}} \leq \text{Rating Background Level (L}_{A90}) + 5 \text{ dB(A)}$$

Based on the monitored background noise levels presented in Section 3.2 and the proposed operating hours of the solar farm, the intrusiveness criteria for the potentially most affected residential receiver locations are presented below.

Table 5.1 – Intrusiveness Noise Criteria, dB(A)

Receiver Location	Intrusiveness Criteria – $L_{Aeq,15min}$		
	Day	Evening	Night
All receivers	30 + 5 = 35	30 + 5 = 35	30 + 5 = 35

Notes: 1. Intrusiveness criteria only applicable for residential receivers

5.1.2 Amenity Criteria

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the NSW INP, the applicable parts of which are reproduced below.

Nearby noise sensitive receivers consist of residential properties situated in a rural area. Based on the nature of these receivers, the amenity criteria (L_{Aeq}) for rural residential properties will be applied. The applicable amenity noise criteria are presented in the table below.

Table 5.2 – Applicable Amenity Noise Criteria, dB(A)

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

Notes: 1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
 2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
 3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am, Sundays & 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. Therefore, the intrusiveness criteria would be assessed for from herein.

5.1.3 Sleep Disturbance

Given the proposed operating hours of the project, noise emanating from the project has been assessed for its potential to disturb sleep. The NSW EPA has made the following policy statement with respect to sleep disturbance:

"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.

Research on sleep disturbance is reviewed in the NSW Road Noise Policy. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.

From the research, the EPA recognised that the current sleep disturbance criterion of an $LA_{1, (1 \text{ minute})}$ not exceeding the $LA_{90, (15 \text{ minute})}$ by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the EPA will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

The detailed analysis should cover the maximum noise level or $LA_{1, (1 \text{ minute})}$, that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of

research results in the NSW Road Noise Policy. Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur
- time of day (normally between 10pm and 7am)
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. The EPA will accept analysis based on either LA1, (1 minute) or LA, (Max).

Source: <http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm> Downloaded: 04.12.2015"

The NSW EPA confirm that a sleep disturbance criterion of $L_{A1(1min)} \leq L_{A90(15min)} + 15dB(A)$, should only be used as a first step guide and where the criteria is not met, more detailed analysis is required as explained in the text above. The L_{Amax} descriptor may be used as an alternative to the $L_{A1(1min)}$ descriptor.

It is noted that the subject site will potentially operate for part of the night time period (prior to 7am) when there is sunlight, during the summer months.

Therefore, the sleep disturbance criterion for the project is presented in Table 5.3.

Table 5.3 – Sleep Disturbance Criterion, dB(A)

Receiver	Sleep Disturbance Criteria, L_{Amax}
All residential receivers	$30 + 15 = 45$

5.2 Operational Noise Sources

The proposed solar farm will operate 950,000 solar panels, which would be installed on single-axis trackers. Tracking systems involve the panels being driven by motors to track the arc of the sun to maximise the solar effect. Therefore, the tracking motors are a potential source of mechanical noise and are included in this assessment. Up to a total of 3,600 tracking motors (NexTracker or equivalent) will be employed to drive the solar panels and are to be evenly distributed across the solar farm area. The tracking motors would turn no more than five (5) degrees every 15 minutes and would operate no more than one (1) minute out of every 15 minute period.

In addition to the trackers, the site will require the operation of up to 66 inverters (Ingeteam 1640TL B630) which will be evenly distributed across the solar farm area.

During operations, it was assumed that three (3) staff member will attend site daily during the day time period to inspect the equipment. It was assumed that each staff member will travel around the subject site in a light vehicle.

Based on the above, the following table lists associated plant and equipment likely to be used for the operation of the proposed solar farm and their corresponding sound power levels.

Table 5.4 – Typical Operational Plant and Equipment & Sound Power Levels

Plant Item	Plant Description	L _{Aeq} Sound Power Levels, dB(A) re. 1pW
1	Tracker Motor (up to 3,600 in total)	78 (each)
2	Ingeteam 1640TL B630 Inverters (up to 66 in total)	88 (each)
3	Light vehicle (3 in total)	88 (each)

The sound power levels for the plant and equipment presented in the above table are provided by the manufacturer, information from past projects and/or information held in our library files.

5.3 ‘Modifying Factor’ Adjustments

Further to the above and in accordance with the INP, where the character of the noise in question is assessed as particularly annoying (ie. if it has an inherently tonal, low frequency, impulsive or intermittent characteristic), then an adjustment of 5dB(A) for each annoyance aspect, up to a total of 10dB(A), is to be added to the predicted value to penalise the noise for its potential increase in annoyance.

Table 4.1 of Chapter 4 of the NSW INP provides definitive procedures for determining whether a penalty or adjustment should be applied from increased annoyance. For the assessment of the solar farm, the noise from the inverters is considered to be tonal in nature. Therefore, a 5dB(A) penalty has been applied to the predicted noise contributions from the inverters.

5.4 Operational Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using CadnaA (version 2017) noise modelling computer program. The program 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 takes 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 (soft); and
- Attenuation from barriers (natural and purpose built).

Furthermore, in accordance with the INP noise predictions were prepared for each of the following meteorological conditions:

1. Calm & isothermal conditions (acoustically neutral) – no wind and no temperature inversion
2. 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.
3. Moderate temperature inversion – applicable for noise predictions during night time periods only

Table 5.5 below presents the predicted noise levels for the worst case scenario based on concurrent operation of all the plant and equipment shown in Table 5.4. The tracker motors were time corrected based on their operation of one (1) minute out of a 15 minute period.

Table 5.5 – Predicted $L_{Aeq,15min}$ Operational Noise Levels at Receiver Locations, dB(A)

Receiver Location	Intrusiveness Criteria ¹	Predicted Operational Noise Levels, $L_{Aeq, 15min}$			Comply? (Yes/No)
		Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion ²	
Receiver R1	35	26	30	30	Yes
Receiver R2	35	27	32	32	Yes
Receiver R3	35	27	32	32	Yes
Receiver R4	35	26	31	31	Yes
Receiver R5	35	<20	25	25	Yes
Receiver R6	35	26	31	31	Yes
Receiver R7	35	26	32	32	Yes
Receiver R8	35	<20	24	24	Yes
Receiver R9	35	21	26	26	Yes
Receiver R10	35	22	27	27	Yes

Notes: 1. Criteria for Day, Evening and Night periods
2. Applicable for the Night time period only

Based on the predicted operational noise levels presented in the table above, predicted noise levels at the nearest receivers comply with the nominated criteria under all scenarios and meteorological conditions.

