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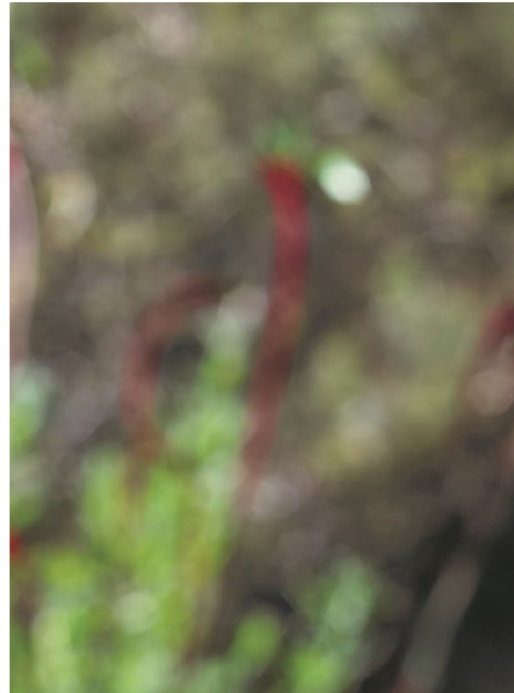
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Environmental Impact Statement

MAXWELL SOLAR FARM

DECEMBER 2019

Project Number: 19-069



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CERTIFICATION

For submission of an Environmental Impact Statement (EIS) under Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (NSW).

EIS prepared by: NGH Pty Ltd, Unit 2 54 Hudson Street, Hamilton NSW 2303

Applicant: Maxwell Solar Pty Ltd

Proposed Development:

The Maxwell Solar Farm Proposal includes the construction, operation and decommissioning of a photovoltaic solar plant that would have an installed capacity of approximately 25 megawatts (MW) (AC) of electricity. Associated infrastructure would include an on-site switch station via proposed overhead transmission lines or connection to an existing on-site substation via existing and proposed overhead transmission lines.

Land to be developed:

The existing Maxwell Infrastructure Approval encompasses 1470ha of which a maximum of 130ha would be developed as the Maxwell Solar Farm, identified as within the following properties:

- Lot 6, DP701496
- Lot 14, DP701496
- Lot 21, DP54087
- Lot 64, DP850818.

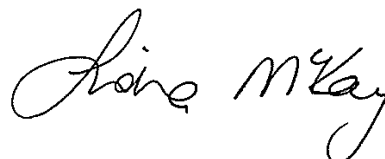
Certification

I certify that I have prepared the contents of this EIS in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW). 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: Angelene McCracken Fiona McKay

Qualification BAppSc, MPM BEnvSc, CEnvP

Signature:



Date: 9/12/2019

9/12/2019

ABBREVIATIONS AND ACRONYMS

ABS	Australian Bureau of Statistics
AC	alternating current
ACHA	Aboriginal Cultural Heritage Assessment
AEP	Annual Exceedance Probability
AER	Australian Energy Regulator
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ARI	Average Recurrent Interval
APZ	Asset Protection Zone
ARENA	Australian Renewable Energy Agency
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BAM	Biodiversity Assessment Methodology
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCC	Biobanking Credit Calculator
BDAR	Biodiversity Development Assessment Report
BOM	Australian Bureau of Meteorology
BSAL	Biophysical strategic agricultural land
CCC	Community Consultative Committee
CCS	Community Consultation Strategy
CEC	Clean Energy Council
CEMP	Construction environmental management plan
CER	Clean Energy Regulator
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB(A)	Decibels, a measure of A-weighted (<i>c.f.</i>) sound levels.
DC	Direct current
DECC	Department of Climate Change (now DPIE)
DECCW	Department of Climate Change and Water (now DPIE)
DEMP	Decommissioning Environmental Management Plan
DIS	Department of Industry and Science
DPE	Department of Planning and Environment (now DPIE)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (previously DPE)
DRG	NSW Department of Resources and Geoscience
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELF	Extremely low frequency, in relation to Hz (<i>c.f.</i>)
EMFs	Electromagnetic fields
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPA	(NSW) Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)

EPC	Engineering Procurement and Construction
EPI	Environmental planning instrument
EPL	Environment Protection Licence, issued under the POEO Act (<i>c.f.</i>)
ERP	Emergency Response Plan
ESD	Ecologically sustainable development
FM Act	<i>Fisheries Management Act 1994</i>
FPL	Flood Planning Level
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gas
GWh	Gigawatt hours
ha	Hectares
HBT	Hollow Bearing Tree
HV	High Voltage
Hz	Hertz
IBRA	International Bioregions of Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
INP	Industrial Noise Policy
ISEPP	<i>State Environmental Planning Policy (Infrastructure) 2007</i>
kl	kilolitres
km	kilometres
kV	kilovolts
kW	kilowatts
LALC	Local Aboriginal Land Council
LCA	Life Cycle Assessment
LEP	Local Environment Plan
LGA	Local Government Area
LLS	Local Land Services
LUCRA	Land use conflict risk assessment
m	Metres
mm	Millimetres
ML	Megalitres
MNES	Matters of National Environmental Significance, under the EPBC Act (<i>c.f.</i>)
MW	Megawatt
MWh	Megawatt hours
NEM	National Electricity Market
NML	Noise Management Level
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage (now DPIE)
OEMP	Operation Environmental Management Plan
PARF	Powering Australian Renewables Fund
PBP	Planning for Bushfire Protection
PCS	Power conversion stations
PCT	Plant Community Type

PEA	Preliminary Environmental Assessment
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
PV	Photovoltaic
RAPs	Registered Aboriginal Parties
RBL	Rating Background Level - the level of background noise
RE Act	<i>Renewable Energy (Electricity) Act 2000 (Commonwealth)</i>
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RNP	<i>Road Noise Policy</i>
Roads Act	<i>Roads Act 1993 (NSW)</i>
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
SHI	State Heritage Inventory
sp/spp	Species/multiple species
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011 (NSW)
SSD	State Significant Development
TEC	Threatened Environmental Communities
μT	Microtesla, multiples of a unit of magnetic field
VIA	Visual Impact Assessment
V	Volts
VOC	Volatile Organic Compound
WAL	Water Allocation License
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WHO	World Health Organisation
WMP	Waste Management Plan

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed Maxwell Solar Farm (the Proposal). The Solar Farm would be located on rehabilitated open cut mine land within the Maxwell Infrastructure site at Muswellbrook, NSW. The proposed Solar Farm would have an installed capacity of approximately 25MW (AC) that would supply electricity to the Maxwell Infrastructure site and/or the Maxwell Underground site and/or the National Energy Market (NEM). NGH has prepared the EIS on behalf of the proponent; Maxwell Solar Pty Ltd.

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

The objective of this EIS is to fulfil the requirements of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and Section 4.15 of the EP&A Act. It is considered a State Significant Development (SSD). The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), provided by DPE on 8 May 2019 (refer to Section 6.1).

To inform the development of the most appropriate Proposal, a Fatal Flaws Analysis of the Proposal site was undertaken in the early planning stages to assist with designing the Solar Farm layout and planning the detailed methodologies for the environmental assessment. Environmental constraints can be defined as factors which affect the 'developability' of a site and include physical, ecological, social and planning factors. A map of these constraints was prepared for the Fatal Flaws Analysis (NGH, 2017) and the Scoping Report (NGH, 2019). Following the detailed field investigations, the mapping has been further refined and is presented in this EIS. This process demonstrates how the Proposal has appropriately responded to the site's constraints.

PROPOSAL NEEDS AND BENEFITS

There is a clear need for the Proposal to meet Australia's greenhouse gas reduction, renewable energy and electricity needs. In addition, it would bring local economic benefits such as job opportunities and local expenditure.

The Maxwell Solar Farm would:

- Support Commonwealth and New South Wales (NSW) climate change commitments.
- Generate enough clean, renewable energy for about 10,000 average NSW homes.
- Enhance electricity reliability and security.
- Create approximately 50 local job opportunities during construction and up to two jobs during operation.
- Diversify the regional economy; providing an alternative income stream that does not affect the long-term land capability or its suitability for other uses (such as pasture after decommissioning).

PROPOSAL DESCRIPTION

The proposed Maxwell Solar Farm (the Proposal) would have an installed capacity of approximately 25MW (AC), with an expected annual energy generation of 60 Giga Watt hours (GWh) and would include:

- Approximately 4,500 strings each containing 30 PV panels, spaced 5-10m and being a combination of mounted east-west horizontal tracking systems and/or north-orientated fixed-tilt structures.
- Electrical conduits and cabling to connect the solar panels, combiner boxes and inverters.
- Up to approximately 1.6km of 33kV or 3.5km 66kV overhead transmission line.
- Additional electrical transformation equipment to be positioned in proximity to the existing Maxwell Infrastructure substation, if the 33kV transmission line option is progressed.
- An onsite switch station containing up to two transformers and associated switchgear, if the 66kV transmission line option is progressed.
- Site access off Thomas Mitchell Drive.
- Internal access tracks and upgrades to existing access roads, where required.

The proposed Solar Farm would connect to one of two alternative proposed connections options to connect to the Ausgrid network:

- Option 1 is to connect to an existing 33kV substation located on the Maxwell Infrastructure Site, building a new section of 33kV transmission line (connecting to the existing 33kV south-east of Maxwell Infrastructure substation). Connection would be via a proposed powerline corridor linking the substation and existing 33kV line to the proposed Maxwell Solar Farm.
- Option 2 is to construct a new 66kV transmission line on the Maxwell Infrastructure site, connecting to a proposed new switch station to connect to the network through the Mt Arthur feeder, which is currently under construction. This installation also appears in the Development Application for the proposed Maxwell Underground as the power supply.

The existing Maxwell Infrastructure approval encompasses 1470ha of land of which a maximum of 130ha would be developed as the Maxwell Solar Farm. Approximately 105ha would contain Solar Farm infrastructure and an additional area of up to 25ha is required for access and transmission line easements to connect to the existing Maxwell Infrastructure substation (33kV option) or proposed switch station (66kV option). The total development footprint for the Proposal is a maximum of 130ha, which includes development within the Solar Farm site ('the largest impact area case') transmission line option.

The Proposal is expected to operate for 30 years. The construction phase of the Proposal is expected to take 12-18 months and is expected to commence in early 2021. After the operating phase, the Proposal would either be (i) upgraded with new photovoltaic equipment, or (ii) decommissioned, removing all above ground infrastructure and returning the site to pasture or other productive state.

COMMUNITY AND STAKEHOLDER CONSULTATION

Maxwell Infrastructure has undertaken comprehensive consultation with nearby landowners, the local community and other relevant stakeholders in developing the Proposal. A Community Consultation Strategy is in place for the Maxwell Solar Farm. Maxwell Infrastructure's Community Consultation Strategy considers stakeholders' views and provides timely feedback on any matters raised.

Maxwell Infrastructure has informed and engaged with relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups and nearby landowners.

The development of the Maxwell Solar Farm was made known to the public early in its development with a fact sheet distributed to local landholders and the Muswellbrook community in August 2018.

While much of the consultation process focused on informing the community about issues relating to the Proposal, activities to engage the community in a two-way dialogue were also undertaken. As well as one-on-one consultation and small group meetings to date, Maxwell Infrastructure have provided a variety of opportunities for the community members to find out more about the Proposal (refer to Table 1).

Table 1 Community consultation to date

Date of activity	Description of activity
August 2018	Direct contact with residential neighbours regarding the proposed Maxwell Solar Farm commenced
August 2018	Community newsletter issued by Maxwell Infrastructure were distributed to neighbours and within the Muswellbrook Local Government Area
August 2018	Establishment of website to provide project information, updates and contact details https://malabarcoal.com.au/projects/maxwell-solar Establishment of a dedicated 24/7 phone number for enquiries
20 August 2018	Introductory press release for the Maxwell Solar Farm project was issued
24 August 2018	Correspondence sent to the Honourable Federal member for Hunter, Joel Fitzgibbon, introducing the Proposal and providing the initial press release
24 August 2018	Correspondence sent to the State member for the Upper Hunter, Michael Johnsen, introducing the Proposal and providing the initial press release
24 August 2018	Correspondence sent to the Mayor for Muswellbrook Shire Council, Martin Rush, introducing the Proposal and providing the initial press release
September 2018	Maxwell Infrastructure Community Consultative Committee update
October 2018	The Spur Hill Community Consultative Committee received a presentation regarding the proposed Solar Farm
21 and 22 November 2018	Two community information sessions were held involving the Maxwell Solar Farm with 48 community members providing their details on the attendance sheet. The sessions were held with Maxwell Infrastructure staff at a manned stall with information and pictures was dedicated to the Maxwell Solar Farm
February 2019	Community newsletter issued by Maxwell Infrastructure were distributed to neighbours and within the Muswellbrook Local Government Area
March 2019	Maxwell Infrastructure Community Consultative Committee update
6 March 2019	Advertisement in the <i>Hunter Valley News</i> regarding seeking interested Aboriginal Parties for the Aboriginal Cultural Heritage Assessment Report
15 March 2019	Meeting with Wild Quarries
28 March 2019	Meeting with Hunter Valley Energy Coal; owner of Mt Arthur Mine

Date of activity	Description of activity
10 April 2019	Archaeological survey undertaken on site with Registered Aboriginal Parties
24 April 2019	Meeting with Muswellbrook Shire Council specifically addressing the proposed Solar Farm
30 April 2019	Consultation undertaken with Department of Resources and Geoscience
April 2019	Consultation with individual residents in Antiene area
9 May 2019	Meeting with NuCoal; owner of the Savoy Hill Exploration Licence
June 2019	Community newsletter issued by Maxwell Infrastructure were distributed to neighbours and within the Muswellbrook Local Government Area
Ongoing	Malabar maintains a website with information on the Maxwell Solar Farm Proposal and a community hotline telephone

KEY ENVIRONMENTAL ISSUES

A detailed investigation of risks and impacts was undertaken specific to the construction, operation and decommissioning phases of the Proposal. In addition to addressing the project-specific SEARs, a risk assessment was carried out to identify key environmental risks of the Proposal in order to guide the depth of investigation that would be undertaken in this EIS. Although impacts are anticipated to be minor due to the scale of the Proposal, the risk assessment identified seven environmental aspects as key risks, and detailed investigations were subsequently undertaken in these areas:

- Biodiversity.
- Aboriginal heritage.
- Compatibility with existing land uses.
- Soil and erosion.
- Visual impacts.
- Noise and vibration.
- Traffic, transport and safety.

Biodiversity

A request to waive the SEARs requirement for a Biodiversity Development Assessment Report (BDAR) was submitted to the Department of Planning and Environment and the Office of Environment and Heritage on 26 April 2019. The waiver included a biodiversity assessment to support the request to waive the requirement against the relevant biodiversity values contained in Clause 1.5 of the BC Act and Clauses 1.4 and 6.1 of the Biodiversity Conservation Regulation 2017.

The BDAR waiver was sought on the grounds that the vegetation integrity score was less than 10 due to species present being primarily exotic.

A waiver was granted under Section 7.9(2) of the BC Act on 1 July 2019 by the Department of Planning, Industry and Environment (DPIE) (refer to APPENDIX E)

A BDAR Waiver was prepared by Emergent Ecology (Emergent Ecology, 2019). The full report is summarised in Section 7.1.

Aboriginal heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) has been undertaken in accordance with the SEARs. Searches of the Aboriginal Heritage Information Management System (AHIMS) database and consideration of the location of previously recorded Aboriginal sites indicates that no sites are located within the study area, with the closest site located 110m from the existing road access.

An archaeological survey was undertaken, with the objective to identify, record and map Aboriginal heritage values within the study area. The survey within the study area identified a modified landscape with no original landforms present. No Aboriginal objects were identified during the field survey. Subsurface archaeological sensitivity was assessed as low due to historic disturbances. Registered Aboriginal Party representatives (RAPs) present during the survey likewise suggested that land within the study area was of low sensitivity due to historic disturbances.

Given that no Aboriginal objects were identified within the study area, no impacts to Aboriginal objects or heritage values are anticipated to result from the construction or operation of the project.

The Proposal can proceed with no additional archaeological investigations however safeguards will be implemented during construction to ensure and Aboriginal heritage matters that may arise are appropriately managed.

Compatibility with existing land uses

The Proposal site occurs in a rural landscape with mining and agriculture as the current dominant land uses. The Proposal site is predominantly mapped as Land and Soil Capability Class 5 (Moderate – low capability land) and Class 6 (low capability land). The site is not mapped as being biophysical strategical agricultural land (BSAL) or critical industry clusters (CIC), therefore the Proposal would not impact on land critical for agriculture.

The agricultural land within the region is primarily used for cropping and grazing. The Maxwell Infrastructure site comprises of rehabilitated landforms and vegetation. The Proposal site is located on land zoned as RU1 Primary Production under the Muswellbrook LEP.

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

Soils and erosion

NGH prepared a soil survey to determine the soil characteristics and consider the potential for erosion to occur. The proposed location for the Solar Farm is a rehabilitated portion of an open cut mining operation.

Observations recorded during the site inspection include two distinct areas;

- Rehabilitated areas where the solar panels are to be located has minimal erosion.
- Areas yet to be rehabilitated, including the access and powerline easement, had evidence of erosion on unstabilised slopes.

These observations demonstrate that through appropriate management, the potential for erosion can be managed.

Impact to soils during operation would be minimal, as maintenance activities and vehicles would be mostly confined to formalised tracks. A risk of erosion during operation is from concentrated runoff from the panels. Such runoff could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts if ground cover is not maintained beneath the array infrastructure.

The proposed activities for the construction and decommissioning stages of the Solar Farm have the potential to increase soil erosion during rainfall events. Proposed activities could also lead to the removal of vegetation and ground cover, increased compacted surfaces and decreased permeability.

These potential impacts have been addressed with specific mitigation measures.

Overall, the risk of erosion resulting in soil loss is considered low during construction, operation and decommissioning and with the implementation of the recommended mitigation measures, the potential risk of erosion would be minimised.

Visual amenity

NGH prepared a Visual Impact Assessment (VIA) of the Proposal, in compliance with the SEARs. The report assesses the visual impact implications of the Proposal on viewers using the local road network and from residential properties, and the appropriateness of the proposed Solar Farm within the current landscape setting.

As visual amenity values and visual impacts can be subjective, the VIA included a transparent, systematic evaluation with reference to existing guidelines, to address subjectivity as much as possible.

The VIA found the proposed Solar Farm would have a low visual impact on surrounding sensitive receivers. This low impact can be attributed to the following:

- The selected location of the Proposal site is within an existing industrial/ mining area
- The Proposal site has been deliberately selected so that it is not visible to most surrounding sensitive receivers, i.e.:
 - The Proposal site is set back from the edge of the plateau in which it is situated, thus restricting the view from viewpoints below the plateau
 - Existing screening provided by neighbouring vegetation
 - Topography between the viewpoints and the Proposal site obstructs the view of the proposed Solar Farm.

Noise and vibration

NGH prepared a Noise Assessment (NA) to quantify potential environmental noise levels associated with the construction and operation of the Proposal and to recommend mitigation measures, where required.

The Proposal site is in an industrial setting surrounded by mining activities. Noise emissions from the existing environment, including the operation of mobile equipment, coal processing and transport, have the potential to adversely affect the acoustic environment and surrounding residences.

Noise management levels were established for the Proposal and were based on the measured rating background noise level (*NSW Noise Policy for Industry (NPI) 2017*) and the *NSW Interim Construction Noise Guideline 2009*. Construction road traffic noise levels were assessed against the *Road Noise Policy 2011* (DECCW, 2011).

The closest residences are located approximately 1.3km from the Proposal site. The sensitive receivers are primarily residences located on both private and Maxwell owned properties. The identified receivers

surrounding the Proposal site are classified as rural., although background noise levels may be elevated due to proximity to surrounding existing operations including mining activities, operation of mobile equipment, rail infrastructure and activities, the New England Highway, and Thomas Mitchell Drive.

During operation, a combination of fixed-tilt panels and motorised single-axis trackers would be used in the solar arrays. Tracking panels produce very little noise (2dBA at the source), therefore unlikely to be audible to any sensitive receivers. Likewise, inverter stations produce little noise and similarly unlikely to be audible to sensitive receivers.

Road traffic noise predictions conclude that the traffic generated by the Proposal is unlikely to result in exceeding the Proposal road traffic noise criteria.

Vibration generating activities would occur only during the construction of the Proposal. These activities include the use of vibrating padfoot rollers and array post boring or pile driving.