Therefore, no further reasonable and feasible noise mitigation measures are required to reduce operational noise impacts.

5.5 Sleep Disturbance Assessment

During the night time period, only mechanical plant will be operating, including the tracking motors and inverters with integrated transformers. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the L_{Amax} noise levels

experienced at the identified receivers will be similar to the predicted $L_{Aeq,15min}$ noise levels shown in Table 5.5. therefore, it is expected that the L_{Amax} noise levels experienced at the identified receivers will be well below the nominated sleep disturbance criteria of 45dB(A).

6 Vibration Assessment

Vibration generating activities would occur only during the construction phase of the project. There are no vibration generating activities expected during the operational phase. As the nearest identified receivers are in excess of 100m from the subject site and there are no high vibration producing plant items to be used, structural damage due to vibration is not expected. Assessment for vibration impact on human comfort is assessed in accordance with EPA requirements.

6.1 Vibration Criteria

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's 'Assessing Vibration; a technical guideline' (DECC, 2006). The guideline provides criteria which are based on the British Standard BS 6472-1992 'Evaluation of human exposure to vibration in buildings (1-80Hz)'. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 6.1 provides definitions and examples of each type of vibration.

Table 6.1 – Types of Vibration

Type of Vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

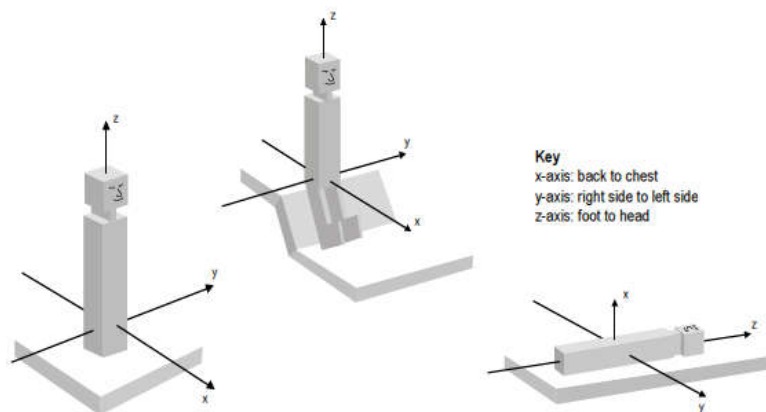
The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

"Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472)."

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore,

application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 2. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 2 – Orthogonal Axes for Human Exposure to Vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 6.2 for the applicable receivers.

Table 6.2 – Preferred and Maximum Levels for Human Comfort

Location	Assessment Period ¹	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s ² , 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive vibration (weighted RMS acceleration, m/s ² , 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 6.3 for the applicable receiver type.

Table 6.3 – Acceptable Vibration Dose Values for Intermittent Vibration (m/s^{1.75})

Location	Daytime ¹		Night-time ¹	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

6.2 Potential Vibration Impacts

Based on the proposed plant items presented in Table 4.3, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 6.4 below. The assessment is relevant to the identified receiver locations.

Table 6.4 – Potential Vibration Impacts for Identified Receivers

Receiver Location	Approx. Distance to Nearest Buildings from Works	Type of Nearest Sensitive Buildings	Assessment on Potential Vibration Impacts	Vibration Monitoring
Receiver R1	135m	Residential	Very low risk of adverse comments	Not required
Receiver R2	330m	Residential	Very low risk of adverse comments	Not required
Receiver R3	465m	Residential	Very low risk of adverse comments	Not required
Receiver R4	1,120m	Residential	Very low risk of adverse comments	Not required
Receiver R5	1,470m	Residential	Very low risk of adverse comments	Not required
Receiver R6	290m	Residential	Very low risk of adverse comments	Not required
Receiver R7	1,220m	Residential	Very low risk of adverse comments	Not required
Receiver R8	710m	Residential	Very low risk of adverse comments	Not required
Receiver R9	495m	Residential	Very low risk of adverse comments	Not required
Receiver R10	470m	Residential	Very low risk of adverse comments	Not required

The potential for adverse comments to vibration impacts during the construction works was determined to be very low due to the large distances between the receiver locations and the construction activities. Therefore, additional vibration mitigation measures and vibration monitoring are not required at the identified receiver locations during construction works associated with the project.

7 Road Traffic Noise Assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

Vehicle access to the subject site will be via Beryl Road. Based on information provided by the client, the peak vehicle movements during the construction stage of the project are presented in the following table.

Table 7.1 – Summary of the Estimated Construction Traffic Volumes During Peak Construction

Vehicle Type	Trips Per Day (peak)
Cars/ light vehicles	300
Trucks/ heavy vehicles	Up to 100

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

7.1 Road Traffic Noise Criteria

Based on functionality, Beryl Road is categorised as a sub-arterial road. For existing residences affected by additional traffic on existing arterial roads generated by land use developments, the following RNP road traffic noise criteria apply.

Table 7.2 – RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L _{Aeq} (15 hour) 60 (external)	L _{Aeq} (9 hour) 55 (external)

7.2 Predicted Road Traffic Noise

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. Compliance during the construction stage would result in compliance during the operational stage. Therefore, operational traffic will not be considered further from herein.

Vehicle movements will only occur during the day time period when construction works occur.

Results of the road traffic noise predictions are presented in the table below. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels due to existing general traffic flows.

Table 7.3 – Predicted Road Traffic Noise Contribution Levels Along Public Roads, dB(A) $L_{Aeq}(15 \text{ Hour})$

Receiver	Criteria	Traffic Movements	Speed (km/h) ¹	Distance to Road ²	Predicted Noise Level	Exceed?
Residences on Beryl Road	$L_{Aeq, (15 \text{ hour})}$ 60	As per Table 7.1	80	20m	53	No

Notes: 1. Based on posted speed limit
2. Based on closest distance from facade of dwelling to the road

From the above table, it can be seen that road traffic noise level contributions from the vehicle movements associated with the construction works are at least 7dB(A) below the applicable noise criterion based on dwellings being 20m from the road. Given that residences are located within a rural environment, distances between the road and the dwellings would likely be significantly greater than 20m.

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.

8 Conclusion

Renzo Tonin and Associates has completed an environmental noise and vibration assessment of the proposed Beryl Solar Farm.

Noise emissions from the construction phase of the project were predicted to exceed the construction noise management levels at the nearest affected receivers. In-principle recommendations are provided in Section 4.4 to limit the potential impact of noise generated by construction activities to acceptable levels.

Noise emissions from the operational phase of the project were predicted to comply with the nominated criteria at the nearest affected receivers.

Given the large separation distance between the nearest affected receivers and the subject site, vibration impacts resulting in structural damage to buildings at the nearest affected receivers are determined to be negligible and there is low risk of adverse comments from occupants of dwellings due to construction vibration.

Road traffic noise impacts on residential properties along the access route were found to comply with the relevant RNP criteria.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.

L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L _{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Long-Term Noise Monitoring Methodology

B.1 Noise Monitoring Equipment

A long-term unattended noise monitor consists of a sound level meter housed inside a weather resistant enclosure. Noise levels are monitored continuously with statistical data stored in memory for every 15-minute period.

Long term noise monitoring was conducted using the following instrumentation:

Description	Type	Octave Band Data	Logger Location(s)
RTA04 (CESVA SC310)	Type 1	1/1	L1

Notes: All meters comply with AS IEC 61672.1 2004 "Electroacoustics - Sound Level Meters" and designated either Type 1 or Type 2 as per table, and are suitable for field use.

The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

B.2 Meteorology During Monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the NSW INP. Determination of extraneous meteorological conditions was based on data provided by the Bureau of Meteorology (BOM), for a location considered representative of the noise monitoring location(s). However, the data was adjusted to account for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is typically 1.5m above ground level (and less than 3m). The correction factor applied to the data is based on Table C.1 of ISO 4354:2009 '*Wind actions on structures*'.

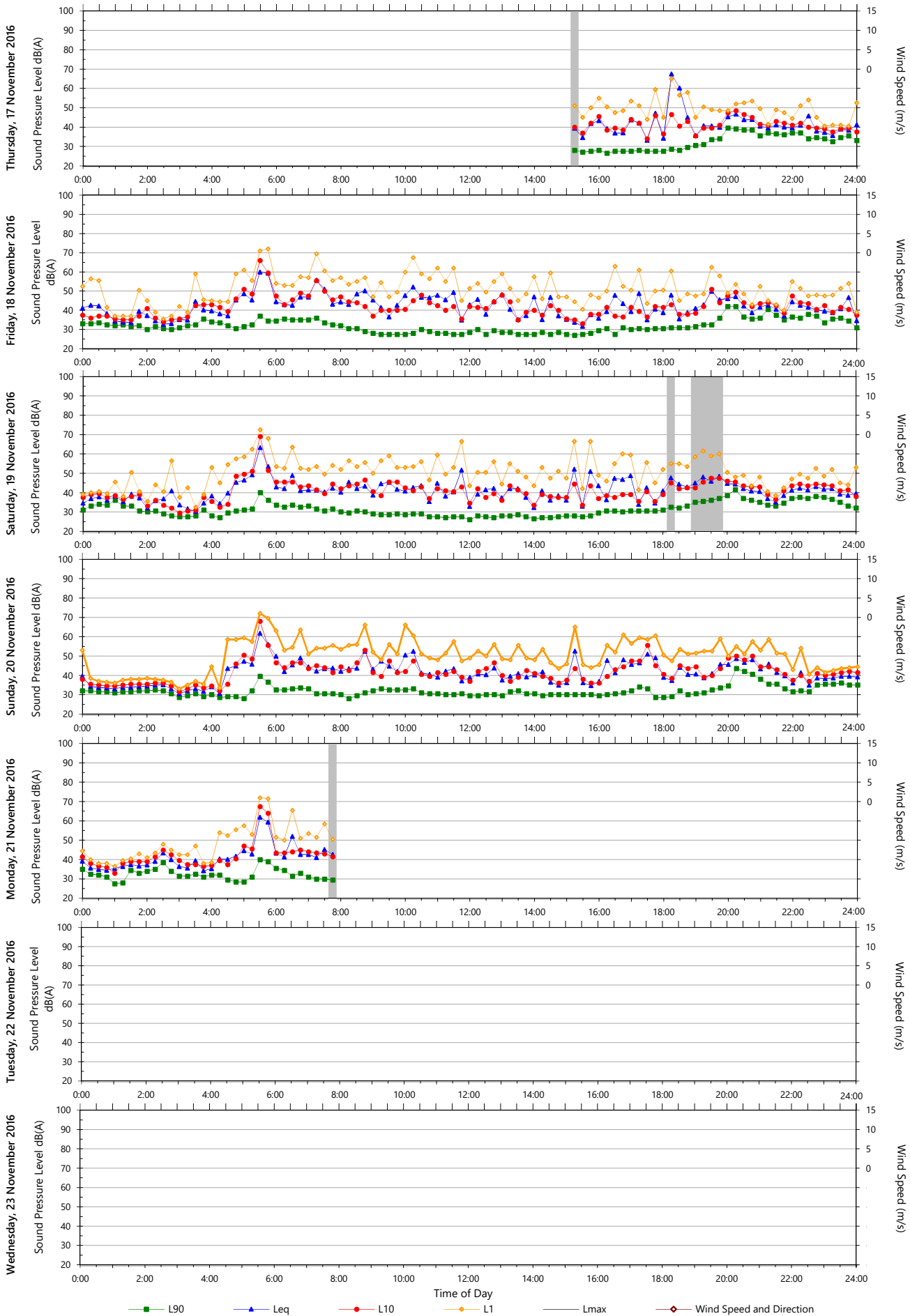
B.3 Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the L_{10} , L_{90} , and L_{eq} levels. The statistical descriptors L_{10} and L_{90} measure the noise level exceeded for 10% and 90% of the sample measurement time. The L_{eq} level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels, as presented in this report, illustrate these concepts for the broadband dB(A) results.

APPENDIX C Long Term Noise Monitoring Results

Unattended Monitoring Results

Location: 5 Holleys Lane, Gulgong



Data File: 2016-11-17_15-00-00_006_RTA.xls

Template: QTE-26 (rev 14) Logger Graphs Program

Construction Noise Management Plan

BERYL SOLAR FARM

MARCH 2017



Document Verification



Project Title:

Beryl Solar Farm

Project Number:	16-347			
Project File Name:	Construction Noise Management Plan _ Beryl			
Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
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ACRONYMS AND ABBREVIATIONS

ANZECC	Australian and New Zealand Environment Conservation Council
dBA	Decibels
EPA	Environment Protection Authority (Previously DECCW and/or OEH)
EPL	Environment Protection Licence
ICNG	Interim Construction Noise Guidelines (EPA 2009)
km	kilometres
L _{Aeq}	Equivalent continuous noise level
m	Metres
NSW	New South Wales
NVMP	Noise and Vibration Management Plan
OEH	NSW Office of Environment and Heritage
OOHW	Out-of-hours work
POEO	<i>Protection of the Environment Operations Act 1997</i>
RBL	Rating Background Level (background noise level)
RMS	Acceleration Root Mean Square

1 INTRODUCTION

The construction of a solar farm comprises activities such as road construction, civil works, excavation and foundation construction and electrical infrastructure works requiring processes such as heavy vehicle movements, loaders, excavators, piling, generators and cranes.