Construction works would be restricted to daytime work hours. The construction noise management level for the Proposal would be 50dB(A) (i.e. 10dB(A) above the background noise level), which is in accordance with the Interim Construction Noise Guideline (DECCW, 2009) . Actual construction noise levels are not likely to reach the construction noise management level of 50dB(A), and construction noise and vibration levels satisfy relevant regulatory construction and operational noise levels for all nearby receivers. No specific mitigation is required, however, several recommendations to further minimise the noise impacts from commitments of the Proposal are outlined in Section 7.6.

Traffic Transport and Safety

Amber Organisation prepared a Traffic Impact Assessment for the proposed construction, operation and decommissioning of the Maxwell Solar Farm.

The construction of the Solar Farm would generate approximately 120 vehicle movements per day during construction, with approximately 12 vehicle movements in the peak hours. Vehicle types are expected to be comprised of light vehicles (100 movements per day), semi-trailer/heavy vehicles (16 movements per day), and cranes (four movements per day). Peak hours are anticipated to be between 5:00am and 7:30am and between 4:30pm and 7:00pm.

Operating traffic volumes would be approximately 10 vehicle movements generated per day. Given the low level of traffic generated by the site, and that the traffic generation would be significantly lower during operations, it was concluded that the small increase in traffic during construction would be readily accommodated by the surrounding road network and would be within the daily variation of traffic movements at the nearby intersections.

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

LOWER RISK ENVIRONMENTAL ISSUES

Five lower risk issues were investigated:

- Socio and economic impacts
- Historic heritage
- Climate and air quality
- Resource use and waste generation
- Cumulative impacts.

These impacts were assessed as either not applicable or negligible.

MANAGEMENT IMPACTS

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

All commitments and environmental safeguards would be managed through the implementation of an Environmental Management Strategy, consisting of a Construction Environmental Management Plan, an Operation Environmental Management Plan and a Decommissioning Environmental Management Plan. These plans would be prepared sequentially and submitted to the DPIE, prior to each stage. These mechanisms support the delivery of the commitments of the EIS to on ground activities in providing effective onsite mitigation of impacts for all stages of the Proposal.

CONCLUSION

The Maxwell Solar Farm would represent an important contribution to Australia's transition to a low emission energy generation economy along with the potential to provide substantial economic benefits to the local area. It is considered compatible with existing land uses and, upon decommissioning, has the capacity to be easily returned to pasture or another productive state.

The environmental impacts and risks identified, are considered manageable with the effective implementation of the measures stipulated in this EIS. Mitigation strategies have been developed with input from the community and agency stakeholders. The Proposal is appropriate within the site's constraints and is therefore, justifiable and acceptable.

1 INTRODUCTION

SECRETARY'S REQUIREMENTS

The EIS for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

The EIS should fully describe the Proposal, the existing environment and impacts of the development including the location and extent of all proposed works that may impact on ACH and biodiversity. The scale and intensity of the proposed development should dictate the level of investigation. It is important that all conclusions are supported by adequate data. The assessment must include all ancillary infrastructure associated with the project and Rural Fire Service requirements for asset protection.

1.1 PURPOSE OF THIS REPORT

Maxwell Solar Pty Ltd (Maxwell Solar) proposes to construct, operate and decommission a photovoltaic (PV) Solar Farm with an installed capacity of approximately 25MW (AC). The proposed Maxwell Solar Farm (the Proposal) is located at Maxwell Infrastructure (previously named the "Drayton Mine") approximately ten kilometres south-south east of Muswellbrook, New South Wales (NSW).

This Environmental Impact Statement (EIS) identifies and assesses the potential environmental impacts associated with the construction, operation and decommissioning of the proposed Maxwell Solar Farm. NGH has prepared the EIS on behalf of the proponent, Maxwell Solar Pty Ltd.

The EIS:

- Describes the proposed works, the Proposal site and the wider study area.
- Identifies statutory approval requirements.
- Identifies and assesses the significance of impacts on the community.
- Identifies and assesses the significance of impacts on environmental values.
- Identifies and assesses potential cumulative impacts.
- Provides mitigation measures to avoid, minimise or mitigate identified impacts.

This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) to support a development application (DA) to be lodged with the Department of Planning, Industry and Environment (DPIE), previously known as the 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 (NSW) (EP&A Regulation) and Section 4.15 of the EP&A Act. It is considered State Significant Development (SSD) as the cost of the works are estimated to be \$39,350,000 (refer APPENDIX B). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEARs), provided by the DPE on 13 March 2019 (refer Section 6.1).

1.2 PROPOSAL OVERVIEW

1.2.1 The Proposal locality

The Maxwell Solar Farm Proposal site is located in the locality of Muswellbrook and is approximately 10km south-south east of Muswellbrook town centre and 35km north west of Singleton, within the

Muswellbrook Local Government Area (LGA) (Figure 1-1). The site would be accessed from Thomas Mitchell Drive, which is located on the northern boundary of Maxwell Infrastructure.

The land immediately surrounding the Proposal site includes agricultural, mining, power generation and rural residential uses (including a residential subdivision).

The existing Maxwell Infrastructure Approval encompasses 1,470ha of which approximately 130ha would be developed as the Maxwell Solar Farm (the Proposal site), identified as within the following properties:

- Lot 6, DP701496.
- Lot 14, DP701496.
- Lot 21, DP54087.
- Lot 64, DP850818.

The proposed location for the Maxwell Solar Farm was disturbed during open cut mining operations and is currently under rehabilitation. There are existing Maxwell-managed internal roads on the site that provide access around the mine and rehabilitation areas. Access to the site is via Thomas Mitchell Drive. Within the Proposal site boundary there are existing 33 kilovolt (kV) powerlines and a substation, which are privately owned and maintained as part of the existing site, as shown Figure 1-1.

Approximately 22 residences are located within 3km of the Proposal (including transmission line options). The closest privately-owned residences are located approximately 1.3km from the proposed Maxwell Solar Farm site.

Notable features within the region include:

- Mount Arthur Coal (MAC), located outside the town of Muswellbrook and located adjacent to the Proposal site. MAC incorporates Mount Arthur North, Bayswater No. 2 and Bayswater No. 3 mines and is the largest individual coal production site in NSW.
- Bengalla open cut mine, located outside the town of Muswellbrook and approximately 9.5km northwest of the Proposal site.
- Liddell Power Station (LPS) located approximately 5km southeast of the Proposal. LPS is a coal fuelled thermal power station with four generators, located adjacent to Lake Liddell.
- Bayswater Power Station (BPS) located approximately 5km south southeast of the Proposal. BPS is a four-generator coal fuelled facility.
- The Hunter River is a major river which originates in the Liverpool Range and flows generally south and then east reaching the Tasman Sea at Newcastle. Muswellbrook is a major town along the Hunter River. The river lies approximately 8km to the northwest of the Proposal site.

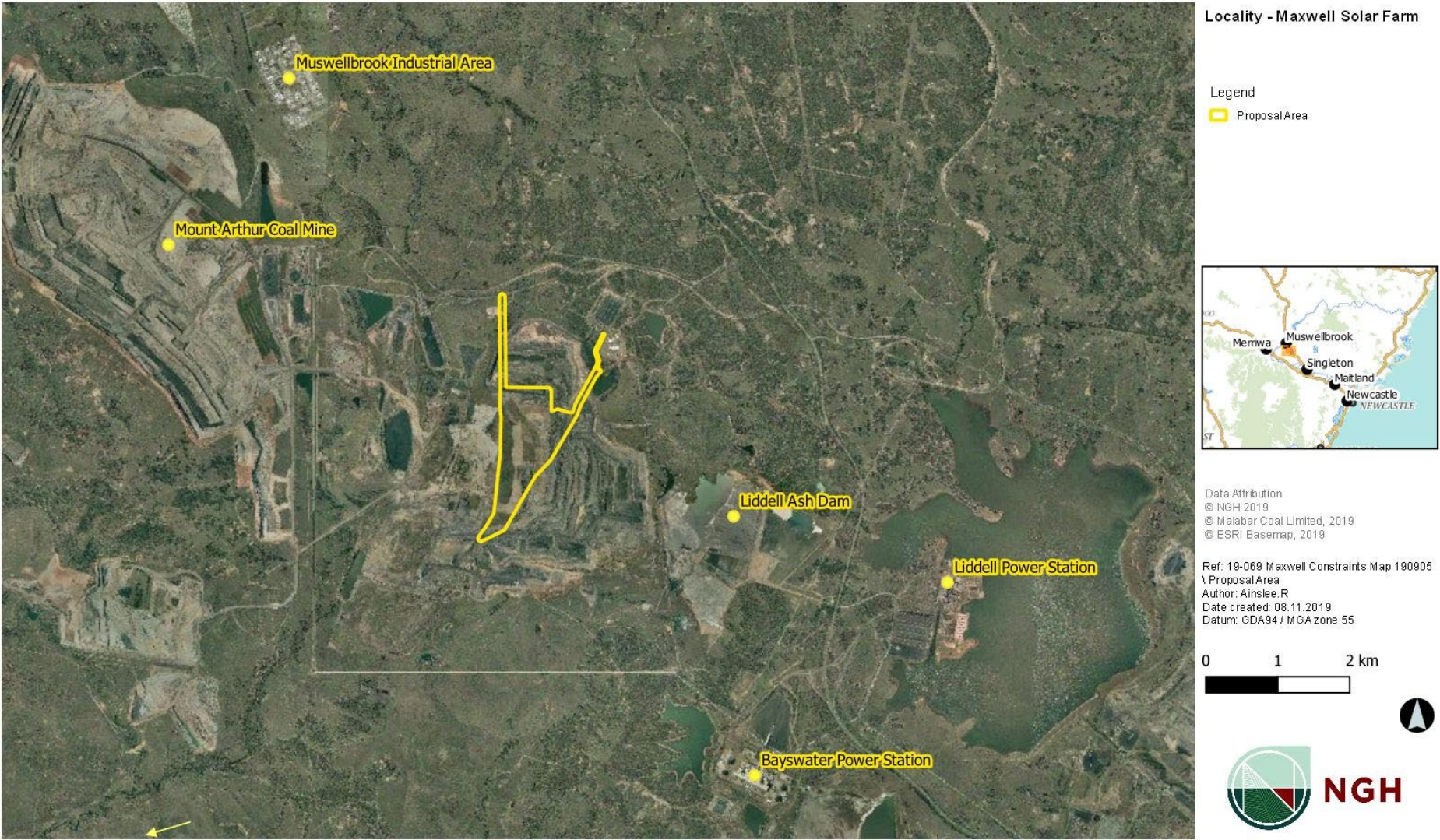
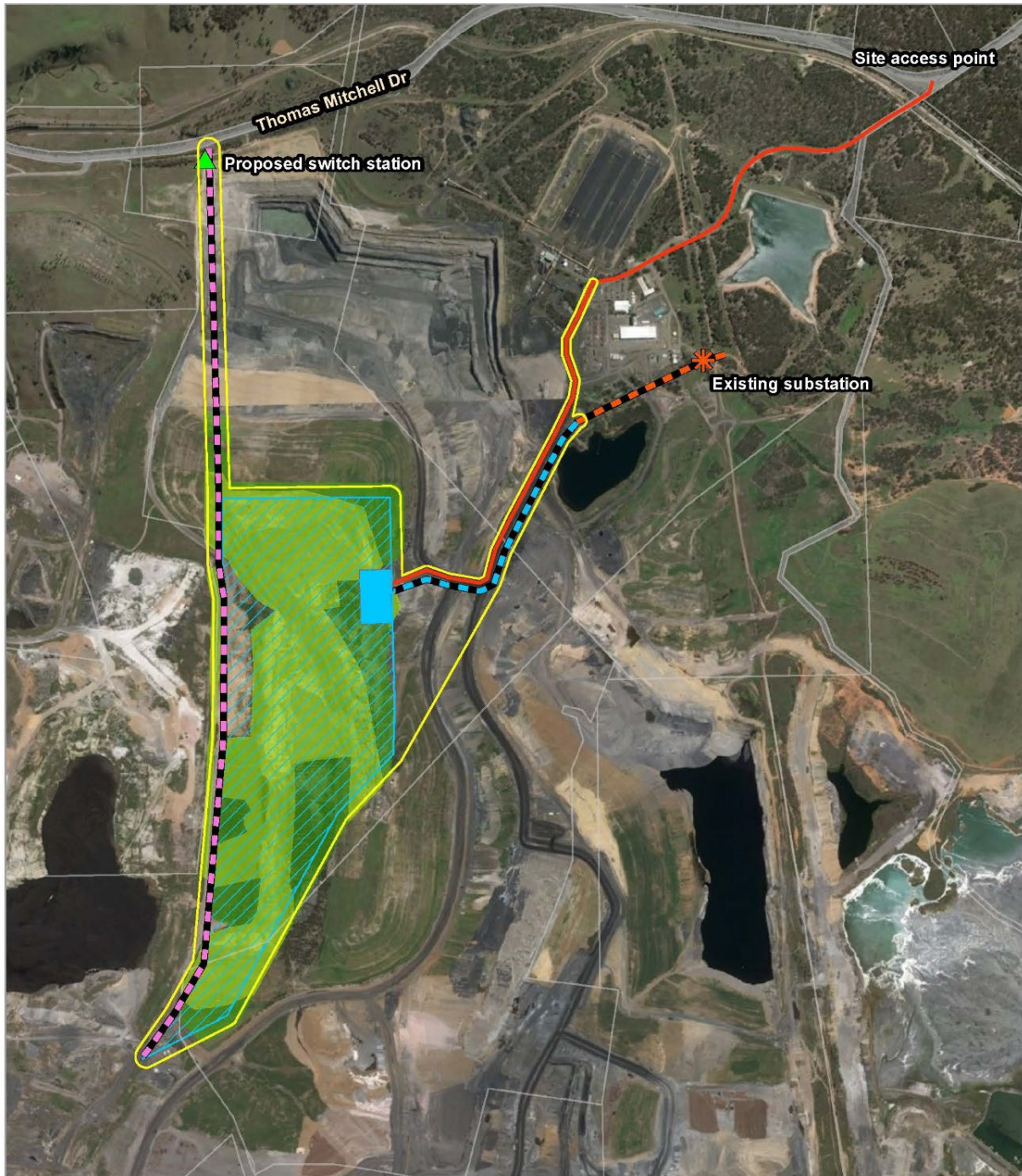


Figure 1-1 Proposal site locality



Site layout

19-069 Maxwell Solar Farm

- | | |
|---|--|
| <ul style="list-style-type: none"> — Project boundary Indicative solar array Indicative battery storage Proposed 66kV line Proposed 33kV line Existing 33kV line Existing access road | <p>Biodiversity constraints:</p> <ul style="list-style-type: none"> ■ Low constraint - Pasture ■ Low-medium constraint - Woodland |
|---|--|

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Figure 1-2 Site Layout

1.2.2 The Proposal site

The components of the proposed Maxwell Solar Farm and existing and proposed ownership arrangements is outlined in Table 1-1.

Table 1-1 Proposal land ownership

Component	Proposed infrastructure	Lot and DP	Owner of land	Existing use	Ownership arrangements
Solar Farm site	All proposed solar plant infrastructure	Lot 64 / DP850818, Lot 21 / DP54087	Maxwell Infrastructure	Mine rehabilitation	Access agreement with Maxwell Solar.
33kV transmission option	33kV eastern transmission line option	Lot 64 / DP850818, Lot 6 / DP701496	Maxwell Infrastructure	Mining / existing private transmission line	Easement would be created.
66kV transmission option	66kV northern transmission line option	Lot 64 / DP850818, Lot 4 / DP701496	Maxwell Infrastructure	Mining / mine rehabilitation	Easement would be created.
Maxwell Infrastructure substation	Transmission lines and connection to existing Maxwell Infrastructure substation	Lot 6 / DP701496	Maxwell Infrastructure	Electricity generation - substation	Easement would be created., and an agreement with third parties
Switch station	Switch station (as part of the 66kV option)	Lot 4 / DP701496	Maxwell Infrastructure	Mining lease	Easement would be created.

The existing Maxwell Infrastructure Approval encompasses 1,470ha, of which a maximum of 130ha would be developed as the Maxwell Solar Farm (the Proposal site), identified as being within the following properties:

- Lot 6, DP701496.
- Lot 4, DP701496.
- Lot 21, DP54087.
- Lot 64, DP850818.

The proposed location for the Maxwell Solar Farm site was heavily disturbed through previous open cut mining operations and currently is under rehabilitation. All lots are owned and managed by Maxwell Infrastructure.

There are existing Maxwell managed internal roads on site that provide access around the mine. Access to the site is via Thomas Mitchell Drive. To the east of the Proposal site there are existing Ausgrid 33 kilovolt (kV) powerlines and a substation, which are owned and maintained as part of the existing site, as shown in Figure 1-3.

No subdivision would be required for the Proposal. The existing substation, proposed switch station (as part of the 66kV, if required), existing and proposed extension of the 33kV powerline and proposed 66kV powerline, would all be located within the Proposal site.

The site is located within the Muswellbrook LGA and is therefore subject to the provisions of the *Muswellbrook Local Environmental Plan 2009* (the LEP). The proposed Maxwell Solar Farm site is located on land zoned Primary Production (RU1). While a PV electricity generating system is not permissible in this zone, under the provisions of the State Environmental Planning Policy (Infrastructure) (ISEPP) Clause 34(1)b, the Proposal is permitted with consent, as discussed in Section 5.

The land within the Proposal site is subject to the following approvals under the *Mining Act 1992* (NSW):

- Consolidated Conditions of Approval (CoA's) issued following approval of Modification 2 – Tailings Emplacement and determined on the 17 February 2012.
- The Mine Operation Plan (MOP).
- Coal Lease No. 229 (CL 229).
- Environmental Protection Licence No. 1323 (EPL 1323).

It is proposed that the land for the Maxwell Solar Farm be excised or removed from CL 229 after approval. The legal mechanism available for this to occur is the lodgement with the Department of Planning and Environment - Division of Resources and Geoscience (DRG) of a completed Form AD6 "Application for full or partial cancellation of an authority" under Section 125 of the *Mining Act 1992*.



Figure 1-3 Existing Maxwell Infrastructure substation and associated infrastructure



Figure 1-4 Existing 33kV transmission line metering point adjacent to Maxwell Infrastructure substation

1.2.3 Key components of the Proposal

The Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would have an installed capacity of approximately 25MW (AC) that would supply electricity to the Maxwell Infrastructure site and/or the Maxwell Underground site and/or the National Energy Market (NEM). The existing Maxwell Infrastructure approval encompasses 1,470ha of land of which a maximum of 130ha would be developed as the Maxwell Solar Farm. Approximately 105ha would contain Solar Farm infrastructure and an additional area of up to 25ha is required for access and transmission line easements to connect to the existing Maxwell Infrastructure substation (33kV option) or proposed switch station (66kV option). The total development footprint for the Proposal is approximately 130ha, which includes development within the Solar Farm site and the ('largest impact area case') transmission line option.

On an annual basis, the proposed Maxwell Solar Farm would provide enough clean, renewable energy for around 10,000 average NSW homes.

Maxwell Solar Farm would include the following infrastructure elements:

- Approximately 4,500 strings each containing 30 PV solar panels, spaced 5-10m apart and mounted on single axis tracking systems or north-orientated fixed-tilt structures (both fixed and tracking options are considered viable for the Proposal).
- Power Conversion Stations (PCS), transformers, and, inverters
- Laydown area
- An operations and maintenance area including parking and demountable buildings
- Provision of an area for a future battery facility to store energy on-site subject to another Development Approval.
- Electrical conduits and cabling to connect the solar panels, combiner boxes, and inverters.
- Up to approximately 1.6km of 33kV or 3.5km of 66kV overhead transmission line.
- If the 33kV transmission line option is progressed, then additional electrical transformation equipment to be positioned within the existing Maxwell Infrastructure substation area.
- if the 66kV transmission line option is progressed, then an on-site switch-station containing up to two transformers and associated switchgear.
- Site access off Thomas Mitchell Drive.
- Where required, internal access tracks and upgrades to existing access roads.

Refer to Section 4.3 for further detail.