An environmental noise assessment was prepared for Beryl Solar Farm (TJ431-01F02 REPORT (R3)) by Renzo Tonin (2017). Noise emissions from the construction phase of the project were predicted to exceed the construction noise management levels at the nearest affected receivers.

The most significant impacts from construction occur from activity at night. It is understood that the proposed hours of construction activity are as follows;

- Monday to Friday: 7am to 6pm
- Saturday: 8 am to 1pm
- Sunday and Public Holidays: No work

With day time only activity occurring at significant separation distances, the construction of Beryl Solar Farm is not expected to generate significant impacts, subject to implementation of the feasible and reasonable noise mitigation measures, as set out in the noise assessment (Renzo Tonin 2017) and carried over to this construction Noise Management Plan (NMP).

This draft NMP has been prepared in advance of the detailed design, to demonstrate the framework for noise management during construction. It would be updated prior to implementation.

2 EXISTING ENVIRONMENT

2.1 AMBIENT AND BACKGROUND NOISE MONITORING

Noise monitoring was carried out one location, north of the proposed solar farm; 5 Holleys Lane Gulgong (refer Appendix A for monitoring location). The noise monitoring was carried out for a period of four days (between Thursday 17th and Monday 21st of November 2016).

The Rating Background Level (RBL) is the indicative background noise level at the monitoring location, while the ambient equivalent (L_{aeq}) noise level is the average noise environment at the monitoring location, determined in accordance with the NSW Industrial Noise Policy (the INP). The RBL and the ambient equivalent (L_{aeq}) noise level for L1 have been derived from the monitoring data are provided in Table 2-1.

Table 2-1 Measured existing background (L90) & Ambient (Leq) Noise Levels, dB(A)

Location	L90 Rating Background Noise Levels (RBL)			Leq Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
L1 – 5 Holleys Lane Gulgong	28 (30*)	30	29 (30*)	45	51	49

*Based on page 24 of the INP, 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 during the daytime and night time assessment periods.

3 NOISE CRITERIA

3.1 CONSTRUCTION ACTIVITY CRITERIA

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

The guideline specifies noise targets, or 'noise management levels', for residences and other noise sensitive receivers (Table 3-1). The 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 3-1 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 RBL + 10dB(A) Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected RBL + 5dB(A)

Table 3-2 identifies the construction Noise Management Levels (NMLs) established for the nearest noise sensitive receivers based upon the noise monitoring results presented in Table 2-1 and the proposed construction hours and ICNG (Table 3-1) requirements. Furthermore, during standard construction hours, a highly affected noise objective of 75 dB(A) applies to all receivers.

Table 3-2 Construction Noise Management Levels at Residential Recievers

Location description	Day L_{A90} Background Noise Level (RBL)	Day Noise Management L_{A90} (15min)
All residential receivers	30 ¹	40
Notes: 1. Construction works occur during the daytime period only, hence only the day period assessed		

3.2 ROAD TRAFFIC NOISE CRITERIA

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP).

Based on functionality, Beryl Road is categorised as a sub-arterial road. For existing residences affected by additional traffic on existing arterial roads generated by land use developments, the following RNP road traffic noise criteria apply.

Table 3-3 RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L _{Aeq} (15 hour) 60 (external)	L _{Aeq} (9 hour) 55 (external)

4 ENVIRONMENTAL IMPACTS AND ASSESSMENT

4.1 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 4-1 .

Table 4-1 Construction equipment sound power levels

Equipment used	L _{Aeq} Sound power levels (dBA)	No. Items required
Small pile driving rig	3	114
Crane	1	110
Drum Roller	1	109
Padfoot roller	1	109
Wheeled loader	1	109
Dump truck	2	108
30t Excavator	4	107
Grader	2	107
Chain trencher	1	104
Water truck	2	104
Telehandler	2	98
Forklift	2	90

4.2 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 the prediction of the total noise from a site.

The noise prediction models take into account:

- Location of noise sources and receiver locations
- Height of sources and receivers
- Separation distances between sources and receivers
- Ground type between sources and receivers
- Attenuation from barriers (natural and purpose built).

Table 4-2 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 noisiest plants operating concurrently.

Table 4-2 Predicted L_{Aeq} 15 min construction noise levels at receiver locations

Receiver location (refer to Figure X)	Noise management level ¹	Predicted Construction Noise Level, $L_{Aeq}(15\text{ min})$ ²	Comply? (Yes/No)
R1	40	<20-52	No
R2		<20-50	No
R3		<20-40	Yes
R4		<20-39	Yes
R5		<20-36	Yes
R6		<20-50	No
R7		<20-38	Yes
R8		<20-36	Yes
R9		<20-46	No
R10		<20-47	No

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 noisiest construction plant and equipment operating concurrently.

Based on the construction noise level presented in the table above, the construction management levels at Receivers R1, R2, R6, R9 and R10 (shown on Appendix A) may be exceeded when construction works are conducted at closest proximity to the receivers. It is noted construction levels at all receivers are predicted to be less than the highly noise affected level of 75dB(A).

Section 5 outlines possible noise reductions from using some recommended control methods.

Table 4-3 Relative effectiveness of various forms of noise control

Noise control method	Practical examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS2436 ¹	Renzo Tonin and Associates	AS2436	Renzo Tonin and Associates
Distance	Doubling of distance between source and receiver	6 dB(A)	6 dB(A)	6 dB(A)	6 dB(A)
Screening	Acoustics barriers such as earth mounds, temporary or permanent noise barriers	5 to 10 dB(A)	5 to 10 dB(A)	15 dB(A)	15 dB(A)
Acoustic enclosures	Engine casing lagged with insulation and plywood	15 to 25 dB(A)	10 to 20 dB(A)	50 dB(A)	30 dB(A)
Engine Silencing	Residential class mufflers	5 to 10 dB(A)	5 to 10 dB(A)	20 dB(A)	20 dB(A)

¹ Refers to Australian Standard (AS)2436.