The proposed Solar Farm would connect to the Ausgrid network by either of two connections options ;

- Option A is to construct a new 33kV transmission line connecting to the existing 33kV transmission line and substation of Maxwell Infrastructure. This new section of transmission line would be within a proposed powerline corridor.
- Option B is to construct a new 66kV transmission line on the Maxwell Infrastructure site, connecting to a proposed new switch station that connects to the Ausgrid network via the Mt Arthur Feeder. The Mt Arthur Feeder is currently under construction. This installation also appears in the proposed Maxwell Underground Development Application as the power supply to the Maxwell Underground Project.

Options A and B are presented in Figure 1-2 and assessed in this EIS, with the impact assessment focussing on the option that has the greater impact on the site.

The Solar Farm site would have a single vehicle access point for construction and operations, and decommissioning. This access point for light and heavy vehicles would be off Thomas Mitchell Drive, which

runs along the northern boundary of the site. Thomas Mitchell Drive would be primarily accessed via the New England Highway. For access around the site an existing internal mine road would be utilised.

The construction phase of the Proposal would take approximately 12-18 months in total, with a shorter peak construction period of approximately six months, during which time the main construction works would be completed.

The Maxwell Solar Farm would be expected to operate for approximately 30 years. After this initial operating period, the Solar Farm would either be decommissioned, removing all above ground infrastructure and returning the site to pasture or other productive state, or repowered with new PV equipment to continue operations as a solar plant. It is noted that an indefinite approval is being sought.

The Maxwell Solar Farm would have an estimated capital investment of approximately \$39,350,000.

The Maxwell Solar Farm design and construction, operation and decommissioning requirements are described in more detail in Section 4.2. An indicative layout is shown in Figure 1-5. Detailed design may lead to some minor layout changes. The layout shown represents the maximum impact areas that would be required.

1.3 THE PROPONENT

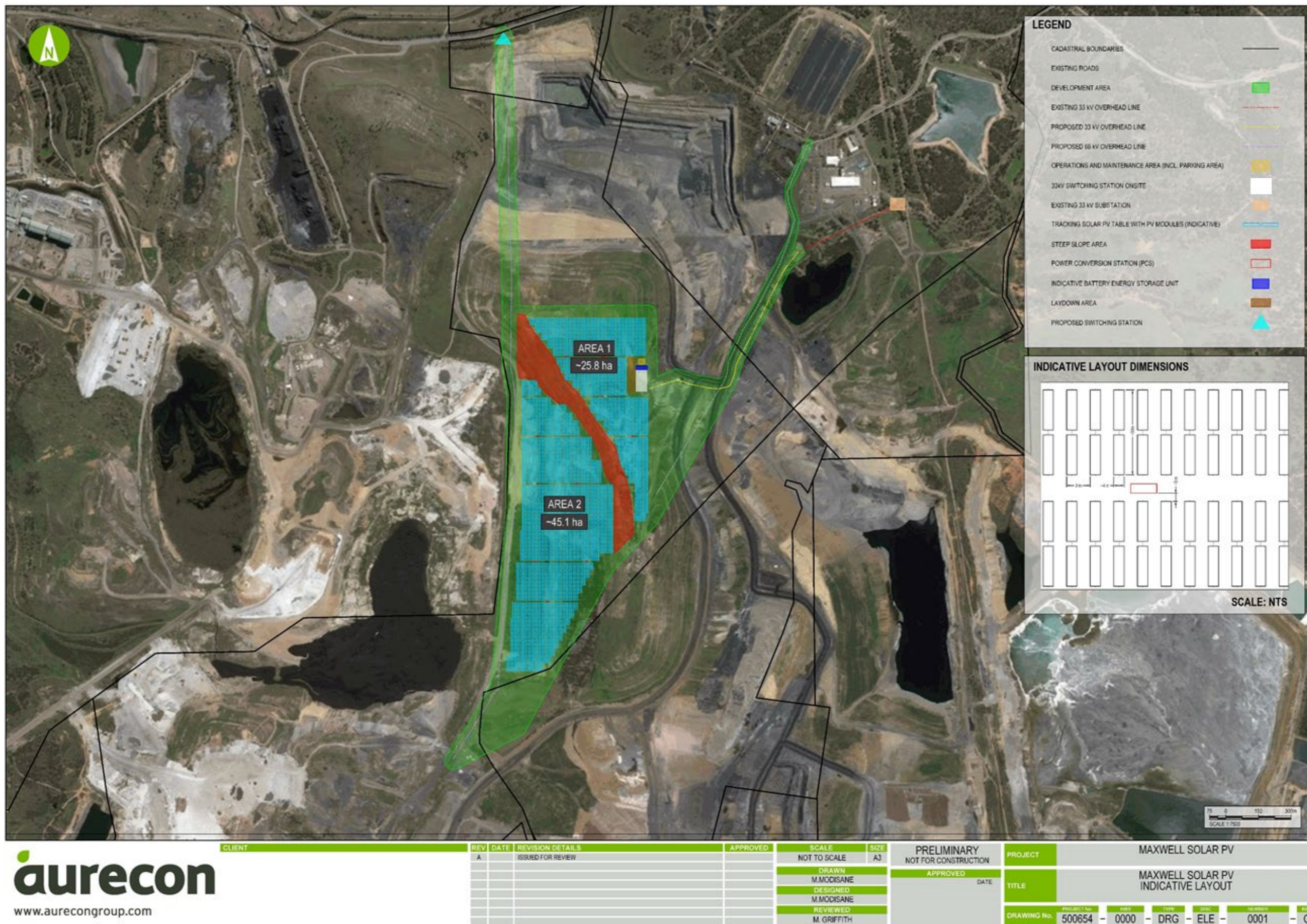
The proponent for this Proposal is Maxwell Solar Pty Ltd.

1.4 LINK WITH OTHER PROJECTS AT MAXWELL

A separate application has been lodged for the Maxwell Underground Project, also identified as an SSD project. The Maxwell Underground Project is located to the south, east and north-east of the proposed Maxwell Solar Farm.

The Development Application for the Maxwell Underground Project is not dependent on the Maxwell Solar Farm Proposal, and vice versa.

Although the projects are independent, nonetheless there are some synergies that will arise including common use of infrastructure such as roads, transmission lines etc.



aurecon
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REV	DATE	REVISION DETAILS	APPROVED
A		ISSUED FOR REVIEW	

SCALE	SIZE
NOT TO SCALE	A3
DRAWN	
M.MODISANE	
DESIGNED	
M.MODISANE	
REVIEWED	
M. GRIFFITH	

PRELIMINARY
NOT FOR CONSTRUCTION
APPROVED
DATE

PROJECT
MAXWELL SOLAR PV
TITLE
MAXWELL SOLAR PV INDICATIVE LAYOUT

DRAWING No.	PROJECT No.	REV	TYPE	DOC	DATE	REV
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Figure 1-5 Indicative Site Layout (Aurecon, 2019)

2 OBJECTIVES, PROJECT NEED AND BENEFITS

2.1 PROPOSAL OBJECTIVES

The objectives of the Maxwell Solar Farm Proposal and how they have been met are outlined in Table 2-1.

Table 2-1 Objectives of the Maxwell Solar Farm Proposal

Objective	How would the Proposal achieve this objective?
Develop an economically viable commercial solar electricity generation project, which contributes to the provision of affordable, sustainable and reliable electricity for NSW;	The selected site has favourable solar irradiation and the proximity to the existing substation makes the site an economically viable commercial project. The Maxwell Solar Farm would form an integral part of a broader plan to provide affordable, reliable and sustainable electricity to NSW homes and businesses.
Produce clean and renewable energy to help reduce greenhouse gas (GHG) emissions and contribute to efforts to meet State and National climate change mitigation targets;	The Proposal would provide enough clean, renewable energy for about 10,000 average NSW homes.
Enhance productivity of existing Maxwell Infrastructure owned properties using sustainable technologies;	The Proposal would utilise existing infrastructure owned by Maxwell Infrastructure including connection to the existing Maxwell Infrastructure Substation (if 33kV option selected).
Obtain broad local community support for the solar Proposal;	Community engagement activities have been undertaken to inform the community of the Proposal and capture feedback to assist the scoping of the Solar Farm project. The feedback received to date has been positive; details are included within this EIS.
Provide local and regional employment opportunities as well as other community benefits;	<p>Approximately 50 jobs averaged over 12 months, peaking at 100 jobs, would be created during construction. During operation the Proposal would employ approximately one or two full time staff.</p> <p>It is expected that in addition to the full-time staff, there would be a range of opportunities for local suppliers in general trade and support services, such as:</p> <ul style="list-style-type: none"> • Vegetation management; clearing, mulching, rehabilitation. • Fencing services. • Electrical work. • General civil services, such as grader, dozer and excavator operators. • Water services. • Security services. • General construction services. • Meals and accommodation services.

Objective	How would the Proposal achieve this objective?
Avoid / minimise environmental impacts wherever practicable, through careful design and best practice environmental protection and impact mitigation.	The maximum impact area presented is responsive to the site’s key environmental constraints, identified through detailed investigations such as biodiversity and nearby sensitive receivers.

2.2 PROJECT NEED AND BENEFITS

2.2.1 Climate change mitigation

The Proposal supports Commonwealth and NSW climate change commitments.

Paris Agreement

Under the United Nations Paris Climate Change Agreement, Australia has committed to the following greenhouse gas emission reduction targets:

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

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

In terms of renewable energy technologies, solar projects have the capacity to provide faster results in reducing greenhouse gas emissions than other options because of shorter potential construction and commissioning times (CER, 2017). Rapidly improving technology in this sector is also seeing the improved performance of solar energy projects.

The Proposal would have an installed capacity of approximately 25MW (AC), saving approximately 12,000 tonnes of carbon dioxide per year¹.

Renewable Energy Target (RET) Scheme

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

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

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

The RET aims to achieve large-scale renewable generation of 33,000GWh in 2020, equating to about 23.5% of Australia’s total electricity generation.

The Large-scale Renewable Energy Target component of the RET requires an estimated 6,000MW of new renewable power stations to be built by 2020, which is likely to consist of approximately 75 per cent wind

¹ Precise generation figures may change subject to final site design and product selection.

and 25 per cent solar (Clean Energy Regulator 2015 in Finkel *et al.* 2016). This would represent a doubling of the total renewable capacity installed since 2001 (Ernst and Young 2016 in Finkel *et al.*, 2016).

The proposed 25MW (AC) Maxwell Solar Farm would contribute to meeting the RET by generating approximately 60 GWh per year.

The Proposal being a solar project has the added advantage of the shorter potential time lag between investment and commissioning allows RET certificates to be processed and made available to the market sooner.

NSW goals and policies

The Proposal supports NSW climate change and energy goals and policies.

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

- Achieve net-zero emissions by 2050
- Produce greater resilience in NSW to a changing climate.

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

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

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

In accordance with the *NSW 2021: A plan to Make NSW Number One*, the Maxwell Solar Plant would:

- *Contribute to the national renewable energy target ... by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources* (NSW Government, 2011).

In 2017, the NSW Government released the *Draft Large-Scale Solar Energy Guideline*. The guideline identifies the key planning and strategic considerations relevant to solar energy State significant development (SSD) in NSW. It aims to assist in the site selection and design of Proposals and it would be used by the DPIE to assist in the assessment of relevant development applications. The Proposal has referenced these guidelines throughout the development assessment process.

2.2.2 Electricity reliability and security benefits

The Proposal would enhance electricity reliability and security.

While most of Australia's electricity is currently provided by coal-fired power stations, as many as three-quarters of these plants are operating beyond their original design life (DIS, 2015). Nine coal fired power stations closed between 2010 and 2016 across four of the Australian states, representing approximately 3,550 MW of capacity (Parliament of Australia, 2016).

Given the high levels of solar irradiance in the Hunter Valley, the strong transmission network in the region and the declining installation cost of solar power over the last decade, the Maxwell Solar Farm Proposal is an important source of new power generation.

The transition to renewable energy sources based on variable wind and solar PV generators has implications for reliability and security; these sources lack usable inertia to support power system security (Finkel, 2017). The National Energy Market grid is long and linear, with much less network meshing than many international systems. Geographic and technological diversity in the network can improve security and smooth out the impacts of variability (Finkel, 2017).

While grid-supplied electricity consumption is expected to remain stable (AEMO, 2016), the Maxwell Solar Farm Proposal would benefit network reliability and security by providing electricity generation closer to local consumption centres, contributing to a more diverse mix of energy sources.

2.2.3 Socio-economic benefits

Local economic benefits

The Proposal would provide local economic stimulus, particularly during construction. The Proposal would generate around 50 direct jobs during construction. In addition, it would employ approximately one to two full time staff during the operation and maintenance phase (expected to be 30 years).

The employment benefits extend through the local supply chains to fuel supply, vehicle servicing, uniform suppliers, hotels/motels, B&B's, cafés, pubs, catering and cleaning companies, tradespersons, tool and equipment suppliers and many other businesses. In 2015-2016, 11,500 Australians were employed directly in the renewable energy sector and the industry is set to generate 18,400 new jobs by 2020 (CEC, 2014; CEC, 2016). These benefits would be predominately during construction; however, benefits would also occur during operation. This would occur mainly in relation to the maintenance and upgrade of infrastructure over the lifetime of the Proposal.

Downward pressure on electricity prices

Household electricity bills increased 61% between 2008-09 and 2012-13, due mainly to network expenditure (ABS, 2016 in Commonwealth of Australia, 2016). Australian households would pay \$510 million more for power in 2020 without renewable growth through the RET and up to \$1.4 billion more per year beyond 2020 (Roam Consulting, 2014). Renewables increase diversity and competition in the wholesale energy market – and as in any market, less competition means higher prices.

Variable renewable energy generation such as PV solar operates with no fuel costs and can, with the right policy framework and technological development to manage variability, be used to reduce overall wholesale prices of electricity (Finkel *et al.*, 2017). Several studies on the impacts of increased large-scale renewable energy generation under the RET have indicated that this is likely to put downward pressure on electricity prices (Australia Institute, 2015).

3 SELECTION OF THE PREFERRED OPTION

3.1 EVALUATION OF ALTERNATIVES

Various options relating to the location, technology and scale of the Proposal were evaluated in developing the Maxwell Solar Farm. This section outlines the alternatives that were considered and justification for the preferred option that is the subject of this EIS.

3.2 THE 'DO NOTHING' OPTION

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

The direct consequence of not proceeding with the Proposal would be to forgo the benefits outlined in Section 2.2. This would entail:

- Lost opportunity to reduce GHG emissions in the electricity generation sector and to contribute to state and national climate change targets and commitments.
- No benefit realised in electricity network reliability and security benefits.
- No direct or indirect social and economic benefits, including employment and increased demand for local goods and services
- Lost opportunity to increase the productivity of the rehabilitation site.

The 'do nothing' option would avoid the negative environmental impacts associated with the development and operation of the Proposal, including construction dust, noise and operational visual impacts. However, as is detailed in Sections 7 and 8 of this EIS, these impacts are manageable and would not likely to result in a substantive negative impact to the environment or community over the medium and/or long term. Rehabilitation within the proposed area would continue.

Given the potential benefits of the Proposal (including climate change mitigation, electricity reliability and socio-economic benefits, as set out in Section 2.2.3), the 'do nothing' option is not the preferred option and cannot be justified from an economic or social standpoint.

3.3 ALTERNATIVE SITE LOCATIONS

Maxwell Infrastructure have reviewed several sites within the Hunter Valley for the proposed Solar Farm and determined that the proposed Maxwell Solar Farm site represents an opportunity for PV development that could be developed to contribute to the Federal Government's Renewable Energy Target of 33,000GWh by 2020.

The development site is of a scale that allows for flexibility in the design, allowing site constraints identified during the EIS process to be avoided or effectively mitigated.

The design of the Proposal is the result of an iterative process. The design has been adapted progressively as information regarding site constraints, and the potential impacts and risks associated with the development of the Proposal have become available.

Considerations during initial site investigations included consideration of:

- Access to and capacity of the electrical transmission network.
- Availability of an abundant solar resource.

- Availability of appropriate land i.e. soils, topography, aspect and presence of native vegetation.
- Suitability in terms of the interests of other stakeholders and the environment.

Of these considerations, Maxwell Infrastructure put substantial weight on obtaining access to the existing transmission network. This is important because it provides long term network stability, lower line losses and the ability to connect a higher capacity plant which supports lower cost and greater diversification in the energy supply. The Proposal site, which is in close proximity to Liddell and Bayswater power stations, is one of the central points on the 330kV transmission network in NSW and hence is an ideal location for connection of large-scale Solar Farm. The existing nearby Liddell and Bayswater substations have also been identified by TransGrid as a connection opportunity in reference to current network capacity availability (Figure 3-1).

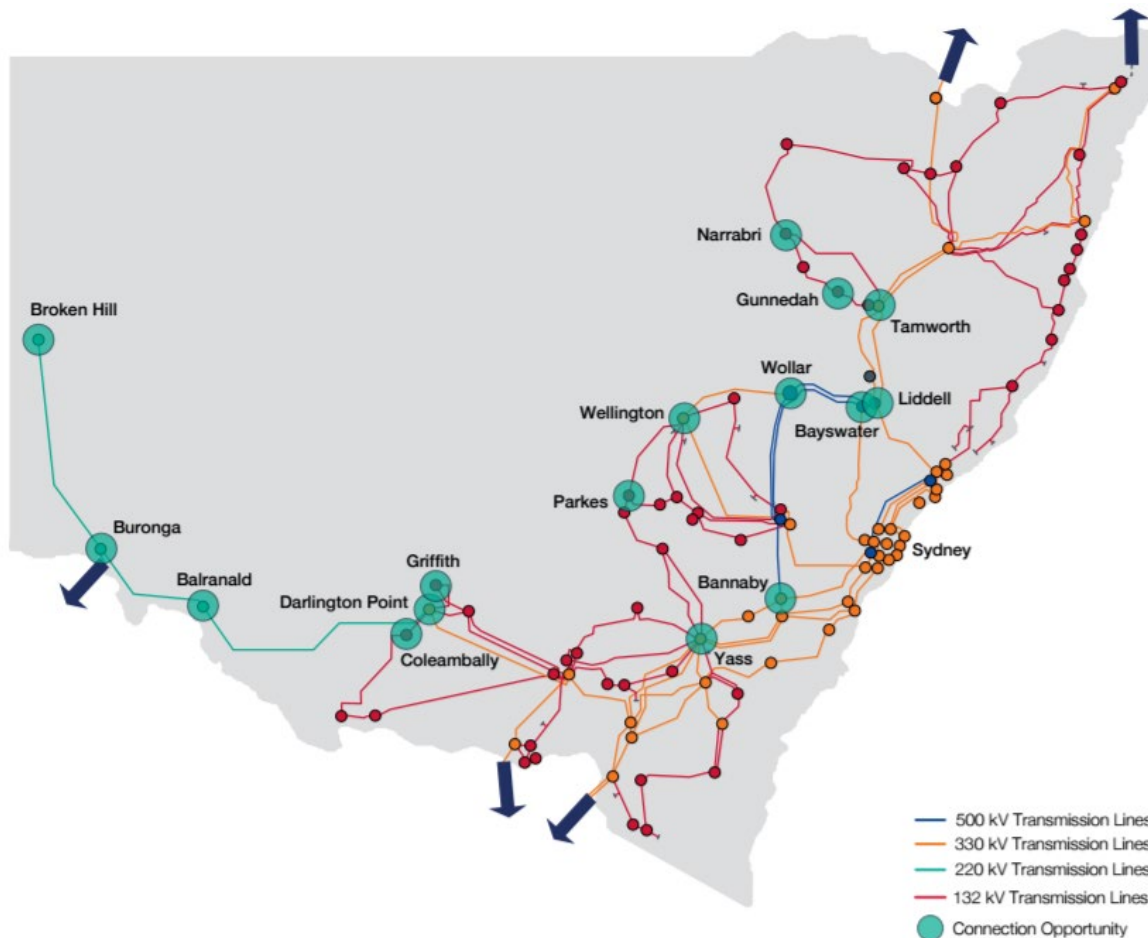


Figure 3-1 The existing Liddell and Bayswater Substations are identified as a Connection Opportunity (TransGrid, 2018)

To inform the development of the most appropriate Proposal, a Fatal Flaws Analysis (NGH, 2017) of the Proposal site was undertaken in the early planning stages to assist with designing the Solar Farm layout and planning the detailed methodologies for the environmental assessment. Environmental constraints can be defined as factors which affect the ‘developability’ of a site and include physical, ecological, social and planning factors. A map of these constraints was prepared for the Fatal Flaws Analysis (NGH, 2017) and Scoping Report (NGH, 2019).

This process demonstrates how the Proposal has appropriately responded to the site’s constraints. With reference to the site’s key constraints, the Proposal has:

Biodiversity:	<ul style="list-style-type: none"> • Minimised the impact to areas of moderate to good condition rehabilitated woodland and pasture. Disturbed areas instead will consist of a low canopy primarily of Sugar Gum (<i>Eucalyptus cladocalyx</i>), a mid-layer of a variety of <i>Acacia</i> species and scattered exotic grass species and herbs. • Avoided waterways and riparian zones that may provide foraging habitat for threatened species such as the Eastern Bent-wing Bat and Squirrel Glider.
Sensitive receivers:	<ul style="list-style-type: none"> • Consulted extensively with nearby residential receivers and the broader community, which have greater potential to be impacted by the Proposal.

3.4 ALTERNATIVE TECHNOLOGIES

Alternative technologies for renewable energy generation at the Proposal site encompass generation technology (principally solar or wind) and PV solar equipment.

Generation Technology

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

Photovoltaic solar technology was chosen because it is cost-effective, low profile, durable and flexible regarding layout and siting. It is a proven and mature technology which is readily available for broad scale deployment at the site.

Superior solar resources have been identified in New South Wales, providing excellent opportunities for solar projects.

Energy Storage Technology

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

The lithium-ion battery (Li-ion) is currently the preferred technology for storing energy generated from wind and solar sources (NOVA, 2017), and is likely to dominate battery chemistry for the next 20 years (Randell Environmental Consulting, 2016). The shift to Li-ion is because of their greater energy density (which means they are smaller and lighter), expected longer life span and ability to undergo deeper discharges. Li-ion’s have a very long lifetime compared to other battery technologies, with 5,000 or more charge cycles.

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

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

Battery storage is not part of the Proposal in this EIS other than setting aside an area for future development. A separate application would be submitted in the future for inclusion of Battery storage on the Maxwell Solar Farm.

3.5 SCALE OF THE PROPOSAL

The scale of this Proposal has been influenced by:

- Level terrain for cost effective construction.
- Commercial investment and viability considerations.
- Onsite connection to the transmission network.
- Transmission grid capacity.
- The constraints and impacts identified in this EIS.

The proposed scale of the Solar Farm successfully responds to the constraints and opportunities presented by these factors. The Proposal seeks to maximise the use of available land within the Proposal boundary, whilst considering the environmental, cultural, and community impacts identified through the development of this EIS. The constraints are outlined in Section 4.

The scale of the Proposal is influenced by the ability of the local transmission network to support the energy generated by the Proposal.

Each of these has contributed to the decision to develop the Proposal to an installed capacity of approximately 25MW (AC), with an expected annual energy generation of 60GWh.

3.6 SITE SUITABILITY AND JUSTIFICATION

The Proposal would meet the Proposal objectives, principally the development of a utility scale solar electricity power station. It is justified in terms of reducing Australia's GHG emissions and meeting future energy demands. It would contribute to Australia's renewable energy targets and support a global reduction in GHG emissions. Finally, it would contribute to economic development in Muswellbrook and the surrounding region.

The Proposal site is suitable for the proposed Solar Farm given:

- It is located within proximity to existing electricity infrastructure with good access to the transmission network, and there are high levels of available capacity on the grid transmission system.
- The land has been heavily disturbed from past mining activities and there are low environmental constraints.
- Given the location, site attributes and the previous disturbance of the land, the Proposal would have low impacts on the environment.

- The Proposal area is not subject to land hazards, such as flooding, and the land is not known to be contaminated.
- The Proposal is not likely to generate land use conflicts with surrounding land uses and is compatible with land use zoning.
- The site is in an area with suitable road access.
- The community has provided support for the Proposal.

3.7 PREFERRED OPTION

The preferred option is to develop an appropriately sited, designed and scaled Proposal to achieve the stated objectives (Section 2.1). The Proposal balances technological, energy and environmental aspects, while retaining the flexibility and adaptability required in the final design stage of the Proposal.

The preferred option represents a commercially viable, technologically feasible contribution to the need to reduce carbon emissions in the energy sector, while achieving a low level of environmental impact. Solar generation using PV panels is particularly well-suited to the topographical and climatic conditions of the Proposal site.

Details of the preferred option are provided in Section 4.

3.8 PROJECT JUSTIFICATION

There are clear justifications for the further development of solar resources in Australia, and specifically at the Maxwell Solar Farm Proposal site:

- The Proposal supports Australia's international commitments to mitigate climate change and NSW targets for renewable energy development.
- The Proposal has benefits that range from providing enhanced electricity reliability and security to the national electricity grid to local economic stimulus and community benefits.

The site, technology and size of the Proposal have been developed in full consideration of alternatives, to ensure the operational site would maximise the benefits of the Proposal to the locality and region in the long term. This section sets out the justification for the Proposal and how the preferred option, that is assessed in this EIS, was selected based on these considerations.

4 THE PROPOSAL

4.1 SUMMARY TABLE

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

Table 4-1 Summary of the key features of the Proposal

Proposal element	Description
Proposal	Maxwell Solar Farm
Proponent	Maxwell Solar Pty Ltd
Capacity	Approximately 25MW (AC)
Solar Farm site area	130ha “worst case” transmission line option
Site description	<p>Solar Farm site: Lot 64 DP850818 and Lot 21 DP54087. Maxwell Infrastructure owned mine rehabilitation. Zoned RU1 Primary Production under the Muswellbrook LEP.</p> <p>33kV transmission line option: Lot 64 DP850818 and Lot 6 DP701496. Mining lease land zoned RU1 Primary Production under the Muswellbrook LEP. Existing transmission line owned by Maxwell Infrastructure.</p> <p>66kV transmission line option: Lot 64 DP850818 and Lot 4 DP701496. Mining lease land zoned RU1 Primary Production the Muswellbrook LEP.</p> <p>Maxwell Infrastructure substation: Lot 6 DP701496. Mining lease land zoned RU1 Primary Production the Muswellbrook LEP. Substation privately owned by Maxwell Infrastructure.</p> <p>Switch station: Lot 4 DP701496 Mining lease land zoned RU1 Primary Production the Muswellbrook LEP.</p>
Local Government	Muswellbrook Shire Council
Subdivision	None required
Solar array	<p>Approximately 105ha of solar photovoltaic modules</p> <p>Row spacing: Approximately 5m – 10m</p> <p>Height: Up to approximately 4m to top of array when fully tilted</p>
Substation	Up to approximately 1ha (if 66kV option selected)
Access tracks	<p>Approximately 5km of proposed access tracks, utilising approximately 3km of existing internal mine access roads</p> <p>Width: Approximately 9m</p> <p>Material: Existing bitumen pavement plus additional unsealed gravel</p>
Operations and maintenance buildings	<p>Buildings would be constructed to provide a site office, amenities and control and storage facilities for the solar plant.</p> <p>If the 66kV option is selected, a switch station is proposed. Alternatively, if the 33kV option is selected, connection to the existing Maxwell Infrastructure substation is proposed.</p>
Security fencing, lighting and CCTV	Security fencing and CCTV are proposed with lighting only proposed for buildings.
Battery Storage	An area has been put aside for the future development of battery storage. Battery storage is not part of this Proposal and would require a separate application.

Proposal element	Description
Construction hours	Daytime construction hours: Monday to Friday: 6.00am to 6.00pm and Saturday: 6.00am to 1.00pm
Construction timing	Expected 12 – 18 month construction period, with a proposed start date of January 2021.
Workforce	Construction: Average 50 workers with a peak of 100 workers Operation: Approximately 1-2 full time equivalent staff
Operation period	Up to 30 years initially with possible extension subject to future technology and economics.
Decommissioning	All infrastructure would be removed. The site would be rehabilitated to pasture.
Capital investment	Estimated \$39,350,000

4.2 PROPOSAL LAYOUT

The indicative infrastructure layout presented in this EIS has been developed iteratively, in tandem with the environmental assessment and consultation with relevant government agencies, the community and other stakeholders, as discussed in Section 3.3. This process aims to avoid or minimise potential impacts wherever practicable and results in a Proposal that responds appropriately to the site constraints for the Maxwell Solar Farm. The Proposal is presented in Figure 1-5.

4.3 PROPOSED INFRASTRUCTURE

The Maxwell Solar Farm Proposal involves the construction, operation and decommissioning of a ground-mounted photovoltaic (PV) solar array which would have an installed capacity of approximately 25MW (AC) that would supply electricity to the Maxwell Infrastructure site and/or the Maxwell Underground site and/or the National Energy Market (NEM). The total development footprint is approximately 130ha, which includes approximately 25ha for the transmission line option requiring the largest impact area.

The key infrastructure for the Proposal would include:

- Approximately 4,500 strings each containing 30 solar photovoltaic panels, spaced 5-10m and being mounted single axis tracking systems and / or north-orientated fixed-tilt structures.
- Power conversion stations (PCS), transformers, inverters.
- An operations and maintenance area including parking and demountable buildings.
- Provision of an area for future BSU to store energy on site, subject to another development application.
- Electrical conduits and cabling to connect the solar panels, combiner boxes and inverters (SMA 2750 or equivalent).
- Up to approximately 1.6km of 33kV or 3.5km 66kV overhead transmission line.
- Additional electrical transformation equipment to be positioned within the existing Maxwell Infrastructure substation, if the 33kV transmission line option is progressed.
- An onsite switch station containing up to two transformers and associated switchgear, if the 66kV transmission line option is progressed.
- Site access off Thomas Mitchell Drive.
- Internal access tracks and upgrades to existing access roads, where required.

The layout of the infrastructure components is shown on Figure 1-5 and key areas are summarised below. The components are described in detail in the following sections. Indicative plans and images of infrastructure components are provided below. The plans and specifications of the components would be subject to detailed design and product selection through a competitive tender process.

Table 4-2 Maxwell Solar Farm layout areas

Maxwell Infrastructure:	1,470 ha
Solar Farm site boundary	105 ha
Largest impact area development footprint:	130 ha
Infrastructure within the solar plant site, excluding transmission line options	105 ha
66kV transmission line option (largest impact area)	25 ha
<i>33kV transmission line option</i>	<i>15 ha</i>

4.3.1 Solar arrays

The Proposal involves the installation of solar photovoltaic solar panels, arranged in a series of rows positioned to maximise the use of the solar resource available at the site (refer to Figure 4-1). The Proposal detail design utilises two options for the configuration of PV panels:

1. Fixed configuration, where the panels would be placed on fixed frames running in rows from east to west and tilted to the north; and
2. Single axis tracking, where the panels would be in rows configured in a north-south direction and the panels would track the sun from east to west throughout the day.

In either configuration, the panels would be fixed to and supported by ground-mounted framing (refer to Figure 4-2 and Figure 4-3). The ground mounted frame piles would be driven or screwed into the ground. During the piling installation measures would be undertaken to limit the potential for erosion (Figure 4-4).

The PV solar panels provide a surface area of approximately 2 square metres (m²) per PV solar panel. PV solar panels are designed for maximum light absorptivity and constructed of solar glass with an anti-reflective surface treatment. Subject to detailed design and the selected configuration the edge of the panels would be up to 4m high when fully tilted.

Approximately 4,500 strings each containing 30 PV solar panels could be accommodated at the site, providing an installed capacity of approximately 25MW (AC). The final number of PV solar panels within the development footprint would be dependent on detailed design, availability and commercial considerations at the time of construction.



Figure 4-1 Typical fixed array solar plant - Nyngan NSW (Nyngan Solar Plant is owned by the Powering Australian Renewables Fund (PARF). Image courtesy of PARF)



Figure 4-2 Example of typical panel framing (Image courtesy of PARF)

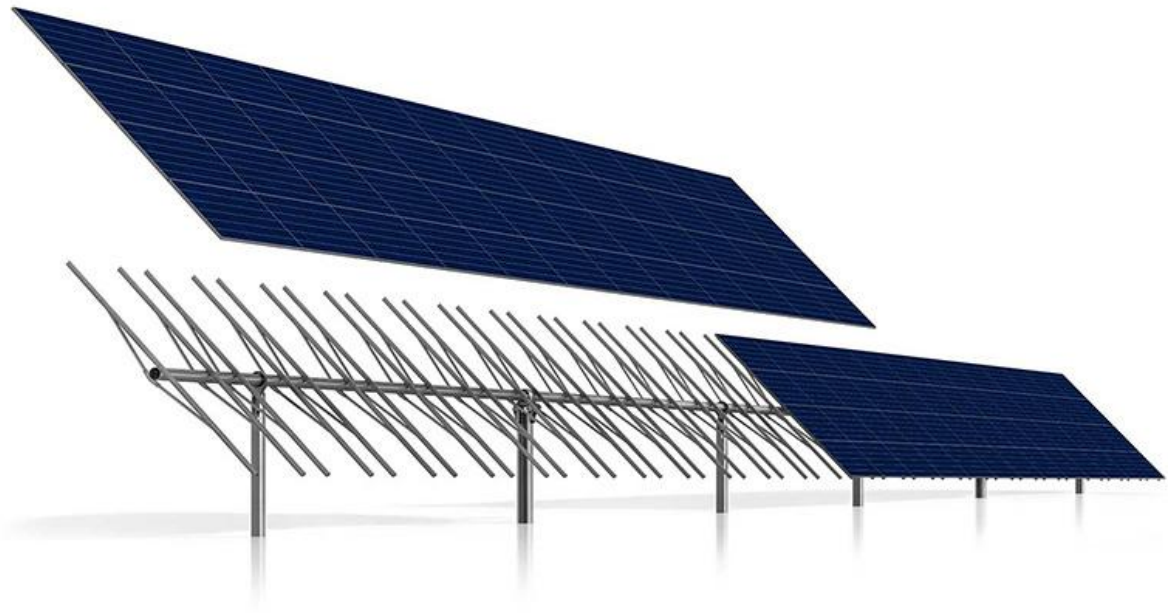


Figure 4-3 Typical single axis tracking system



Figure 4-4 Typical pile driving unit (Image courtesy of PARF)

4.3.2 Power conversion stations

The solar array would be divided into blocks, which would generally be sized between 2MW to 8MW. This would provide up to 12 Power Conversion Stations (PCS) consisting of:

- Inverters (SMA 2750 or equivalent) to convert DC power to AC power.
- Power transformers to step the voltage up to the solar plant reticulation voltage.
- Medium voltage switchgear.
- Communications and ancillary equipment.

The PCSs would be approximately 12m long, 3m high and 3m wide (refer to Figure 4-6). They would be spread across the site, in areas adjacent to the solar panels.



Figure 4-5 Typical containerised PCS (courtesy: SMA)



Figure 4-6 Typical PCS (courtesy: Power Electronics)

4.3.3 Transmission network connection

Electricity generated by the Solar Farm would supply electricity to the Maxwell Infrastructure site and/or the Maxwell Underground site and/or be transmitted to the National Energy Market (NEM).

The Proposal seeks approval for either a 66kV or 33kV transmission line option to be constructed. The 66kV overhead transmission line would connect the solar plant to the possible 66kV switch station, or a section of powerline would connect to the existing 33kV transmission line at the Maxwell Substation (presented Figure 1-5). The greatest transmission line impact area would result from the 66kV overhead option which requires 25ha. The 33kV line, if constructed, would be above ground and would require 15ha of area.

If the 66kV overhead transmission line is progressed, an additional switch station near Thomas Mitchell Drive is proposed to facilitate connection to the transmission network. The 66kV transmission line option passes through Maxwell Infrastructure owned land.

The 33kV transmission line option would pass through Maxwell Infrastructure owned land. Much of the proposed route runs parallel to internal mine roads. The route would run to the existing Maxwell Substation.

4.3.4 Ancillary infrastructure

An onsite substation would be provided to convert the medium voltage AC electricity generated by the Solar Farm to either 33kV or 66kV electricity.

The existing Maxwell Infrastructure substation would be utilised for the 33kV option or a new onsite substation would be constructed to facilitate the 66kV option. If required the 66kV substation would include a prepared foundation bench with earth grid, transformers, switchgear, and would occupy approximately 2ha. The substation would be surrounded by gravel and enclosed by a security fence.

Site office and staff amenities, including toilets would be located within the Proposal.

Temporary laydown areas for construction equipment and parking for construction workers and operational staff would also be provided. Temporary construction laydown and parking areas would be rehabilitated in the operational phase.

The location of all ancillary infrastructure is shown on Figure 1-5.

4.3.5 Site access and internal tracks

A single vehicle access point to the Proposal site is proposed from Thomas Mitchell Drive located at the northern boundary of the site. This access point would be used for both light and heavy vehicles.

Access would include existing mine roads, which are constructed of compacted gravel and access tracks. Access tracks would be up to 9m wide to allow for the safe delivery, unloading and installation of key components such as the power conversion stations, PV panels, transformers and switching equipment. The exact location of access tracks would be determined during the detailed design phase, when the solar array design is finalised.

4.4 EARLY WORKS

The proposed Maxwell Solar Farm may include early works (activities that would commence prior to the construction phase) including installation of fencing (if required), overhead line safety marking and / or surveying and preparation of construction compounds and site facilities.

4.5 CONSTRUCTION

4.5.1 Construction activities

The construction phase is expected to last approximately 12 - 18 months with peak activity during the middle six months of the construction period. The main construction activities would include:

1. Site establishment and preparation for construction - ground preparation, construction/upgrade of the internal access track system, upgrade of existing access points/intersections, preliminary civil works and drainage.
2. Installation of steel post and framing system for the solar panels.
3. Installation of cabling and installation of PCS's and footings.
4. Installation of PV panels.
5. Construction of site office.
6. Construction of the onsite substation and connections.
7. Removal of temporary construction facilities and rehabilitation of disturbed areas.

It is expected that some of these stages of construction would occur concurrently.

4.5.2 Site preparation and earthworks

Figure 1-2 indicates the development footprint which covers approximately 130ha including development within the Solar Farm site and the transmission line option with the largest impact. The Proposal site is already disturbed due to historic mining activities. Ground disturbance resulting from earthworks associated with the Proposal would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven or screwed into the ground typically to a depth of approximately 1.5 -2.4m depending on geotechnical conditions.
- Necessary reconditioning of internal access tracks, access points and associated drainage.
- Substation bench preparation.
- Concrete or steel pile foundations for the of power conversion stations and onsite switch station.

The ground disturbance from pile foundations would be less than approximately 10% (representing approximately 8ha) of the total site area. Panels within the solar array area would sit above the ground and existing ground cover vegetation would be maintained underneath the panels. Approximately 80% of the total site area groundcover would be affected by shading to varying degrees depending on time of year and time of day.

Apart from the permanent development footprint, any disturbed areas would be restored to vegetation (groundcover) after construction.

Topsoil and ground cover vegetation under the footprint of the array area would remain in place during the construction of the Solar Farm. Apart from some levelling to facilitate construction, minimal ground surface impact is expected during construction. Damage from construction activities shall be restored, to provide protection against erosion, during the operational phase of the Proposal.

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

4.5.3 Materials and resources

Key resourcing requirements for the Proposal would include labour, machinery and equipment, steel, electrical components (including PV panels and cables), water and gravel.

Machinery and equipment

The machinery and equipment required for the construction of the Proposal would include earthmoving machinery and equipment for site preparation, laying equipment, post-driving equipment, assisted material handling equipment (forklifts and cranes), machinery and equipment for connection infrastructure establishment, and water trucks for dust suppression. Typical quantities of such machinery and equipment for this Proposal are listed in Table 4-3.

Table 4-3 Estimated machinery and equipment

Plant Description	Estimated Number of Items
Small pile driving rig	2
Crane	1
Drum roller	1
Padfoot roller	1
Wheeled loader	2
Dump truck	1
30t Excavator	1
Grader	1
Chain trencher	1
Water truck	1
Telehandler	1
Forklift	1

Materials

Proposed resource materials for construction are listed in Table 4-4. These figures are estimated and would be confirmed during the detail design phase of the Proposal.

Table 4-4 Estimated material resources.

Resource	Estimated Quantity
Gravel (access tracks)	5,000m ³
Sand (bedding for cables)	1,000m ³
Concrete	300m ³
Estimated no. of solar panels	4,500 strings each containing 30 Solar Panels
Water during construction	10ML pa (approximately 20ML total)

Potable water would be trucked to the site on an as needs basis and stored within temporary water tanks at the staff amenities area. Water for dust suppression would be sourced from a dam on the adjacent Maxwell Infrastructure site.