Noise control method	Practical examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS2436 ¹	Renzo Tonin and Associates	AS2436	Renzo Tonin and Associates
Substitution by alternative process	Use electric motors in preference to diesel or petrol	-	15 to 25 dB(A)	-	40 dB(A)

Consideration of these methods is recommended in Section 5.

4.3 ROAD TRAFFIC NOISE ASSESSMENT

Vehicle access to the subject site will be via Beryl Road. Based on information provided by the client, the peak vehicle movements during the construction stage of the project are presented in the following table.

Table 4-4 Summary of the Estimated Construction Traffic Volumes During Peak Construction

Vehicle Type	Trips Per Day (peak)
Cars/ light vehicles	300
Trucks/ heavy vehicles	Up to 100

Results of the road traffic noise predictions are presented in the table below. It is noted that the predicted noise levels represent the traffic noise contribution from the vehicle movements associated with the construction works and does not take into account existing traffic noise levels due to existing general traffic flows.

Table 4-5 Predicted Road Traffic Noise Contribution Levels Along Public Roads, dB(A) $L_{Aeq}(15 \text{ Hour})$

Receiver	Criteria	Traffic Movements	Speed (km/h) ¹	Distance to Road ²	Predicted Noise Level	Exceed?
Residences on Beryl Road	L_{Aeq} (15 hour) 60	As per Table 7.1	80	20m	53	No

Notes: 1. Based on posted speed limit

2. Based on closest distance from facade of dwelling to the road

From the above table, it can be seen that road traffic noise level contributions from the vehicle movements associated with the construction works are at least 7dB(A) below the applicable noise criterion based on dwellings being 20m from the road. Given that residences are located within a rural environment, distances between the road and the dwellings would likely be significantly greater than 20m.

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. No specific mitigation is provided.

5 PROJECT MITIGATION MEASURES

The following recommendations provide feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those provided in this report, more detailed design of noise control measures may be required.

5.1 PHYSICAL NOISE CONTROLS

Physical noise controls set out in Table 4-3 would be investigated where exceedances are predicted for specific activities:

- Doubling of distance between source and receiver
- Temporary acoustics barriers
- Engine casing lagged with insulation and plywood

5.2 GENERAL MINIMISATION MEASURES

In addition to physical noise controls, the following general noise management measures should be followed:

- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.

5.3 TIMING RESTRICTIONS

Where noise level exceedances cannot be avoided, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.

Some items of plant may exceed noise limits even after noise treatment is applied. To reduce the overall noise impact, the use of noisy plant may be restricted to within certain time periods, where feasible and reasonable and to be negotiated with Council and the residents. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.

6 COMPLIANCE MANAGEMENT

6.1 MONITORING

The aim of a monitoring procedure is to ensure works are being carried out in accordance with the NMP. On site monitoring should include the following elements;

Plant and Equipment

Regular on site inspections to identify:

- Equipment has quality OEM mufflers installed;
- Equipment is well maintained and fitted with adequately maintained silencers which meet the OEM design specifications;
- Silencers and enclosures are intact and closed, rotating parts are balanced, loose bolts are tightened, frictional noise is reduced through lubrication and cutting noise reduced by keeping equipment sharp;
- Site personnel are using only necessary power to complete the task;
- Plant and equipment that is noisier than other similar machines;
- Care is being taken to place material in trucks rather than being dropped;
- Plant emitting noise strongly in one direction is orientated so that the noise is directed away from noise sensitive areas if practicable;
- Machines that are used intermittently are being shut down in the intervening periods between works or throttled down to a minimum.

6.2 COMPLAINTS RESOLUTION

The aim of the complaints resolution process is to identify any feasible and reasonable measures that may further reduce impacts following a complaint, and to provide feedback to the community on the above process within a reasonable timeframe.

The proponent would:

- Take direct actions to develop good relations with people living and working in the vicinity of a construction site at the beginning of a project and this would be maintained throughout the project, as this is of paramount importance.
- Keep people living and working in the vicinity of a construction site informed of progress.
- Appoint a person to liaise with the community who is adequately trained and experienced in such matters

The complaints resolution process should implement the following noise elements;

- Establishment of a complaints mechanisms for the community via either telephone or email;
- Notification of the relevant project contact details through the community consultation process;
- Take all complaints seriously and deal with them expeditiously;
- Assesses whether the issue can be resolved easily and take immediate action if possible;
- If not, ensures that the appropriate consultation has been undertaken for the activity;
- Ensures the on-site inspections of the NMP have been carried out regularly for the activity;

- Assesses the construction site and activities to determine whether there is any reason to believe the noise exposure of receivers is higher than anticipated;
- Undertakes monitoring of noise levels where this cannot be confirmed, with the aim of establishing if the exposure of receivers is higher than anticipated by the NMP;
- Takes remedial action if any of the above cannot be confirmed;
- Advises complainant of action taken;
- Maintains a record of the above to enable review by an independent authority such as EPA.

7 CONCLUSION

Renzo Tonin and Associates has completed an environmental noise and vibration assessment of the proposed Beryl Solar Farm. Noise emissions from the construction phase of the project were predicted to exceed the construction noise management levels at the nearest affected receivers.

Feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers are included in this NMP.

The NMP provides a framework document that the construction contractor can use to develop and implement action plans for each individual construction activities. It has been prepared in advance of the detailed design, to demonstrate the framework for noise management during construction and would be updated prior to implementation.

8 REFERENCES

- DECCW. 2011. NSW Road Noise Policy. Department of Environment, Climate Change and Water, Sydney, New South Wales.
- DECCW. 2009. Interim Construction Noise Guideline. Department of Environment, Climate Change and Water, Sydney, New South Wales.
- Renzo Tonin and Associates. 2017. Beryl Solar Farm, Construction & Operational Noise & Vibration Assessment. Report prepared for First Solar, March 2017.

APPENDIX A RECIEVER LOCATIONS



APPENDIX H SOIL SURVEY

Desk Study and Preliminary Soil Survey for Beryl Solar Farm, Beryl

First Solar

14 March 2017

Ref: 17-096



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APPENDICES

Appendix A – Laboratory Reports

1 INTRODUCTION

At the request of Tom Best from First Solar, Macquarie Geotechnical has carried out a Desk study and preliminary site investigation for the proposed Beryl Solar Farm, Beryl.

The objectives of this desk study were to describe the existing geology, geomorphology, groundwater information, description of soil types and properties including erosion potential and chemical properties.