4.5.4 Transport and access

Construction infrastructure and materials are expected to be transported to Newcastle via rail and delivered to the site via road transport.

The site is serviced by major state and regional roads including the Thomas Mitchell Drive and the New England Highway. It is anticipated that materials would be delivered to the site from either the port of Sydney or the port of Newcastle. Materials would generally be shipped in containers on heavy vehicles up to B-double size and would include, and not be limited to:

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

The main vehicular access to the site would be from Thomas Mitchell Drive via the New England Highway.

Specialist oversize equipment such as the site transformers would have ‘Oversize’ transport management. Following approval of the Proposal, a Construction Traffic Management Plan would be prepared.

Traffic movements

Estimated total and maximum daily traffic movements during peak construction are shown in Table 4-5.

Table 4-5 Estimated traffic volumes and requirements for the Maxwell Solar Farm

Type of vehicle	Peak vehicle movements per day
Light vehicles – workforce	90
Light vehicles – Visitors, consultants	10
Semi-trailer/heavy vehicle	16
Cranes	4
Total	120

At the peak of construction, it is anticipated that up to 100 site personnel would be required to undertake the works. This would generate up to 10 heavy vehicles accessing the site during the peak construction period in addition to 50 passenger vehicles. This has been taken into consideration within Table 4-5. The number of oversized vehicles required for the construction of the Maxwell Solar Farm is low. It is expected that up to four one-way movements of oversized vehicles would be required within the later months of the construction period (month 14 and 15).

4.5.5 Hours of operation during construction

Construction activities would be undertaken during standard daytime construction hours (7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays). Exceptions would occur as staff arrive and

leave the site, before and after shifts. Some of this light traffic may occur outside the standard construction hours. Additionally, the delivery of large components may take place outside normal working hours.

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

4.6 OPERATION

4.6.1 Activities during operation

Activities undertaken during operation would include:

- Routine visual inspections, general maintenance and cleaning operations of the solar arrays as required.
- Routine visual inspections, general maintenance and cleaning operations of the substation.
- Vegetation management within the development envelope. This is likely to use a combination of mechanical methods to manage grass growth beneath the panels. Groundcover vegetation would be maintained over the site to minimise erosion, dust and weeds (subject to climatic conditions). Groundcover would be monitored and remediation (such as reseeding or soil protection) undertaken as required to maintain a stable cover.
- Site security response (24hr), if required.
- Site operational response (24hr), if required.
- Replacement of equipment and infrastructure, as required.
- Maintenance of landscaping, as required.
- Pest plant and animal control, as required.

4.6.2 Water requirements

During operation, non-potable water would be required for cleaning panels. Potable water would be required for the workers. In terms of quantities required, the operational water use volumes would be minimal; the water required for staff amenities is estimated to be approximately 150kL per annum. Panel cleaning may be required in dry conditions when open cut mining operations in the region are generating dust. Non-potable water would be preferentially used for panel cleaning. Rainwater would be gathered from the office roof and stored within onsite tanks. In cases of prolonged drought, water would be trucked to site as required.

4.6.3 Personnel and work hours

The Solar Farm would be monitored and operated remotely and would require a small number of maintenance personnel (approximately 1-2 full time equivalent staff) to be based at the site. Staff would primarily use light vehicles (4x4) for site maintenance activities. It is expected that the staff would be local to the region.

The majority of plant infrastructure maintenance, including power conversion station, transformer and HV switchgear, PV arrays and the trackers (if fitted), would be scheduled consistently throughout the year and co-ordinated by site staff with specialist support where necessary. There would be some occasions, such as during a major substation maintenance shut down, where additional maintenance staff may be required on site.

Other site maintenance activities would include:

- Vegetation management.
- Weed and pest management.
- Fence and access road management.
- Security monitoring.

4.6.4 Refurbishment and upgrading

The Solar Farm operator may replace or upgrade solar panels or other infrastructure within the existing development envelope during the projected 30-year life of the Solar Farm. If any upgrade works occur during the life of the Solar Farm that extend beyond the proposed development footprint or alter the nature or scale of environmental impacts, the proponent would consult the DPIE regarding the need for further assessment or approval.

4.7 DECOMMISSIONING AND REHABILITATION

At the end of the Proposal’s operational life, the site would be either re-equipped, returned to its pre-mining land capability, or to an alternative land use. During the site’s decommissioning, all Solar Farm infrastructure would be removed. Key elements of the Proposal decommissioning would include:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted for removal from the site for recycling or reuse. Much of the solar array panels are recyclable.
- All site amenities and equipment would be removed, and materials recycled or reused, wherever practicable.
- Posts and cabling would be removed and recycled.
- Areas of soil disturbed during decommissioning would be rehabilitated to pasture.
- Traffic required for decommissioning would be similar in type but of shorter duration than that required for the construction phase.

4.8 INDICATIVE TIMELINE

An indicative timeline for the Proposal is outlined in *Table 4-6*. The commissioning of the Solar Farm would likely be phased. It is expected that the Solar Farm would be commissioned progressively in 1-3 phases before full commissioning at the end of the 12-18 month construction period.

Table 4-6 Indicative timeline

Phase	Approximate commencement	Approximate duration
Construction	1 st Quarter 2021	12 -18 months
Operation	3 rd Quarter 2022	30 years
Decommissioning	2052	9 months

4.9 CAPITAL INVESTMENT

The Maxwell Solar Farm would have an estimated capital investment of approximately \$39,350,000 (refer to CIV calculation and report in APPENDIX B).

5 PLANNING CONTEXT

This section sets out the legislative planning context for the Proposal. This includes:

- Clarification of the status of the Proposal as SSD.
- The permissibility of the Proposal under relevant environmental planning instruments (EPIs), including relevant State environmental planning policies (SEPPs) and local environmental plans (LEPs).
- Evaluation of the Proposal against relevant NSW, local, State and Commonwealth legislation (Acts and Regulations).

This section also identifies any additional approvals which would apply to the Proposal.

5.1 PERMISSIBILITY

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

Development assessment provisions are contained in Part 4 of the EP&A Act. Section 4.36 under Division 4.7 of the EP&A Act provides that a development would be State Significant Development (SSD) if it is declared to be SSD by a State Environmental Planning Policy (SEPP).

The proposed development is defined as **electricity generating works** and is permissible with consent under clause 34(1)b of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP). Consent may be granted under Part 4 of the EP&A Act.

The State Environmental Planning Policy (State and Regional Development) 2011 (NSW) (SRD SEPP) states that development for the purpose of electricity generating works with a capital investment value of greater than \$30 million is classed as SSD (Clause 20, Schedule 1). The capital investment value of Maxwell Solar Farm is \$39,350,000 and therefore fulfils one of the State Significant Development criteria. Consent may be granted under Part 4 of the EP&A Act.

Section 4.12(8) of the EP&A Act requires SSD development applications 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.

The proponent made a written application to the Secretary requesting the Secretary's Environmental Assessment Requirements (SEARs) for the proposed Maxwell Solar Farm on 19 December 2018, which was resubmitted on 30 January 2019 via email to the Department. This is in accordance with Clause 3 of Schedule 2 of the EP&A Regulations. The proponent's application was accompanied by the Scoping Report, which outlined key information about the proposed Maxwell Solar Farm, including the key environmental issues and investigation strategies, for the Proposal site.

On 8 March 2019, the Secretary issued the SEARs for the Maxwell Solar Farm (APPENDIX A). In formulating the SEARs, the Secretary consulted with relevant public authorities and agencies and considered key issues raised by those authorities. Section 6.1 outlines the SEARs and provides a cross reference to where each item is addressed within this EIS. Additional agency consultation undertaken during the preparation of the EIS is also summarised in Section 6.1. This EIS complies with the SEARs and the environment assessment requirements contained in Schedule 2 of the EP&A Regulation.

5.2 NSW LEGISLATION

5.2.1 Environmental Planning and Assessment Act 1979

Objects

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

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

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

Matters for consideration

Section 4.40 of the EP&A Act provides that Section 4.15 applies to the determination of Development Applications (DAs) for SSD. The consent authority is required to consider the matters listed in Section 4.15 when determining an SSD Development Application (DA). These matters are listed in Table 5-1 and assessed in terms of their relevance to the Proposal.

Table 5-1 Matters for consideration under Section 4.15 of the EP&A Act

Provision	Relevance to the Proposal
Any environmental planning instrument;	<p>Relevant EPIs are discussed in Section 5.2. They include:</p> <ul style="list-style-type: none"> • SRD SEPP. • ISEPP. • SEPP No 55. • Muswellbrook LEP.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority;	There are no draft instruments relevant to the Proposal.
Any development control plan;	Clause 11 of the SRD SEPP provides that development control plans do not apply to SSD.
Any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4;	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the Proposal.
The regulations (to the extent that they prescribe matters for consideration);	<p>Clause 92 of the EP&A Regulation requires consideration of:</p> <ul style="list-style-type: none"> • The Government Coastal Policy, for DAs in certain local government areas; and. • The provisions of AS 2601 for DAs 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>. <p>The Maxwell Solar Farm is not located on land that is under the provisions of the <i>Dark Sky Planning Guideline</i>.</p> <p>The Proposal does not involve any other types of development and therefore the other provisions provided by the EP&A Regulation are not relevant to the Proposal.</p>
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;	<p>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 the Proposal have, to the extent reasonably and feasibly practicable, been avoided or minimised through careful design and through the implementation of mitigation measures provided within this EIS. Overall impacts are considered manageable and justifiable.</p>

Provision	Relevance to the Proposal
The suitability of the site for the development;	<p>As discussed in Section 3, various options were considered when selecting an appropriate site for the Proposal. The Proposal site has several characteristics that make it suitable for the development of a Solar Farm. Most notably, its location is within proximity to an existing transmission line and electricity substation with good connection capacity.</p> <p>Other characteristics include:</p> <ul style="list-style-type: none"> • Availability of an abundant solar resource. • Availability of appropriate land i.e. topography, aspect, lack of native vegetation. • Suitability in terms of the interests of other stakeholders and the environment. <p>Further, the Maxwell Solar Farm is largely reversible; at the end of the life of the Solar Farm, all above ground infrastructure could be removed and agricultural/mine rehabilitation land use activities could resume.</p>
Any submissions made in accordance with the EP&A Act or the regulations; and	<p>Maxwell Infrastructure would consider and, as necessary, respond constructively to any submission made in relation to the Maxwell Solar Farm. Consultation with stakeholders that has been undertaken during the planning stages including the preparation of this EIS is summarised in Section 6.</p>
The public interest.	<p>The Maxwell Solar Farm is in the public interest for several reasons. The plant would have an installed capacity of approximately 25MW (AC). On an annual basis, the proposed Maxwell Solar Farm would provide enough clean, renewable energy for about 10,000 average NSW homes.</p> <p>The Solar Farm would also assist to:</p> <ul style="list-style-type: none"> • Directly contribute to Australia meeting international commitments. • Reduce the greenhouse gas emissions required to meet Australia’s energy demands • Assist in the transition towards cleaner electricity generation. • 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. <p>Maxwell Infrastructure has undertaken community consultation activities to inform the community and stakeholders about the Proposal and provided opportunities to provide input into the assessment and development process. To date stakeholders and the community have been supportive of the Proposal. Further details on the consultation process is provided in Section 6.</p>

Other approvals to be applied to the Proposal

Under section 4.42 of the EP&A Act, several authorisations cannot be refused if they are necessary for the carrying out of SSD authorised by development consent and substantially consistent with the consent. These authorisations include:

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

Approvals that apply to the Proposal

Three matters that may be relevant to the Proposal include:

1. Project approval (06_0202) under the EP&A Act

The Drayton Mine Extension Project (DMEP) was granted project approval (06_0202) under Part 3A of the EP&A Act on 1 February 2008. The planning approval has been modified on two subsequent occasions:

- Modification 1 (granted on 16 October 2009), involving a minor extension (7.5ha) of the approved mining disturbance footprint for the DMEP, and the addition of 12 ha of land to the Drayton Wildlife Refuge to provide an offset for the extended mining disturbance footprint.
- Modification 2 (granted 17 February 2012), involving changes to tailings emplacement at the DMEP so as to result in the emplacement of raw tailings within the East Pit Void, instead of a co-disposed dry tailings product as was then approved, as well as the construction and operation of an explosives storage facility.

Since 31 December 2017, mining operations at Maxwell Infrastructure are no longer carried out under the planning approval and the site has moved into its rehabilitation phase.

In the event that development consent is granted for the Maxwell Solar Farm, it is currently the intention of Maxwell Ventures (Management) Pty Ltd to subsequently lodge an application under Section 4.55 of the EP&A Act to the Maxwell Infrastructure planning approval to remove the land on which Maxwell Solar Farm is proposed and land subject to the development consent granted for the Solar Farm. The access road and powerline corridor shown in Figure 1-2 are not proposed to be removed from the planning approval and are intended to be shared infrastructure with Maxwell Infrastructure.

It is proposed to remove the Maxwell Solar Farm land from planning approval 06_0202 to ensure that no regulatory confusion or practical difficulties result from the land being subject to development consent for the Solar Farm and being subject to the planning approval for Maxwell Infrastructure.

2. EPL 1323 under the POEO Act

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

An EPL is in place for the Maxwell Infrastructure site (EPL 1323) as it was required for the carrying out of the Maxwell Infrastructure project, as that project constitutes a “*scheduled activity*” for the purposes of Schedule 1 of the POEO Act. If the Proposal is granted development consent, it is Maxwell Ventures’ intention to lodge an application under the POEO Act to vary EPL 1323 for Maxwell Infrastructure so as to remove the land which is subject to the Proposal from the EPL.

3. Coal Lease No. 229 (CL229) under the *Mining Act 1992*

Whilst there are numerous mining tenements and titles currently held in respect of the Maxwell Infrastructure, the only mining tenement that has relevance to the Solar Farm Proposal is Coal Lease No. 229 (CL 229). CL 229 was first granted on 3 February 1982 and has been subsequently renewed to remain in force for a further term until 2 February 2024.

Upon physical commencement of the Proposal, Maxwell Infrastructure intends to lodge an application to the Resources Regulator under Section 125 of the *Mining Act 1992* to have:

- CL 229 partially cancelled to excise the Maxwell Solar Farm land excluding shared roads and powerlines from that mining lease
- The Maxwell Solar Farm land excluding shared roads and powerlines excised from the MOP (Mining Operations Plan).

In respect of applying to excise the Maxwell Solar Farm land from CL 229 and the MOP, Maxwell would consult with the NSW Resources Regulator about this proposed course of action.

Approvals that do not apply to the Proposal

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

- (a) A permit under section 201, 205 or 219 of the *FM Act (NSW)*.
- (b) An approval under Part 4, or an excavation permit under Section 139, of the *Heritage Act 1977 (NSW)* (Heritage Act).
- (c) An Aboriginal Heritage Impact Permit under section 90 of the *National Parks and Wildlife Act 1974 (NSW)* (NPW Act).
- (d) A bushfire safety authority under Section 100B of the *Rural Fires Act 1997 (NSW)*.
- (e) A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000 (NSW)*.

Even though the Proposal does not require the authorisations listed above, the potential impact of the Proposal on these matters is assessed in this EIS and mitigation strategies included in the Proposal’s commitments.

5.2.2 Environmental Planning and Assessment Regulation 2000

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

The Maxwell Solar Farm Development Application and accompanying information (including this EIS) would be placed on public exhibition by DPIE for a period not less than 30 days.

5.2.3 Muswellbrook Local Environment Plan 2009

The site is located within the Muswellbrook Local Government Area and is therefore subject to the provisions of the *Muswellbrook Local Environmental Plan 2009* (the LEP).

(2) *The particular aims of this Plan are as follows:*

(a) to encourage the proper management of the natural and human-made resources of Muswellbrook by protecting, enhancing or conserving:

- (i) productive agricultural land, and*
- (ii) timber, minerals, soils, water and other natural resources, and*
- (iii) areas of significance for nature conservation, and*
- (iv) areas of high scenic or recreational value, and*
- (v) places and buildings of archaeological or heritage significance,*

(b) to manage the urban areas of Muswellbrook by strengthening retail hierarchies and employment opportunities, promoting appropriate tourism development, guiding affordable urban form and providing for the protection of heritage items and precincts,

(c) to promote ecologically sustainable urban and rural development,

(d) to manage development in flood-prone areas by ensuring any obstruction, re-direction or pollution of flood waters will not have adverse consequences for the environment or increase the risk of endangering life or property,

(e) to enhance the urban amenity and habitat for flora and fauna,

(f) to protect and conserve:

- (i) soil stability by controlling development in accordance with land capability, and*
- (ii) remnant native vegetation, and*
- (iii) water resources, water quality and wetland areas, natural flow patterns and their catchments and buffer areas,*

(g) to provide a secure future for agriculture by expanding Muswellbrook's economic base and minimising the loss or fragmentation of productive agricultural land,

(h) to allow flexibility in the planning framework so as to encourage orderly, economic and equitable development while safeguarding the community's interests and residential amenity, and to achieve the objectives of each zone mentioned in Part 2 of this Plan.

It is considered that the Proposal is compatible with the aims of the Muswellbrook LEP, especially in encouraging sustainable economic growth and development, protecting natural and cultural heritage assets and providing opportunities for the growth of townships.

Land Zoning

The proposed Maxwell Solar Farm site is located on land zoned RU1 Primary Production under the provisions of the LEP. Electricity generating works are not listed among developments that are permitted within the zone. However, provisions of the ISEPP, takes precedence over the LEP and permits electricity generating works with consent in the RU1 zone.

The *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) provides for the declaration of SSD and declares that the Independent Planning Commission (IPC) is the consent authority for certain SSD.

No subdivision would be required for the development. The existing substation, proposed switch station (as part of the 66kV, if required), existing and proposed extension of the 33kV powerline and potential 66kV powerline, would all be located within the subject land, which would continue to be privately owned and maintained.

Additionally, when land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under s.7A is required when the total of the original term of the lease, together with any option of renewal, is more than five years.

In this regard, the subject land is owned by the proponent and it is understood that subdivision for the purpose of a lease agreement would not be required.

Land Use Zone Objectives

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 the RU1 zone are to:

- *To encourage sustainable primary production by maintaining and enhancing the natural resource base*
- *To encourage diversity on 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 protect the agricultural potential of rural land not identified for alternative land use, and to minimise the cost to the community of providing, extending and maintaining public amenities and services*
- *To maintain the rural landscape character of the land in the long term*
- *To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines from the surface of the flood plain), will not:*
 - a. *Destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or*
 - b. *Detrimentially affect in any way the quantity, flow and quality of water in either subterranean or surface water systems, or*
 - c. *Visually intrude into its surroundings, except by way of suitable screening.*
- *To protect or conserve (or both):*
 - a. *Soil stability by controlling development in accordance with land capability, and*
 - b. *Trees and other vegetation, and*
 - c. *Water resources, water quality and wetland areas, and their catchments and buffer areas, and*

- d. Valuable deposits of minerals and extractive materials by restricting development that would compromise the efficient extraction of those deposits.*

For the life of the Proposal, the development site would harness a natural resource (solar energy). The activity would impact on land availability for primary production, however, it would be developed in a way that would minimise fragmentation and alienation of resource land and minimise land use conflict. Being reversible and involving limited ground disturbance, the Proposal would not remove the potential to use the land for primary production at the end of its life. Upon decommissioning of the Proposal, the development footprint the land would be rehabilitated to pasture.

It is also important to note that Solar Farms do not preclude the use of land for primary industry production. Some agricultural and production activity, e.g. grazing, is still possible whilst a Solar Farm is operational.

Mitigation measures are contained within the EIS that would form a commitment of the Proposal, address construction and operational soil and water impacts and would act to maintain the onsite land capability. Land use and capability is assessed in Section 7.3.

5.2.4 Development Control Plans and Council policies

The *Muswellbrook Shire Development Control Plan 2009* (DCP) applies to all land within the Muswellbrook Local Government Area, however, Clause 11 of the State and Regional Development SEPP provides that development control plans do not apply to State Significant Developments.

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

The aims of the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) are to identify developments that are SSD, which are major projects that require approval from the Minister for Planning and Environment or delegate (being the Independent Planning Commission, the Secretary of the DPIE or other public authority).