2 METHOD OF INVESTIGATION

A desk study was undertaken using readily available geological and geotechnical information and included the following:

- Dubbo 1:250,000 Geological Sheet SI/55-4
- Dubbo 1:250,000 Geological Sheet SI/55-4 Explanatory Notes
- Dubbo 1:250,000 Soil Landscape Series Sheet
- ASRIS/CSIRO
- ESPADE/Salis
- NSW Office of Water – Water Resources and Management
- NSW Office of Water – Borehole search
- Australian Standard 1726 – 2007 Geotechnical Site Investigations

The assessment involved review of the geological setting of the slope, strength of soils, slope gradient, existing erosion and potential erosion risk, salinity risk, and the topographic setting of the site. In addition drainage paths, extent of possible waterlogging during wet periods and site vegetation were also considered.

As part of the desk study reference has been made to the preliminary geotechnical investigation undertaken within the proposed site footprint. A site visit was also undertaken by an Engineering Geologist from our Bathurst office.

3 SITE DESCRIPTION

The site is located adjacent to Beryl Substation, Beryl. The site is located on gently undulating grassed areas that is currently used for cropping and grazing.. The site is bound to the south by Spring Ridge Rd and Perseverance Lane and grassed paddocks all other directions. The north western section of the site is bound by Beryl Road and Beryl substation

3.1 Regional Geology

Reference to the Dubbo Geological map (1:250'000 SI/55-4) indicates that the geology underlying the site consists of the following;

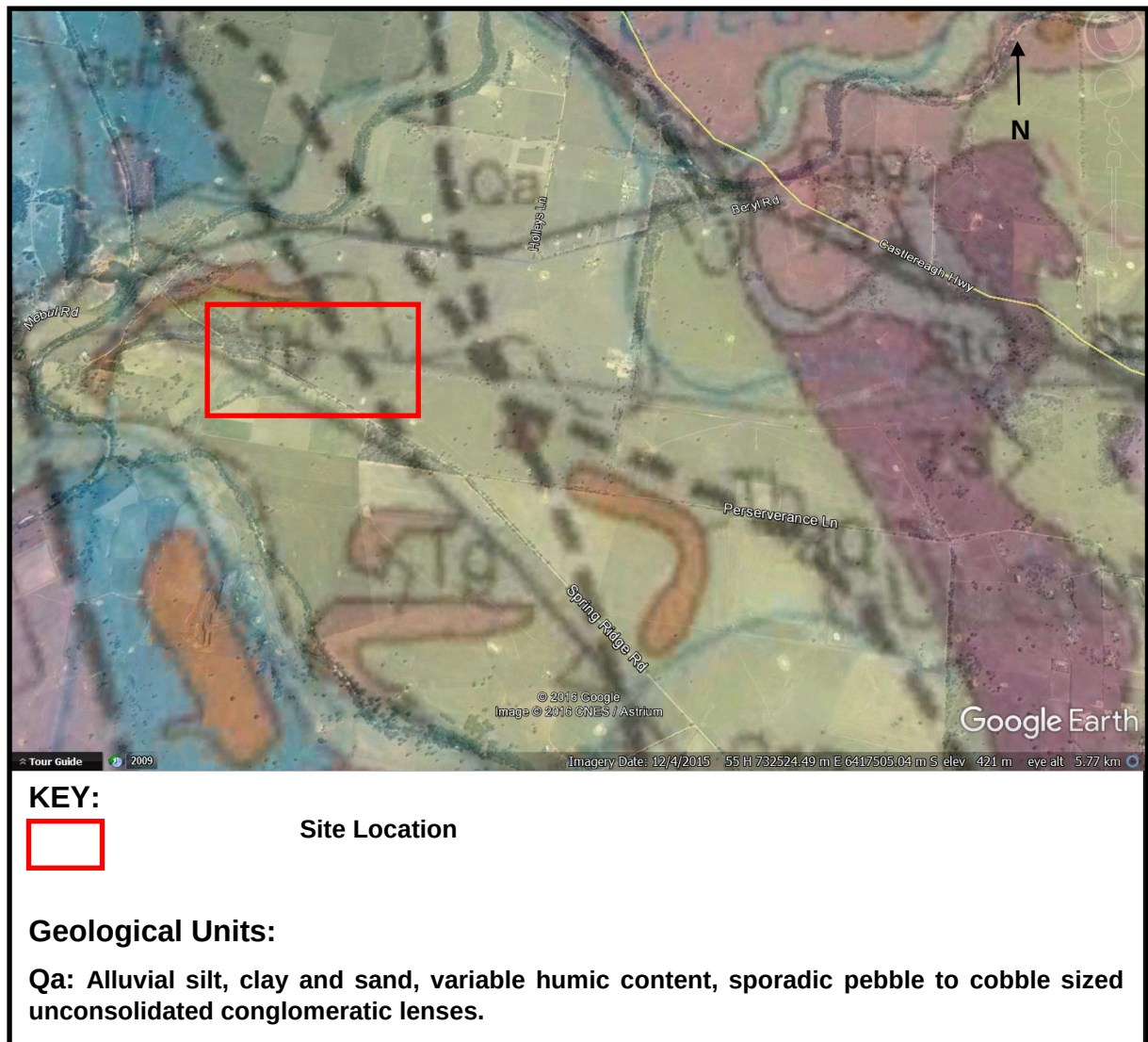


Figure 1: Solid Geology of the Area

The site is generally underlain by the following geological sequences:

- Qa (Alluvial Deposits) – Alluvial silt, clay and sand, variable humic content, sporadic pebble to cobble sized unconsolidated conglomeratic lenses.

The 1:250000 “Dubbo” Soil Landscape Series Sheet indicates that the site is located within the following soil landscape groups:

The “Home Rule” Soil Group

The “Membul” Soil Group

The “Craigmore” Soil Group

The site predominantly falls into the Home Rule soil group and is described as follows:

- These soils are found on undulating low rises ranging in elevation between 420 and 500m above sea level.
- Slopes are gently inclined 4 – 8%.
- The landscape consists of siliceous sands, bleached sands and earthy sands overlying yellow sodic soils.
- Erosion hazard is high especially in areas with minimal ground cover and drainage depressions are susceptible to gully erosion.