Clause 20 of Schedule 1 of the SRD SEPP defines SSD as:

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

- (a) has a capital investment value of more than \$30 million, or*
- (b) has a capital investment value of more than \$10 million and is in an environmentally sensitive area of State significance.*

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

5.2.6 State Environmental Planning Policy (Infrastructure) 2007

Part 3 Division 4 Clause 34(1)(b) of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) provides that development for the purpose of 'electricity generating works', solar in particular, may be carried out by any person with consent on any land in a prescribed rural, industrial or special use zone.

The proposed Maxwell Solar Farm would be located on land zoned RU1 Primary Production, under the provisions of the Muswellbrook LEP (refer Section 5.2.11). The Proposal is permissible with consent under the ISEPP.

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

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

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

- a) to human health, life of property, or*
- b) to the biophysical environment,*

and includes a hazardous industry and a hazardous storage establishment.”

‘Potentially offensive industry’ defined as:

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

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

A checklist and a risk screening procedure developed by DOP (now DPIE) is used to help determine whether a development is considered potentially hazardous industry (DOP, 2011). Appendix 3 of the Applying SEPP 33 guidelines lists industries that may fall within SEPP 33; the lists do not include Solar Farms and energy storage facilities. The hazardous development status of the Proposal is assessed in Section 8.2.

5.2.8 State Environmental Planning Policy No 55 - Remediation of Land

The *State Environmental Planning Policy No 55 - Remediation of Land* (SEPP No 55) aims to promote the remediation of contaminated land for the purposes of reducing the risk of harm to human health or any other aspect of the environment. Clause 7 of the SEPP No 55 requires that the remediation of land be considered by a consent authority in determining a DA.

There are no contaminated sites in the Muswellbrook Shire Council LGA in the NSW Environment Protection Authority (EPA) contaminated land register. During the site inspection by NGH, it was noted that there are areas of potential contamination surrounding the Proposal site including diesel storage facilities and refuelling areas as well as explosive pre-cursor storage areas. A contamination assessment has been conducted by Maxwell Infrastructure on these facilities and minor remediation is required when they are demobilized.

In terms of the proposed Solar Farm, the need for remediation in this area prior to works commencing is low. Section 7.4 considers the potential for contamination at the Proposal site and potential contamination impacts from the Proposal.

The DPE has announced that SEPP No 55 would be repealed and replaced by the Remediation of Land SEPP (currently in draft form). The Proposal is in accordance with the Draft Remediation of Land SEPP.

5.2.9 State Environmental Planning Policy (Primary Production and Rural Development) 2019

The new *State Environmental Planning Policy (Primary Production and Rural Development)*, known as the PPRD SEPP, is a new framework that commenced on 28 February 2019. The new framework simplifies the NSW planning system by consolidating, updating and repealing provisions in five former agriculture-themed SEPPs, including the Rural Lands SEPP. The intention is to provide for better outcomes in balancing rural needs, including farming, and development, and to reduce the risk of land use conflict and rural land fragmentation. Many of the provisions in the repealed SEPPs were local-level land use planning matters, which have now been transferred to local LEPs. This aims to ensure local industry and community have greater access to and awareness of the agricultural land use planning provisions that apply. The intent of the new SEPP is to deal with agricultural land use matters of State or regional significance only.

The aims of the *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (Primary Production SEPP) are:

- (a) to facilitate the orderly economic use and development of lands for primary production,*
- (b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,*
- (c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,*
- (d) to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,*
- (e) to encourage sustainable agriculture, including sustainable aquaculture,*
- (f) to require consideration of the effects of all proposed development in the State on oyster aquaculture,*
- (g) to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.*

The objectives of Part 2 (State Significant Agricultural Land) of Primary Production SEPP are as follows:

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

Land that is considered State Significant Agricultural Land is listed in Schedule 1 of the Primary Production SEPP. Schedule 1 of the SEPP is currently incomplete/blank, with mapping yet to be completed or publicly available (*pers comm* DPI 12/06/19). As such, reference to the significance of agricultural land from Schedule 2 of the previously repealed *State Environmental Planning Policy (Rural Lands) 2008* is applied within this EIS (see below).

5.2.10 State Environmental Planning Policy (Rural Lands) 2008 (repealed)

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

- (a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,
- (b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State,
- (c) to implement measures designed to reduce land use conflicts,
- (d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,
- (e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The Proposal area is not identified in schedule 2 as State significant agricultural land.

5.2.11 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

This SEPP (the Mining SEPP) is designed to provide for the proper management and development of mineral, petroleum and extractive material resources and establish appropriate planning controls to encourage ecologically sustainable development through environmental assessment and management.

In particular, the SEPP outlines land that has been classed as Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CIC).

The Proposal site has not been identified as BSAL or CIC.

5.2.12 Protection of the Environment Operations Act 1997

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

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

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

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

Section 143 and 145 of the POEO Act also creates offences relating to pollution and the transport and disposal of waste and imposes a duty on the occupier of a site to notify certain 'pollution incidents.' The proponent must comply with the POEO Act in carrying out the Proposal

5.2.13 Crown Lands Management Act 2016

The main aims of the *Crown Lands Management Act 2016* are to provide for the ownership and management of Crown land in NSW, and provide clarity concerning the law applicable to Crown land.

Works within a Crown reserve require environmental, social, cultural heritage and economic considerations to be considered, and must facilitate the use of land by the NSW Aboriginal people.

No land defined as Crown Land would be impacted by the Proposal.

5.2.14 Water Management Act 2000

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

Water may be sourced from dams at Maxwell Infrastructure. As such, any approvals specified under the WM Act are not required.

5.2.15 Fisheries Management Act 1994

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

A permit under sections 201, 205 or 219 of the FM Act is not required for SSD under the provisions of Section 4.41 of the EP&A Act.

There are no water courses listed as Key Fish Habitat (KFH) or aquatic habitats within the Proposal site.

5.2.16 National Parks and Wildlife Act 1974

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

The provisions of the NPW Act have been considered for the Proposal. The Proposal area is not located within 10km of any nature reserve or forest protected under the NPW Act, with the closest nature reserve being Wollemi National Park located more than 15km south of the Proposal. No impact on these areas is expected.

An assessment of impacts to Aboriginal heritage is provided in Section 7.2 and APPENDIX F. It is noted that under section 89J(d) of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NPW Act is not required for SSD.

5.2.17 Heritage Act 1977

The Heritage 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 register. 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.

A search of the NSW State Heritage Inventory Database on 7 February 2019 for the Muswellbrook LGA identified there were eight items listed under the NSW State Heritage Register. None of the items listed are within or adjacent to the Proposal site. A total of 205 items were also listed by Local Government and State Agencies on the NSW State Heritage Inventory database. None of the items listed are within the Proposal site. The closest item, *Yammanie* (database ID: 2120116), is located approximately 3.7km from the northernmost extent of the Proposal'. The Proposal would not impact directly or indirectly on any items of heritage significance.

Section 146 of the Act requires any person who believes they have discovered or located a relic (in any circumstances) to notify the NSW Heritage Council.

5.2.18 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) establishes a regulatory framework for assessing and offsetting the biodiversity impacts of proposed developments and activities. The BC Act contains provisions relating to flora and fauna protection, threatened species and ecological community listings and assessment, a Biodiversity Assessment Methodology (BAM), and a Biodiversity Offsets Scheme (BOS) for the calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The BC Act is supported by the Biodiversity Conservation Regulation 2017 (NSW). The BC Act has been considered in the preparation of this EIS. The SEARs required the preparation of a Biodiversity Development Assessment Report (BDAR), assessing the biodiversity values and the likely biodiversity impacts of the project (including on Inland Grey Box woodland endangered ecological community) in accordance with Section 7.9 of the BC Act. A waiver for the requirement for a BDAR was submitted to DPE and accepted by the Department of Planning, Industry and Environment (DPIE) (previously DPE) on 1 July 2019 (APPENDIX E). The BC Act and biodiversity issues are addressed in Section 7.1.

5.2.19 Biosecurity Act 2015

The *Biosecurity Act 2015* (NSW) provides a framework for the prevention, elimination and minimisation of biosecurity risks. The Biosecurity Act and supporting Biosecurity Regulation 2017 (NSW) provide for the establishment and functions of Local Control Authorities for weeds (Muswellbrook Shire Council or, a county council or a joint organisation, as defined under the *Local Government Act 1993*) and weed control obligations on public and private land. Maxwell Infrastructure has a duty to ensure the biosecurity risk is prevented, eliminated or minimised, so far as is reasonably practicable at the Proposal site.

5.2.20 Mining Act 1992

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

The Proposal site is subject to the following authority under the *Mining Act 1992*:

- Coal Lease No. 229 (CL 229) – held by Maxwell Coal

The proposed Maxwell Solar Farm would be sited within part of the rehabilitated area of Maxwell Infrastructure. Maxwell Infrastructure have consulted with relevant authority holders and the details and outcomes of the consultation are provided in Section 6. There is a potential to impact exploration activities under each authority. However, there would be no impact on the exploration of mineral resources that

could be explored at the end of the Proposal's life, if this becomes a preferred land use option at this later stage.

5.2.21 Conveyancing Act 1919

The purpose of the *Conveyancing Act 1919* is to amend and consolidate the law of property and to simplify and improve the practice of conveyancing, and for such purposes to amend certain Acts relating thereto.

When land is leased from a landowner and the lease affects part of a lot or lots in a current plan, a subdivision under *s.7A Conveyancing Act 1919* is required when the total of the original term of the lease, together with any option of renewal, is more than five years.

Given the proponent is the landowner, subdivision is not required and therefore the *Conveyancing Act* is not applicable to this application.

5.2.22 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The Proposal's resource management options would be considered against a hierarchy of the following order:

- Avoidance of unnecessary resource consumption.
- Resource recovery (including reuse, reprocessing, recycling and energy recovery).
- Disposal.

Adopting the above principles would encourage the most efficient use of resources and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development (refer Section 8.6).

5.3 COMMONWEALTH LEGISLATION

5.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Commonwealth Department of the Environment and Energy (DEE). 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 nine MNES are:

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

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

A search of the Commonwealth Protected Matters Search Tool (10km buffer, undertaken on 20 March 2019) indicated four threatened ecological communities, 29 threatened species and 14 migratory species within the search area. The search also indicated 1 wetland of international importance located greater than 50km upstream.

The potential impacts to listed threatened species and communities are assessed in the Biodiversity Assessment (Emergent Ecology, 2019) and summarised in Section 7.1. These conclude that the Proposal is not likely to have a significant impact on threatened species and communities, migratory bird species and marine species listed under the EPBC Act.

A summary of the EPBC Act search report is provided in Table 5-2. The full search report is provided in APPENDIX D.

Table 5-2 Summary of EPBC Act Protected Matters Report search results

Protected Matter	Entities with potential to occur within 10km of the Proposal site
World Heritage Properties	0
National Heritage	0
Wetlands of International Importance (Ramsar)	1 ²
Threatened Ecological Communities	4
Threatened Species	29
Migratory Species	14
Listed Marine Species	21
Commonwealth land	3
Commonwealth Heritage places	0
Critical habitats	0
Commonwealth reserves (terrestrial)	0
State reserves	0
Regional Forest Agreements	1
Invasive species	32
Nationally Important Wetlands	0

² Hunter Wetlands are located 50km upstream, with potential to occur within a 10km radius of the Proposal site as per the PMST.

5.3.2 Native Title Act 1993

The *Native Title Act 1993* (Cwth) 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 leases.
- Some land held for Aboriginal communities.
- Beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

A search of the National Native Title Tribunal Registers on 8 March 2019 found no Native Title Claims or active applications within the Muswellbrook Shire LGA (refer to APPENDIX D).

5.3.3 Renewable Energy (Electricity) Act 2000

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

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

Section 17 of the RE Act defines renewable energy sources eligible under the Commonwealth Government's Renewable Energy Target; including 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 as small-scale technology certificates following changes to the RET scheme.

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

5.4 OTHER RELEVANT POLICIES AND MATTERS

5.4.1 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In NSW, the concept has been incorporated

into legislation including the EP&A Act, the EP&A Regulation and the *Protection of the Environment Administration Act 1991* (NSW).

Based on the likely costs and benefits of the proposed Solar Farm, the Proposal is considered to comply with the principles of ESD. ESD principles and their relationship to the design, construction and ongoing operations of the Proposal are identified in Table 5-3.

Table 5-3 Assessment of the Proposal against the principles of ESD

Assessment of the Proposal against the principles of ESD	
<p><i>(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></p> <ul style="list-style-type: none"> <i>(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and</i> <i>(ii) an assessment of the risk-weighted consequences of various options.</i> 	<p>The precautionary principle has been adopted in the assessment of impact of the Proposal; potential impacts have been considered and mitigated where an unacceptable risk is present. Where uncertainty exists, measures have been included to address the uncertainty. An impact assessment has been undertaken with the maximum potential footprint to account for the uncertainty in the final impact footprint.</p>
<p><i>(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.</i></p>	<p>Potential impacts of the Maxwell Solar Farm are likely to be localised and would not diminish the options regarding land and resource uses and nature conservation available to future generations. It diversifies land use in the area and ensures productive use of the land during operation of the Proposal. Importantly, the Maxwell Solar Farm provides additional renewable energy that contributes to minimising the impact of climate change to current and future generations by reducing carbon emissions from electricity generation.</p> <p>The Maxwell Solar Farm would be either (i) decommissioned at the end of its operational life, removing all infrastructure or (ii) upgraded with new photovoltaic equipment. Decommissioning would result in returning the site to pasture for future generations.</p>
<p><i>(c) conservation of biological diversity and ecological integrity— namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>The impacts of the Maxwell Solar Farm on biodiversity, including EPBC Act listed species, have been assessed in detail in the Biodiversity Assessment in (Emergent Ecology, 2019) and are summarised in Section 7.1 of this EIS. This has included avoidance of areas of higher conservation value and management prescriptions to minimise and manage residual impacts.</p>
<p><i>(d) improved valuation, pricing and incentive mechanisms— namely, that environmental factors should be included in the valuation of assets and services, such as:</i></p> <ul style="list-style-type: none"> <i>(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and</i> <i>(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, and</i> <i>(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.</i> 	<p>Attributes of the Proposal site such as the existing 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.</p>

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in Section 9.2 provide an auditable set of environmental management commitments to these parameters. Based on the social and environmental benefits accruing from the Maxwell Solar Farm at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of ESD.

5.4.2 NSW Large-scale Solar Energy Guideline for State Significant Development 2018

The guideline provides the proponent and regulators with general guidance on the planning framework for the assessment and determination of state significant large-scale solar energy projects under the EP&A Act.

The objectives of the guideline are to:

- Provide guidance to the community, applicants, industry and regulators on how DPE assesses environmental, social and economic impacts of state significant solar energy projects.
- Encourage industry to select suitable sites for projects to reduce the likelihood and extent of land use conflicts and environmental and social impacts.
- Facilitate better on-ground outcomes by promoting early identification of potential impacts.
- Promote meaningful, respectful and effective community and stakeholder engagement.
- Support the development of a sustainable solar industry in NSW by providing a clear, consistent and responsive policy framework.

The Proposal has addressed the requirements of the guidelines through the assessment of environmental impacts (Sections 7 and 8), site suitability (Section 3.6), community and agency consultation (Section 6) and policy and framework requirements (Section 5).

5.4.3 Hunter Regional Plan 2036

The Hunter Regional Plan 2036 established a framework to grow the region's cities and local centres, support the protection of high-value environmental assets and make developing a strong, diverse and competitive economy central to building prosperity and resilience in the region (DPE 2019).

The plan guides the NSW Government's land use priorities over the next 20 years, providing an overarching framework to guide subsequent land use plans, development Proposals and infrastructure funding decisions.

The plan is broken down into four goals which detail actions to be considered during the planning process. The four goals include:

- The leading regional economy in Australia.
- A biodiversity-rich natural environment.
- Thriving communities.
- Greater housing choice and jobs.

5.5 APPROVALS AND LICENCES

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

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

Legal instrument	Licence or approval requirement
<i>EP&A Act, Part 4</i>	SSD applications require approval from the Minister for Planning or the Independent Planning Commission. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.

The Applicant must also ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the Building Code of Australia.

6 CONSULTATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Consultation –

During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators, mineral title holders.

In particular, you must undertake detailed consultation with affected landowners surrounding the development and Muswellbrook Shire Council.

The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.

Further consultation after 2 years –

If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS.

6.1 AGENCY CONSULTATION

Secretary's Environmental Assessment Requirements (SEARs)

As the Proposal is classified as SSD, a Scoping Report was prepared, and the SEARs requested for a 25MW (AC) Solar Farm at Muswellbrook. The SEARs were provided by DPE on 8 March 2019 (refer APPENDIX A). The SEARs are intended to guide the structure and content of the EIS and reflect the responsibilities and concerns of NSW government agencies in relation to the environmental assessment of the Proposal.

The following sections provide a summary of the SEARs from the various agencies and cross reference where each agency's specific matters are addressed within this EIS. Additional consultation was undertaken with several of the agencies to clarify some of the issues raised in the SEARs or seek further advice prior to EIS lodgement.

Department of Planning and Environment

Issue summary	Addressed in EIS
The EIS for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000 .	
In particular, the EIS must include: <ul style="list-style-type: none"> • A stand-alone executive summary; 	Executive Summary
<ul style="list-style-type: none"> • A full description of the development, including: <ul style="list-style-type: none"> - Details of construction, operation and decommissioning; 	Section 4
<ul style="list-style-type: none"> - 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); 	Section 4
<ul style="list-style-type: none"> - 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); 	Section 4
<ul style="list-style-type: none"> - A detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development; 	APPENDIX J

Issue summary	Addressed in EIS
<ul style="list-style-type: none"> • A strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including proposed or approved Solar Farms, rural residential development and subdivision potential); 	Section 2 and 3
<ul style="list-style-type: none"> • An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: <ul style="list-style-type: none"> - A description of the existing environment likely to be affected by the development; 	Section 7 and 8
<ul style="list-style-type: none"> - An assessment of the likely impacts of all stages of the development, (which is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; 	Section 7 and 8
<ul style="list-style-type: none"> - 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 	Section 7 and 8
<ul style="list-style-type: none"> • A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and 	Section 9.2
<ul style="list-style-type: none"> • The reasons why the development should be approved having regard to: <ul style="list-style-type: none"> - Relevant matters for consideration under the <i>Environmental Planning and Assessment Act 1979</i>, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; 	Section 5
<ul style="list-style-type: none"> - The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and 	Section 3.6
<ul style="list-style-type: none"> - Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. 	Section 3
<p>The EIS must also be accompanied by a report from a suitably qualified person providing:</p> <ul style="list-style-type: none"> • A detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the Proposal, including details of all assumptions and components from which the CIV calculation is derived; and 	APPENDIX B
<ul style="list-style-type: none"> • Certification that the information provided is accurate at the date of preparation; and 	Page xii
<ul style="list-style-type: none"> • The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation). 	APPENDIX K
<p>Biodiversity –</p> <ul style="list-style-type: none"> • An assessment of the biodiversity values and the likely biodiversity impacts of the project (including on Inland Grey Box woodland endangered ecological community) in accordance with Section 7.9 of the <i>Biodiversity Conservation Act 2016</i> (NSW) the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless DPIE and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values; 	Emergent Ecology Report (Emergent Ecology, 2019) and Section 7.1
<ul style="list-style-type: none"> • The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and 	Emergent Ecology report (Emergent Ecology, 2019) and Section 7.1

Issue summary	Addressed in EIS
<ul style="list-style-type: none"> An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the <i>Fisheries Management Act 1994</i>, and a description of the measures to minimise and rehabilitate impacts. 	Not relevant to Proposal as there are no water courses or aquatic habitat within the Proposal site
<p>Heritage –</p> <ul style="list-style-type: none"> Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents</i>. 	APPENDIX F, Section 7.2 and 0
<p>Land –</p> <p>An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:</p> <ul style="list-style-type: none"> Consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights/tenements (including the Drayton Mine (06_0202)); 	Section 7.3
<ul style="list-style-type: none"> A soil survey to determine the soil characteristics and consider the potential for erosion to occur; and 	APPENDIX G and Section 7.4
<ul style="list-style-type: none"> A cumulative impact assessment of nearby developments. 	Section 8.7
<p>An assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:</p> <ul style="list-style-type: none"> Consideration of existing approvals, licences, titles, tenures and rehabilitation requirements for the site, including those specified under 06_0202 (as modified) and the Mine Operations Plan; 	Section 5
<ul style="list-style-type: none"> Consideration of the zoning provisions applying to the land, including subdivision; 	Section 3.6
<ul style="list-style-type: none"> Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's <i>Land Use Conflict Risk Assessment Guide</i>; and 	Section 7.3
<ul style="list-style-type: none"> A description of measures that would be implemented to remediate the land following decommission in accordance with <i>State Environmental Planning Policy No 55 – Remediation of Land</i>. 	Section 5.2.8
<p>Visual –</p> <ul style="list-style-type: none"> 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. 	APPENDIX H and Section 7.5
<p>Noise –</p> <ul style="list-style-type: none"> Including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and cumulative noise impacts (considering other development in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria. 	Section 7.6
<p>Transport –</p> <ul style="list-style-type: none"> An assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation; 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> An assessment of the likely transport impacts to the site access route (including Thomas Mitchell Drive, New England Highway and Denman Road), site access point, rail safety issues, any Crown land, particularly in relation to the capacity and condition of the roads; 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> A cumulative impact assessment of traffic from nearby developments; 	APPENDIX I and Section 7.7

Issue summary	Addressed in EIS
<ul style="list-style-type: none"> A description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> A description of the measures that would be implemented to mitigate any transport impacts during construction. 	APPENDIX I and Section 7.7
<p>Water –</p> <ul style="list-style-type: none"> An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including drainage channels, wetlands, riparian land, farm dams, 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; 	Section 8.1
<ul style="list-style-type: none"> Details of water requirements and supply arrangements for construction and operation; and 	Section 8.1
<ul style="list-style-type: none"> 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). 	Section 7.4 and 8.1
<p>Hazards and Risks –</p> <ul style="list-style-type: none"> A preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DOP, 2011), and if the preliminary risk screening indicates the development is “<i>potentially hazardous</i>”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with <i>Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis</i> (DOP, 2011) and <i>Multi-Level Risk Assessment</i> (DOP, 2011); and 	Section 8.2
<ul style="list-style-type: none"> An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure. 	Section 8.2
<p>Socio-Economic –</p> <ul style="list-style-type: none"> Including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation. 	Section 8.3
<p>Waste –</p> <ul style="list-style-type: none"> Identify, quantify and classify the likely waste stream to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste. 	Section 8.6
<p>Consultation –</p> <ul style="list-style-type: none"> During the preparation of the EIS, you should consult with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders; 	Section 6
<ul style="list-style-type: none"> In particular, you must undertake detailed consultation with affected landowners surrounding the development and Muswellbrook Shire Council; and 	Section 6
<ul style="list-style-type: none"> The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendment have not been made to address an issue, a short explanation should be provided. 	Section 6
<p>Further consultation after 2 years – If you do not lodge a development application and EIS for the development within 2 years of the issue date of these SEARs, you must consult further with the Secretary in relation to the preparation of the EIS.</p>	Section 6

Department of Planning and Environment – Division of Resources and Geoscience (DRG)

Issue summary	Addressed in this EIS
<ul style="list-style-type: none"> Provide evidence of authentic consultation with nominated stakeholders including DRG. If the proponent is not able to make contact for consultation with any of the nominated parties, the proponent is to contact the Division which will assist with establishing contact. The nominated stakeholders are: <ul style="list-style-type: none"> Maxwell Ventures (Management) Pty Ltd Mt Arthur Coal Pty Ltd Hunter Valley Energy Coal Pty Ltd Dellworth Pty Ltd Wild Plant Hire Pty Ltd 	Section 6
<ul style="list-style-type: none"> Provide a date stamped and referenced map from Minview to record the title tenure details at the time of consultation; 	Offered at time of consultation
<ul style="list-style-type: none"> Show on a map the relationship of existing coal titles to the project boundary (including ancillary infrastructure); and 	Offered at time of consultation
<ul style="list-style-type: none"> Detail any proposed interaction with the proposed Solar Farm, mining titles and any rehabilitation requirements for the site under the Mine Operations Plan. 	Section 5.2.1

Muswellbrook Shire Council

Issue summary	Addressed in this EIS
<p>Traffic - A traffic impact assessment should be prepared in relation to the project, which investigates the effect of additional traffic movements associated with the construction, operational and decommissioning phases of the project on the local and regional road network.</p>	APPENDIX I and Section 7.7
<p>Soils and Land Degradation - Council understands that there are erosion issues in the area, low soil fertility, high salinity and structural issues. Detailed assessment of the soils and geology of the site, and areas that will receive stormwater flows from the site, will need to be included in the application to establish mechanisms for erosion and sediment control, inform the site's management during operation, and intended rehabilitation strategies once the solar array is decommissioned.</p>	APPENDIX G and Section 7.4
<p>Rehabilitation - Council has a keen interest in ensuring that the rehabilitation of mine sites is completed to high standards, in line with industry best practice and to support post mining land uses. This site is currently in the post mining rehabilitation phase. The application should identify what further rehabilitation is proposed prior to construction of the solar array. The application should also include information on the intended rehabilitation for the site when the solar array is decommissioned. It is requested that consideration be given to the employment of micro-relief to the site, in line with the principles of Geofluv design, to ensure long-term site stability and erosion control, and to create a more natural looking landscape post development.</p>	Section 4.7
<p>Economic Opportunities - Council is interested in ensuring the local community would be the beneficiaries of reported economic and employment opportunities. Accordingly, it is requested that the application considers measures that can be put in place to ensure that the project supports local jobs and businesses and results in opportunities for local people to gain skills in the construction and maintenance of solar arrays. Apprenticeships for local young people would be welcomed.</p>	Section 8.3

Department of Industry (DOI) – Water

Issue summary	Addressed in this EIS
<ul style="list-style-type: none"> The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased 	Not applicable to this project
<ul style="list-style-type: none"> A detailed and consolidated site water balance. 	Not applicable to this project
<ul style="list-style-type: none"> Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts. 	Section 8.1
<ul style="list-style-type: none"> Proposed surface and groundwater monitoring activities and methodologies. 	Section 8.1
<ul style="list-style-type: none"> Consideration of relevant legislation, policies and guidelines, including the <i>NSW Aquifer Interference Policy (2012)</i>, the <i>Guidelines for Controlled Activities on Waterfront Land (2018)</i> and the relevant Water Sharing Plans. 	Section 8.1

Department of Planning, Industry and Environment (DPIE)

Issue summary	Addressed in this EIS
<p>Biodiversity -</p> <ul style="list-style-type: none"> Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the BC Act using the BAM and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the BC Act (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless DPIE and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values; 	Emergent Ecology Report (Emergent Ecology, 2019) and Section 7.1
<ul style="list-style-type: none"> The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; 	APPENDIX E (BDAR Waiver)
<ul style="list-style-type: none"> The BDAR must include details of the measures proposed to address the offset obligation as follows; <ul style="list-style-type: none"> The total number and classes of biodiversity credits required to be retired for the development/project; The number and classes of like-for-like biodiversity credits proposed to be retired; The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; Any Proposal to fund a biodiversity conservation action; Any Proposal to make a payment to the Biodiversity Conservation Fund. 	APPENDIX E (BDAR Waiver)
<ul style="list-style-type: none"> If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits; and 	APPENDIX E (BDAR Waiver)
<ul style="list-style-type: none"> The BDAR must be prepared by a person accredited in accordance with the <i>Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017</i> under s6.10 of the BC Act. 	APPENDIX E (BDAR Waiver)

Issue summary	Addressed in this EIS
<p>Aboriginal cultural heritage –</p> <ul style="list-style-type: none"> 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 an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the <i>Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW</i> (DPIE 2010), and be guided by the <i>Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW</i> (DECCW, 2011) and consultation with DPIE regional branch officers; 	APPENDIX F and Section 7.2
<ul style="list-style-type: none"> 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 ACHAR; and 	Section 6.2, APPENDIX F and Section 7.2
<ul style="list-style-type: none"> Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to DPIE. 	APPENDIX F and Section 7.2
<p>Historic heritage –</p> <p>The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:</p> <ul style="list-style-type: none"> 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 <i>NSW Heritage Manual</i> (1996); 	Section 8.4
<ul style="list-style-type: none"> 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); 	Section 8.4
<ul style="list-style-type: none"> Include a statement of heritage impact for all heritage items (including significance assessment); 	Not necessary for Proposal- no anticipated impacts to heritage items
<ul style="list-style-type: none"> 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 	Section 7.6 and Section 8.4
<ul style="list-style-type: none"> 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. 	Not applicable to Proposal as site is heavily impacted from previous mining activities.
<p>Water and soils –</p> <ul style="list-style-type: none"> The EIS must map the following features relevant to water and soils including: <ul style="list-style-type: none"> Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map); 	Section 7.4
<ul style="list-style-type: none"> Rivers, streams, wetlands, estuaries (as described in Section 4.2 of the Biodiversity Assessment Method); 	Section 8.1 and Figure 8-2
<ul style="list-style-type: none"> Wetlands as described in Section 4.2 of the Biodiversity Assessment Method; 	Section 7.1
<ul style="list-style-type: none"> Groundwater; 	Section 8.1 and Figure 8-2
<ul style="list-style-type: none"> Groundwater dependent ecosystems; and 	Section 8.1 and Figure 8-3

Issue summary	Addressed in this EIS
<ul style="list-style-type: none"> - Proposed intake and discharge locations. 	Section 8.1
<ul style="list-style-type: none"> • The EIS must describe background conditions for any water resource likely to be affected by the development, including: <ul style="list-style-type: none"> - Existing surface and groundwater; 	Section 8.1
<ul style="list-style-type: none"> - Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations; 	Section 8.1
<ul style="list-style-type: none"> - Water Quality Objectives including groundwater as appropriate that represent the community's uses and values for the receiving waters; and 	Section 8.1
<ul style="list-style-type: none"> - Indicators and trigger values/criteria for the environmental values (Water Quality Objectives) in accordance with the <i>ANZECC (2000) Guidelines for Fresh and Marine Water Quality</i> and/or local objectives, criteria or targets endorsed by the NSW Government. 	N/A
<p>Water quality – The EIS must assess the impacts of the development on water quality, including:</p> <ul style="list-style-type: none"> • 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; and 	Section 8.1
<ul style="list-style-type: none"> • Identification of proposed monitoring of water quality. 	Water quality monitoring is already undertaken onsite by Maxwell Infrastructure.
<p>Hydrology – The EIS must assess the impact of the development on hydrology, including:</p> <ul style="list-style-type: none"> • Water balance including quantity, quality and source; 	Section 8.1
<ul style="list-style-type: none"> • Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas; 	Section 7.1 and 8.1
<ul style="list-style-type: none"> • 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); 	Section 7.1
<ul style="list-style-type: none"> • Changes to environmental water availability, both regulated/ licensed and unregulated/ rules-based sources of such water; 	Section 8.1
<ul style="list-style-type: none"> • 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; and 	Section 8.1
<ul style="list-style-type: none"> • Identification of proposed monitoring of hydrological attributes. 	Water quality monitoring is already undertaken onsite by Maxwell Infrastructure
<p>Flooding and coastal erosion -</p> <ul style="list-style-type: none"> • The EIS must map the following features relevant to flooding as described in the <i>Floodplain Development Manual 2005</i> (NSW Government, 2005) including: <ul style="list-style-type: none"> - Flood prone land; 	Flood prone land mapping is currently not available for the Muswellbrook LGA. Flooding is discussed in Section 8.1.
<ul style="list-style-type: none"> - Flood planning area, the area below the flood planning level; and 	N/A
<ul style="list-style-type: none"> - Hydraulic categorisation (floodways and flood storage areas). 	N/A
<ul style="list-style-type: none"> • 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. 	Section 8.1.

Issue summary	Addressed in this EIS
<p>The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:</p> <ul style="list-style-type: none"> • 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. 	Section 8.1.
<p>Modelling in the EIS must consider and document:</p> <ul style="list-style-type: none"> • The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. 	Section 8.1.
<ul style="list-style-type: none"> • Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affectation of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. 	Section 8.1.
<ul style="list-style-type: none"> • Relevant provisions of the <i>NSW Floodplain Development Manual 2005</i>. 	Section 8.1.
<p>The EIS must assess the impacts on the proposed development on flood behaviour, including:</p> <ul style="list-style-type: none"> • Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure. 	Section 8.1.
<ul style="list-style-type: none"> • Consistency with Council floodplain risk management plans. 	Section 8.1.
<ul style="list-style-type: none"> • Compatibility with the flood hazard of the land. 	Section 8.1.
<ul style="list-style-type: none"> • Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. 	Section 8.1.
<ul style="list-style-type: none"> • Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. 	Section 8.1.
<ul style="list-style-type: none"> • 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. 	Section 8.1.
<ul style="list-style-type: none"> • 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. 	Section 8.1.
<ul style="list-style-type: none"> • Whether the Proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council. 	Section 8.1.
<ul style="list-style-type: none"> • 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. 	Section 8.1.
<ul style="list-style-type: none"> • Any impacts the development may have on the social and economic costs to the community as consequence of flooding. 	Section 8.1.

Environmental Protection Authority (EPA) NSW

Issue summary	Addressed in this EIS
<p>EPA provided comment regarding whether the proposed Maxwell Solar Farm should remain within the existing Environmental Protection Licence. The Proposal does not appear to involve an activity at or above the relevant threshold set out in Schedule 1 of the POEO Act. Consequently, Muswellbrook Shire Council would be the appropriate regulatory authority for the Proposal.</p>	Section 5

Fire and Rescue (FR) NSW

Issue summary	Addressed in this EIS
Should a fire or hazardous material incident occur, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matter are recommended to be addressed: <ul style="list-style-type: none"> That a comprehensive ERP is developed for the site. 	Section 8.2
<ul style="list-style-type: none"> That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents. 	Section 8.2
<ul style="list-style-type: none"> That the ERP detail the appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical hazards). Such measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination procedures, minimum evacuation zone distances and a safe method for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment). 	Section 8.2
<ul style="list-style-type: none"> Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP. 	Section 8.2
<ul style="list-style-type: none"> That two copies of the ERP (detailed in recommendation above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s. 	Section 8.2
<ul style="list-style-type: none"> One constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council. 	Section 8.2

Roads and Maritime Services

Issue summary	Addressed in this EIS
Roads and Maritime recommends that the EIS should refer to the following guidelines regarding the traffic and transport impacts of the proposed development: <ul style="list-style-type: none"> Road and Related Facilities within the Department of Planning EIS Guidelines, and, 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> Section 2 Traffic Impact Studies of Roads and Maritime's <i>Guide to Traffic Generating Developments 2002</i>. 	APPENDIX I and Section 7.7
A traffic and transport study shall be prepared in accordance with the Road and Maritime's <i>Guide to Traffic Generating Developments 2002</i> and is to include (but not be limited to) the following: <ul style="list-style-type: none"> Assessment of all relevant vehicular traffic routes and intersections for access to/ from the subject properties. 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> Current traffic counts for all the traffic routes and intersections. 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> The anticipated additional vehicular traffic generated from both the construction and operational stages of the project. 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> The distribution on the road network of the trips generated by the proposed development. It is requested that the predicted traffic flows are shown diagrammatically to a level of detail sufficient for easy interpretation. 	APPENDIX I and Section 7.7

Issue summary	Addressed in this EIS
<ul style="list-style-type: none"> Consideration of the traffic impacts on existing and proposed intersections, in particular, the intersections of Thomas Mitchell Drive / New England Highway and Thomas Mitchell Drive /Denman Road, and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development during both the construction and operational stages. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area. 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> Identify the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network for the development. In this regard, preliminary concept drawings shall be submitted with the EIS for any identified road infrastructure upgrades. However, it should be noted that any identified road infrastructure upgrades will need to be to the satisfaction of Roads and Maritime and Council. 	Not necessary for Proposal- no road upgrades have been identified
<ul style="list-style-type: none"> Traffic analysis of any major / relevant intersections impacted, using SIDRA or similar traffic model, including: <ul style="list-style-type: none"> Current traffic counts and 10-year traffic growth projections With and without development scenarios 95th percentile back of queue lengths Delays and level of service on all legs for the relevant intersections Electronic data for Roads and Maritime review. 	APPENDIX I and Section 7.7
<ul style="list-style-type: none"> Any other impacts on the regional and state road network including consideration of pedestrian, cyclist and public transport facilities and provision for service vehicles. 	APPENDIX I and Section 7.7

6.2 ABORIGINAL COMMUNITY CONSULTATION

6.2.1 Local Aboriginal Land Council and Registered Aboriginal Parties

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 NSW Office of Environment and Heritage’s (DPIE) *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRP) (DPIE, 2010) guide provided by DPIE. The guide outlines a four-stage process of consultation as follows:

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

The full list of consultation steps, including those groups and individuals that were contacted and a consultation log, is provided in Appendix A of the Aboriginal Cultural Heritage Assessment Report (ACHAR).

Formal Aboriginal community consultation was undertaken as outlined in the ACHCRP (DPIE, 2010). This included advertising in the *Hunter Valley News* on 6 March 2019 and writing to prescribed agencies including DPIE seeking interested parties, which also occurred on 31 January 2019 (refer to Appendix C and E of the ACHAR (APPENDIX F of this EIS)).

A total of 30 Aboriginal organisations registered their interest in the Maxwell Solar Farm project.

The process for the additional survey areas was as follows:

- A proposed methodology was provided to registered parties for comment, allowing a minimum 28-day review period.
- An ACHAR survey was conducted on 10 April 2019 and seven Registered Aboriginal Parties (RAPs) attended the fieldwork.
- The draft ACHAR report (APPENDIX F) was provided to the registered parties for comment with a minimum 28-day review period.

6.2.2 *Aboriginal Community Feedback*

Community consultation occurred throughout the preparation of the ACHAR. The draft report was provided to each of the RAPs and feedback was sought on the recommendations, the assessment and any other issues that may have been important. The period for RAPs comments on the draft assessment closed on 15 May 2019. A total of 13 responses were received supporting the assessment and management recommendations, one response not in support, two responses with no comment, two general comments and 12 RAPs did not provide any comments.

Table 6-1 RAP responses to draft ACHAR

Registered Aboriginal Party	Date	Method	Summary of response	Response
Wonnarua Elder LHWCS	17/04/19	Email	Requested hard copy of the report	A hard copy of the report sent 18 April 2019
Merrigarn	18/04/19	Email	Endorsed the assessment	None required
AHCS	22/04/19	Email	Endorsed the assessment	None required
Murrabidgee Mullangari	22/04/19	Email	Endorsed the assessment	None required
Divine Diggers	23/04/19	Email	Endorsed the assessment	None required
Tocomwall (PCWP)	23/04/19	Email	Four issues raised: 1) Stated no attempts have been made to contact the PCWP 2) Section on Native Title Claims is not detailed enough 3) Rejects statement that 'no Aboriginal cultural values within the study area' and further noted there are cultural values within the study area	1) An invitation was sent to RAPs to meet to discuss cultural values. In addition, Mary Franks attended the survey. 2) Further detail will be added to that section. 3) Statement reworded to 'RAPs did not identify any Aboriginal cultural values within the study area'.

Registered Aboriginal Party	Date	Method	Summary of response	Response
			4) creating a Solar Farm was a violation of the original mine approval.	4) Maxwell has met their obligations regarding rehabilitation of the site.
Tocomwall (PCWP)	30/04/19	Email	Scott Franks responded that he would review the provided information and would be open to a paid meeting.	On 3 May 2019 Geordie discussed this with Scott on the phone with Scott stating 'contact Danny Franks for rates'. An email was sent to Danny on 3 May 2019 requesting rates. Danny responded on 15 May 2019 asking if a meeting had been arranged. Geordie responded on 15 May 2019 that no meeting had been arranged and requesting meeting rates.
Wallagan Cultural Services	23/04/19	Email	Endorsed the assessment	None required
Culturally Aware	24/04/19	Email	Responded in support of the ACHAR. In addition, had questions around economic issues and benefits of the project to the community	On 3 May 2019 a response was provided that there were few job opportunities within the Solar Farm with only two long-term positions available. Nonetheless, Malabar uses Blackrock Industries as a service provider on site for general labour and land management works. Blackrock, which is based in Muswellbrook, is 100 percent indigenous owned.
Ungooroo Aboriginal Corporation	29/04/19	Email	Melanie stated she would forward to Allen Paget for comment	None required
Muragadi	1/05/19	Email	Responded in support of the ACHAR	None required
Giddawaa Walang	2/05/19	Email	Stated they did not have any comments	None required

Registered Aboriginal Party	Date	Method	Summary of response	Response
A1 Indigenous Services	5/05/19	Email	Responded in support of the ACHAR	None required
John Mathews	15/05/19	Phone	John indicated that artefacts were discovered near a dam in the vicinity of the mine and that he hoped to be able to survey that area.	It was explained that the dam was not part of the study area and John stated that he and Margaret were happy with the findings of the report.
Wattaka WCCS LH	15/05/19	Phone	Des indicated support of the ACHAR proving that the assessment of no cultural values or sites came from the RAPs and not solely from the AECOM archaeologists.	None required
Norman Archibald	15/05/19	Phone	Norman in support of the ACHAR providing that the creek line was surveyed.	None required
Kawul Cultural Services	15/05/19	Phone	Responded in support of the ACHAR.	None required
WLALC	15/05/19	Phone	Noel indicated that he would call or email back with comments that afternoon. Noel later emailed that he had nothing to add.	None required
Dave Horton	15/05/19	Phone	Responded in support of the ACHAR.	None required

6.3 BROADER COMMUNITY CONSULTATION

Community and stakeholder consultation is integral to the Proposal. In 2017, DPE updated their guidelines for community and stakeholder engagement (DPE, 2017), which describe how expectations for engagement have increased and stressing the importance of early engagement.