Extract summary from Dubbo Soil Landscapes is provided below:

Table 1: Dubbo Soil Landscape – Home Rule

SUMMARY TABLE FOR THE MAIN SOILS OF HOME RULE SOIL LANDSCAPE		
	Siliceous Sands	Yellow Solodic Soils
Dominance	Co-dominant	Co-dominant
Landform element	Crests, mid to upper slopes	Lower slopes
Surface condition	Loose	Hardsetting
Drainage	Excessively well-drained	Imperfectly drained
Soil permeability	High	Slow
Watertable depth	>150 cm	>150 cm
Available waterholding capacity	Low	Moderate to low
Depth to bedrock	100 - 300 cm	150+ cm
Flood hazard	Nil	Low
pH (topsoil)	Slightly acidic	Slightly acidic to neutral
Fertility (chemical)	Low	Low
Expected nutrient deficiencies	N, P	N, P
Soil salinity	Low	Low to moderate
Erodibility (topsoil)	Moderate	High
Erodibility (subsoil)	Moderate	High
Erosion hazard	High	High to very high
Structural degradation hazard	Low	High
Land capability classification	III, VI	IV, V, VI
USCS (subsoil)	CL, SM, SP, SW	CL, SC
Shrink-swell potential	Low	Moderate
Mass movement hazard	Low	Low

The Membul soil group and is described as follows:

- These soils are found on undulating low hills ranging in elevation between 400 and 540m above sea level.
- Slopes range from 2 –15%.
- The landscape consists of chocolate soils and euchozems.
- Erosion hazard is high especially in areas with minimal ground cover.

Extract summary from Dubbo Soil Landscapes is provided in Table 2.

Table 2: Dubbo Soil Landscape – Membul

SUMMARY TABLE FOR MAIN SOILS OF MEBUL SOIL LANDSCAPE			
	Chocolate Soils	Euchrozems	Non-calcic Brown Soils
Dominance	Dominant	Minor	Minor
Landform element	Mid and upper slopes	Mid to lower slopes	Upper slopes and crests
Surface condition	Friable	Friable	Hardsetting
Drainage	Well-drained	Well-drained	Well-drained
Soil permeability	Moderate	Moderate to rapid	Moderate
Watertable depth	>300 cm	>300 cm	>300 cm
Available waterholding capacity	Moderate to high	Moderate to high	Moderate
Depth to bedrock	>100 cm	>100 cm	>100 cm to 60 cm
Flood hazard	Nil	Nil	Nil
pH (topsoil)	Neutral	Neutral	Slightly acidic
Fertility (chemical)	Moderate	Moderate to high	Moderate
Expected nutrient deficiencies	N, P	N, P	N, P
Soil salinity	Low	Low	Low
Erodibility (topsoil)	Low	Low	Moderate
Erodibility (subsoil)	Low	Low	Low
Erosion hazard	Moderate	Moderate	Moderate
Structural degradation hazard	Moderate	Moderate to low	High
Land capability classification	III, IV	III, IV	III, IV
USCS (subsoil)	CL, CH	CL, CH	CL, CH
Shrink-swell potential	Moderate to high	Moderate to high	Moderate to high

The Craigmores soil group and is described as follows:

- These soils are found on high terrace ranging in elevation between 460 and 475m above sea level.
- The landscape consists of non-calcic soils and red earths.
- Erosion hazard is low unless in areas with minimal ground cover.

Extract summary from Dubbo Soil Landscapes is provided in Table 3.

Table 3: Dubbo Soil Landscape – Craigmore

SUMMARY TABLE FOR THE MAIN SOILS OF CRAIGMORE SOIL LANDSCAPE		
	Red Earths	Non-calcic Brown Soils
Dominance	Co-dominant	Co-dominant
Landform element	Alluvial terrace	Alluvial terrace
Surface condition	Hardsetting	Hardsetting
Drainage	Moderately well drained	Moderately well drained
Soil permeability	Permeable	Permeable
Watertable depth	>100 cm	>100 cm
Available waterholding capacity	Moderate to high	Moderate to high
Depth to bedrock	Very deep	Very deep
Flood hazard	High terrace above modern flood level	High terrace above modern flood level
pH (topsoil)	Slightly acidic	Slightly acidic
Fertility (chemical)	Moderate to high	Moderate to high
Expected nutrient deficiencies	N, P	N, P
Soil salinity	Low	Low
Erodibility (topsoil)	Low	Low
Erodibility (subsoil)	Low	Low
Erosion hazard	Low	Low
Structural degradation hazard	High	High
Land capability classification	II, III, IV	II, III, IV
USCS (subsoil)	ML, SM	CL
Shrink-swell potential	Low	Low to moderate
Mass movement hazard	Nil	Nil

3.2 Existing Borehole Data

As part of the deskstudy a bore hole search was undertaken using the NSW Groundwater data, the borehole search predominatly provides information to groundwater, however they do provide basic information on geology. Only one borehole with information is noted with 1km of the eastern boundary of the site.

Table 4: Geological Summary of Borehole data – GW803647

Depth (m)	Strata
0.00-0.30	TOPSOIL
0.30-5.00	CLAY
5.00-7.40	SAND, GRAVEL & CLAY
7.40-9.50	CLAY
9.50-25.00	SAND & GRAVEL
25.00-33.50	CLAY
33.50-35.00	BASALT
35.00-54.00	SHALE

3.3 Acid Sulphate Soils

A review of the Acid Sulphate risk maps has been undertaken and presented below:

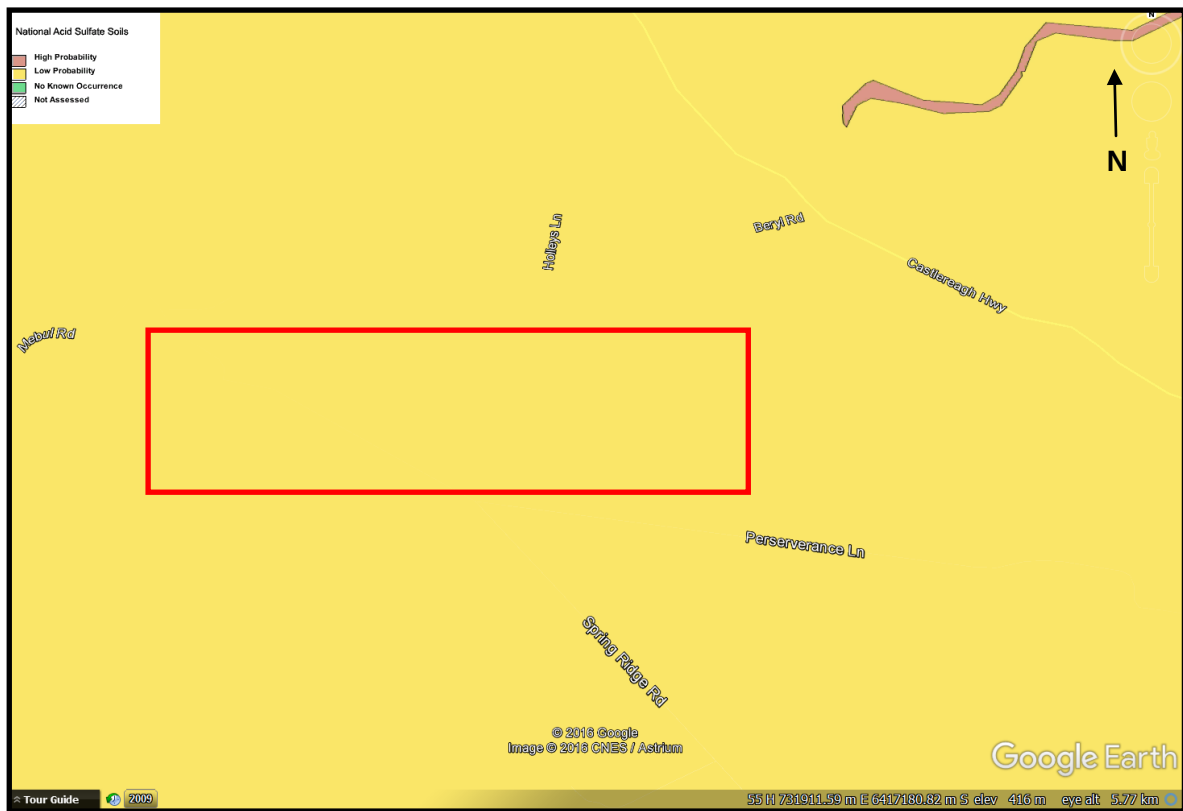


Figure 2: Acid Sulphate Soils

The acid sulphate risk map shows that the investigation area is located within an area no known occurrence.

3.4 Geotechnical Investigation

Fieldwork was undertaken on the 20th of February 2017 by an Engineering Geologist from our Bathurst office.

The fieldwork was undertaken in accordance with AS1726 - "Geotechnical Site Investigations" and our proposal dated 09th February 2017.

The fieldwork comprised six shallow boreholes to depths of up to 0.5m for dispersion testing.

The boreholes were drilled using a 4wd mounted Innovative Sampla 24LT. The boreholes were identified as BH-01 to BH-06 inclusive.

The subsurface investigation indicates that the following:

Table 5: Borehole Summary

Borehole	BH01	BH02	BH03	BH04	BH05	BH06
	Depth (m)					
Silty SAND – loose (TOPSOIL)	0.00–0.30	0.00–0.50	0.00-0.45	0.00-0.40	0.00-0.50	0.00-0.50
Sandy CLAY – stiff (ALLUVIAL)	0.30-0.50	-	0.45-0.50	0.40-0.50	-	-
Termination Depth (m)	0.50	0.50	0.50	0.50	0.50	0.50
Groundwater Encountered	No	No	No	No	No	No

A number of rocky outcrops were noted at borehole BH06 within the north eastern section of the site.

Samples were taken from all of the boreholes and returned to our NATA accredited laboratory in Bathurst for Emerson Crumb Testing in accordance with AS1289 3.8.1. The results of the testing are presented in the table below:

Table 6: Emerson Crumb Results

Depth (m)	Emerson Crumb Result
0.45 – 0.50	2
0.45 – 0.50	1
0.45 – 0.50	1
0.45 – 0.50	1
0.45 – 0.50	1
0.45 – 0.50	1

4 DISCUSSIONS

Based on the results of the desk study, geotechnical investigation for Beryl Solar Farm and the site inspection and our experience with similar soils, the main geotechnical properties of the underlying soils are as follows;

- Site soils fall predominantly into the Home Rule Soil Group and consisted of silty sands underlain by clays.
- The emerson crumb results range between 1 to 2 and indicate that the site soils are dispersive.
- The erosion risk of the area is high based especially in areas with no or minimal ground cover. It is noted that the majority of the site investigated is protected from erosion by existing groundcover.
- Erosion on site can be managed and controlled by implementation of erosion and sedimentation management plans.
- The probability of acid sulphate soils in the area is generally low.

5 CONCLUSION

The findings of our report were based on our fieldwork, in-situ testing, laboratory testing, technical assessment and local knowledge for this site. We trust the foregoing is sufficient for your present purposes, and if you have any questions please contact either of the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read 'J A Boyle', with a stylized, cursive script.

John Boyle

Senior Engineering Geologist

BSc (Hons) Affil MIE Aust

LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

Scope of Services

This report has been prepared for the Client in accordance with the Services Engagement Form (SEF), between the Client and Macquarie Geotechnical.

Reliance on Data

Macquarie Geotechnical has relied upon data and other information provided by the Client and other individuals. Macquarie Geotechnical has not verified the accuracy or completeness of the data, except as otherwise stated in the report. Recommendations in the report are based on the data.

Macquarie Geotechnical will not be liable in relation to incorrect recommendations should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

Geotechnical Investigation

Findings of Geotechnical Investigations are based extensively on judgment and experience. Geotechnical reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client and expressly for the Clients purposes.

This report is based on a subsurface investigation, which was designed for project-specific factors. Unless further geotechnical advice is obtained this report cannot be applied to an adjacent site nor can it be used when the nature of any proposed development is changed.

Limitations of Site investigation

As a result of the limited number of sub-surface excavations or boreholes there is the possibility that variations may occur between test locations. The investigation undertaken is an estimate of the general profile of the subsurface conditions. The data derived from the investigation and laboratory testing are extrapolated across the site to form a geological model. This geological model infers the subsurface conditions and their likely behavior with regard to the proposed development.

The actual conditions at the site might differ from those inferred to exist.

No subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

Time Dependence

This report is based on conditions, which existed at the time of subsurface exploration. Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report.

Macquarie Geotechnical should be kept appraised of any such events, and should be consulted for further geotechnical advice if any changes are noted.

Avoid Misinterpretation

A geotechnical engineer or engineering geologist should be retained to work with other design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

No part of this report should be separated from the Final Report.

Sub-surface Logs

Sub-surface logs are developed by geoscientific professionals based upon their interpretation of field logs and laboratory evaluation of field samples. These logs should not under any circumstances be redrawn for inclusion in any drawings.

Geotechnical Involvement During Construction

During construction, excavation frequently exposes subsurface conditions. Geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendations and should make their own enquiries and obtain independent advice in relation to such matters

Macquarie Geotechnical assumes no responsibility and will not be liable to any other person or organisations for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisations arising from matters dealt with or conclusions expressed in the report.

Other limitations

Macquarie Geotechnical will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Other Information

For further information reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, 1987.