Maxwell is committed to engaging with the local community and ensuring that information is widely available for the proposed Maxwell Solar Farm.

6.4 COMMUNITY CONSULTATION STRATEGY

A Community Consultation Strategy (CCS) has been prepared to provide a framework to further engage with the community and stakeholders about the Proposal and to provide opportunities to offer input into

the assessment and development process. Stakeholders have been identified as those potentially being impacted by the Proposal or having an interest in the project.

A range of community stakeholders were identified for the project based on land ownership information. Given the small nature of the project and the minimal environmental impacts associated with this type of project, the community stakeholders to be consulted included all privately-owned residences along Balmoral Road, Pamger Drive and a small section along the New England Highway (see Figure 6-1). In addition, neighbouring mines, Muswellbrook Shire Council and the existing Maxwell Infrastructure Community Consultative Committee (CCC) were also be consulted regarding the project.

Consultation Process

1. Malabar Coal to call privately owned residences to:
 - a. Provide an overview of the project.
 - b. Discuss any concerns regarding the project.
 - c. Document any support for the project.
 - d. If issues or concerns cannot be resolved over the phone, arrange to visit the resident to discuss further.
2. Malabar Coal to distribute a community newsletter with information on the project.
3. Malabar Coal to present the project to the existing Maxwell Infrastructure (CCC).
4. Malabar Coal to engage directly with neighbouring mines to provide information on the project.
5. Malabar Coal to engage directly with Muswellbrook Shire Council to provide information on the project.
6. Malabar Coal to engage directly with State and Federal members to provide information on the project.
7. Malabar Coal to maintain a website with information on the project.
8. Malabar Coal to maintain a 24-hour community hotline for any feedback on the project.



Figure 6-1 Residents identified for community consultation (extract from Maxwell Solar Farm Community Consultation Strategy)

6.5 COMMUNITY CONSULTATION ACTIVITIES TO DATE

Direct contact with residential neighbours

A total of 17 residential neighbours were contacted in the Antiene area for consultation either by phone or in writing or both.

- Seven residents were engaged in a telephone conversation and required no further information.
 - Four expressed support for the Proposal, no-one expressed an objection.
 - Questioning included usage of the electricity produced, operation on cloudy days, commencement timing, employment and noise from the development.
- One resident requested a follow up visit. On that visit location size and capacity were discussed. The resident was not opposed to the Proposal.
- Four residents were not contactable by phone. A letter was delivered to three residents with no subsequent response. The fourth resident no longer had a mailbox nor connected phone and no other contact was made.
- Five residents had two messages left by phone with no response.

Representative bodies

The Maxwell Infrastructure Community Consultative Committee (CCC) received updates on September 2018 and March 2019. The CCC includes a representative of Muswellbrook shire council, local businesses and residents from the neighbouring Antiene area. Questions were asked about noise from construction and visibility. No objections were raised.

The Spur Hill CCC received information in a presentation in October 2018. The CCC includes a representative of Muswellbrook Shire Council, an aboriginal group, local businesses and residents from the local government area. No objections were raised.

Muswellbrook Shire Council consultation has included:

- Representation at CCCs, as described above.
- Letter to the Mayor introducing the project 24 August 2018.
- A meeting with Council staff 4 October 2018, which included Maxwell Solar Farm consultation.
- A meeting with Council 24 April 2019 specifically consulting on the Solar Farm.
- A site visit and presentation on all Malabar activities including the Maxwell Solar Farm on 8 May 2019.
- No specific objections to the Solar Farm have been raised. It is noted that Council shall take an interest in final land uses.

Broader community and local businesses

Two community Information sessions were held on 21 and 22 November 2018 covering both the proposed Maxwell underground project and the proposed Maxwell Solar Farm. Forty-eight community members completed their details on the attendance sheet at the information sessions. An attended stall with information and pictures was dedicated to the Maxwell Solar Farm. Questions about the Solar Farm were general in nature and inquisitive, including its location and size. No issues or objections were raised with the Proposal. No comments were left regarding the Solar Farm in the attendance sheet.

Community Newsletters including updates were distributed on August 2018, February 2019 and June 2019. The newsletters were distributed to neighbours and within the Muswellbrook Local Government area.

Malabar maintains a website with information on the Maxwell Solar Farm Proposal and a community hotline telephone.

6.6 COAL OPERATOR AND QUARRY OPERATOR CONSULTATION

Following issue of the SEARs, it was noted that there are no current mineral or petroleum titles or applications in the vicinity of the site. There are three coal operations and one extractive quarry within the immediate vicinity which warrant consultation regarding this Proposal. The relevant operations are:

- Maxwell Infrastructure (formally Drayton Mine) – Held by Maxwell Ventures (Management) Pty Ltd.
- Mt Arthur – Held by Mt Arthur Coal Pty Ltd and Hunter Valley Energy Coal Pty Ltd.
- Savoy Hill – Dellworth Pty Ltd (subsidiary of NuCoal Resources Ltd).
- Wild Quarry – Wild Plant Hire Pty Ltd.

Maxwell Infrastructure is the mine site undergoing rehabilitation on which the Maxwell Solar Farm is proposed to be located. Both Maxwell Infrastructure (Management) Pty Ltd and Maxwell Solar Pty Ltd are fully owned by Malabar Coal Ltd. The directors of Malabar Coal Ltd are fully aware of and supportive of the Maxwell Solar Farm Proposal.

A meeting was held with Hunter Valley Energy Coal (HVEC); the owner of Mt Arthur Mine on 28 March 2019. Information on the Solar Farm project was provided. HVEC raised no objections to the Proposal.

On 9 May 2019 a meeting was held with NuCoal; the owner of Savoy Hill Exploration Licence. Information on the project was provided. NuCoal raised no objections to the Proposal.

A meeting was held with Wild Quarries on 15 March 2019. Wild Quarries is supportive of the Proposal.

Correspondence was also exchanged with the NSW Department of Resources and Geoscience (DRG) regarding consultation with neighbouring mines flagged in the SEARS. The DRG confirmed on 30 April 2019 that consultation with the DRG was satisfactory.

6.7 GOVERNMENT CONSULTATION

To date no consultation has been undertaken with the Commonwealth Government. This EIS has considered Matters of National Environmental Significance and has concluded that it would be highly unlikely for the project to generate an adverse impact for any Commonwealth Matter of National Environmental Significance (MNES). As such, an EPBC referral is not considered to be required for the Proposal.

Correspondence has been sent to the Honourable Federal member for Hunter, Joel Fitzgibbon, and the State member for the Upper Hunter, Michael Johnsen, on 24 August 2018 introducing the Proposal and providing the initial press release. Michael Johnsen also inspected the site.

Additionally, correspondence has been sent to the Mayor for Muswellbrook Shire Council on 24 August 2018 introducing the Proposal and providing the initial press release. The Mayor and representatives of Council staff also visited the site.

6.8 INFRASTRUCTURE AND SERVICE PROVIDER CONSULTATION

Consultation undertaken with Muswellbrook Shire Council is outlined in Section 6.1. Consultation with Roads and Maritime Services was not required for this Proposal.

In addition to conducting studies to assess the capability of the electricity network, Maxwell Infrastructure has been in consultation with AGL and Ausgrid, as the operator of the existing 33kV powerline to the east of the existing Maxwell Infrastructure substation.

6.9 FUTURE AND ONGOING CONSULTATION

When the EIS is placed on public exhibition, Maxwell Infrastructure would notify all interested parties and stakeholders that public consultation has begun, via the Maxwell Infrastructure website. The notification would provide the dates of public exhibition and where to find the EIS.

Maxwell Infrastructure further proposes to provide an opportunity for community members to discuss the EIS and explain any technical aspects of the Proposal. Maxwell Infrastructure would again distribute a factsheet with key details contained in the EIS to the broader community within a 10km radius of the Proposal site.

7 ASSESSMENT OF KEY ISSUES

7.1 BIODIVERSITY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Biodiversity –

- An assessment of the biodiversity values and the likely biodiversity impacts of the project (including on Inland Grey Box woodland endangered ecological community) in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW) the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless DPIE and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values;
- The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and
- An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the Fisheries Management Act 1994, and a description of the measures to minimise and rehabilitate impacts.

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

Biodiversity -

- Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the BC Act using the BAM and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the BC Act (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless DPIE and DPE determine that the proposed development is not likely to have any significant impact on biodiversity values.
- The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.
- The BDAR must include details of the measures proposed to address the offset obligation as follows;
 - The total number and classes of biodiversity credits required to be retired for the development/project;
 - The number and classes of like-for-like biodiversity credits proposed to be retired;
 - The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;
 - Any Proposal to fund a biodiversity conservation action;
 - Any Proposal to make a payment to the Biodiversity Conservation Fund.
- If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.
- The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act.

7.1.1 Approach

A request to waive the SEARs requirement for a Biodiversity Development Assessment Report (BDAR) was submitted to the Department of Planning and Environment and the Office of Environment and Heritage on 26 April 2019. The waiver included a biodiversity assessment to support the request to waive the requirement against the relevant biodiversity values contained in Clause 1.5 of the BC Act and Clauses 1.4 and 6.1 of the Biodiversity Conservation Regulation 2017. Additionally, the waiver was prepared in accordance with the DPE's *Fact Sheet: Biodiversity development assessment report waiver determinations for SSD and SSI applications* (DPE, 2018b).

The BDAR waiver was sought on the grounds that the vegetation integrity score was less than 10 due to species present being primarily exotic.

A waiver was granted under Section 7.9(2) of the BC Act on 1 July 2019 by the Department of Planning, Industry and Environment (DPIE) (refer to APPENDIX E)

The BDAR waiver was prepared by Emergent Ecology (Emergent Ecology, 2019), with an extract presented below.

7.1.2 Field survey methods

Systematic plot-based floristic surveys in accordance with the Biodiversity Assessment Method (BAM) were undertaken within the 132.5ha Proposal site on 27 November 2018 by Alaina Casey (Senior Ecologist/BAM accredited assessor) and Tasman Willis (Principal Ecologist). The details of the field surveys are provided in the following sections.

7.1.3 Plant community types and vegetation zone determination

In accordance with the BAM, the Proposal site was divided into preliminary plant community types (PCTs) and vegetation zones based on the composition and condition of the existing vegetation, utilising site knowledge and aerial photo interpretation. The vegetation of the Proposal site is in early stage rehabilitation which does not currently correspond with any PCT listed on the Vegetation Information System (VIS). To select the most appropriate PCT to assign to the vegetation of the Proposal site, a review was undertaken to find a PCT that occurs in nearby remnants, would occur in a similar topographic position and would be an appropriate target community for the rehabilitation areas. The PCT determined to be most appropriate was PCT 1604: *Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter*. For the purposes of entering data into the BAM calculator (DPIE 2018b), all vegetation on the Proposal site is treated as PCT 1604. While this PCT has been selected to enable use of the calculator, the vegetation of the Proposal site does not currently align with this community.

The vegetation of the Proposal site was divided into three vegetation zones and one area of non-vegetated land (i.e. haul road and hard stand) (refer to Figure 7-1).

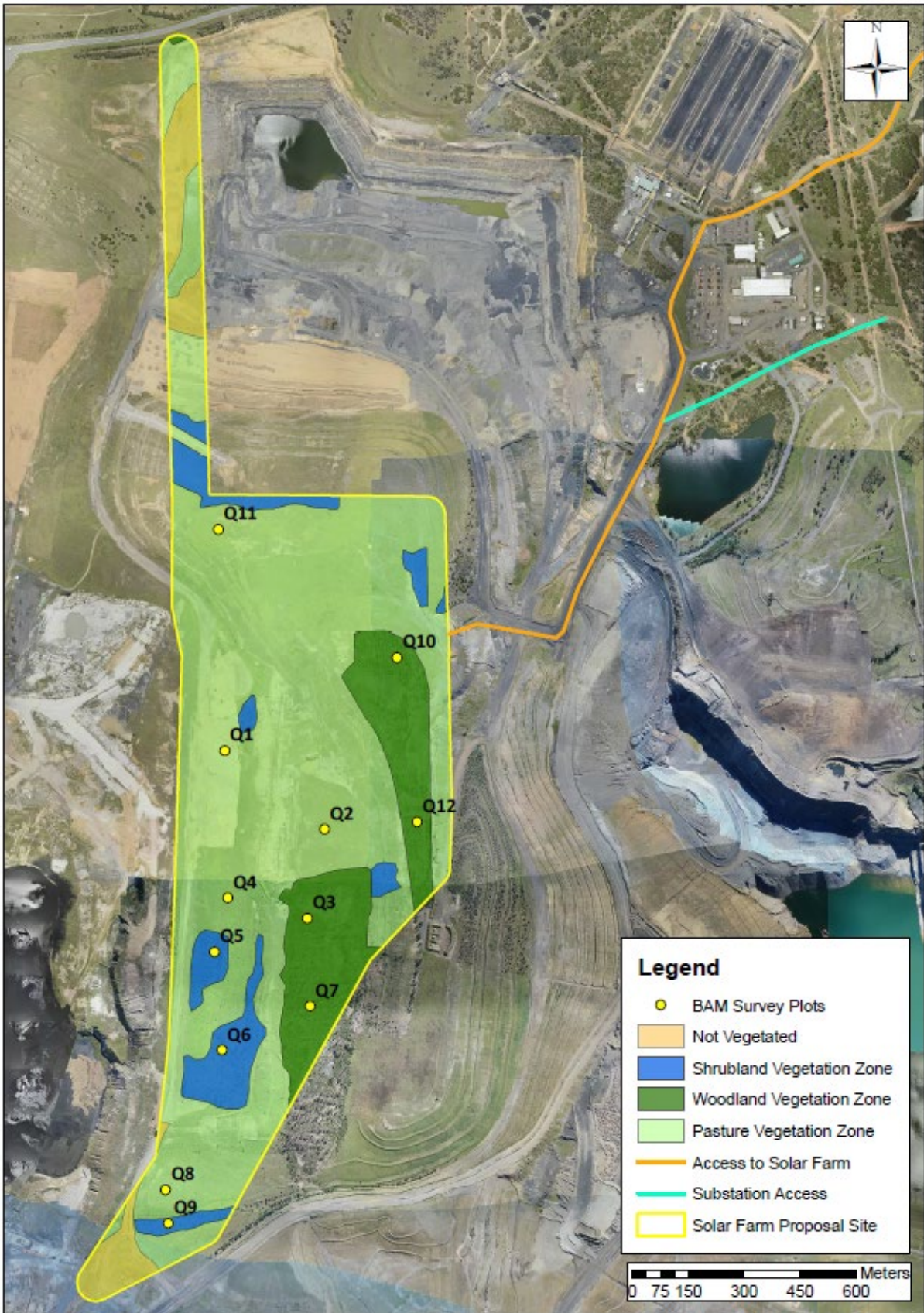


Figure 7-1 Vegetation zones and plot locations (Source: Emergent Ecology, 2019)

7.1.4 Existing environment

Vegetation

The vegetation within the Proposal site occurs on mine overburden rehabilitation. Vegetation establishment in the rehabilitation commenced in 2000 and ceased in approximately 2010. Detailed records of methodologies were not available, however, techniques would have included importing and spreading salvaged topsoil, application of ameliorant (such as gypsum) and a combination of direct seeding and tubestock planting. Local native species were used in some areas of the rehabilitation, however non-local species considered to be weeds were also used, in particular Sugar Gum (*Eucalyptus cladocalyx*) and Golden Wreath Wattle (*Acacia saligna*).

The rehabilitation is in early successional stages and as such the vegetation has simplified floristic and structural values and functional attributes are minimal. The most appropriate PCT for the Proposal site was determined to be 1604: *Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter*. This PCT is generally found to be consistent with a BC Act listed endangered ecological community (EEC): *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions*. The vegetation of the Proposal site does not currently correspond with this EEC.

Three vegetation zones representing variations in composition and/or condition of PCT 1604 were defined and are described in the following sections. The descriptions are based on the data obtained from systematic plot-based sampling. A full flora list is provided in Appendix 1 of the BDAR waiver (Emergent Ecology, 2019). A total of 74 flora species were recorded across all 12 plots, 32 of which are native (43%), 33 introduced and 9 are high threat exotics.

Pasture (rehabilitation) zone

The pasture zone comprises a grassland established from rehabilitation of mined land. It supports native and introduced grasses and forbs, a foliage cover of up to 90% and a height range of 0.2 – 1 metre (Figure 7-2). A total of 50 species were recorded across the five pasture plots, 19 of which were native (38%), 26 introduced and 5 high threat exotics. A full flora list is provided in Appendix 1 of the BDAR waiver (Emergent Ecology, 2019). While there is a reasonable diversity of native species, these occurred at low cover compared to the dominating introduced species.

Woodland (rehabilitation) zone

This zone comprises a developing woodland on rehabilitated mined land that includes an open canopy of immature trees established from direct seeding and tube stock planting (Figure 7-3). A total of 42 species were recorded in this zone, 18 of which were native (43%), 18 introduced and 6 high threat exotics. A full flora list is provided in Appendix 1 of the BDAR waiver (Emergent Ecology, 2019). While there is a moderate diversity of native species, these occurred at low cover compared to the dominating introduced species.



Figure 7-2 Pasture vegetation zone (Source: Emergent Ecology, 2019)



Figure 7-3 Woodland vegetation zone (Source: Emergent Ecology, 2019)

Shrubland (rehabilitation) zone

This zone comprises a developing shrubland on rehabilitated mined land that includes an open canopy of shrubs established from direct seeding and tube stock planting practices (Figure 7-4). A total of 30 species were recorded in this zone, 8 of which were native (27%), 16 introduced and 6 high threat exotics. A full flora list is provided in Appendix 1 of the BDAR waiver (Emergent Ecology, 2019) there is a reasonable diversity of native species, these occurred at low cover compared to the dominating introduced species.

Not vegetated

The 'not vegetated' zone is in the south-west corner of the Proposal site and along the 66kV powerline option (to the north of the proposed solar panels). The not vegetated zone incorporates a disused haul road and hard stand area to the south and northern void. This zone is 7.22ha and does not support any vegetation, native or introduced. Given the lack of vegetation, no assessment was undertaken in this zone.



Figure 7-4 Shrubland vegetation zone (Emergent Ecology, 2019)

Threatened fauna and flora

Annual ecological monitoring as part of the current mining project approvals has been undertaken at six flora sites and one fauna site within the Solar Farm Proposal site since 2013. No threatened flora species have been recorded within the Proposal site during the field surveys or previous ecological monitoring. A total of five threatened micro-bat species have been recorded through echolocation analysis at the fauna monitoring site as shown in Figure 7-5. The Proposal site offers marginal foraging habitat for these species that would be utilised as part of a wider foraging range, however, lacks suitable roosting habitats. Species recorded are listed in Table 3.2 of the BDAR waiver (Emergent Ecology, 2019). No other threatened fauna species have been recorded within the Proposal site since ecological monitoring commenced in 2013.

The BAM calculator predicts threatened species (flora and fauna) that could have potential to occur within the Proposal site. Appendix 2 of the BDAR waiver (Emergent Ecology, 2019) provides an assessment of threatened flora and fauna species that could have potential to occur in the Proposal site. Species considered included the predicted and candidate species generated from the BAM calculator, as well as species returned from a search of BioNet within a 10-kilometre radius of the Proposal site.

Connectivity

The Proposal site is positioned on rehabilitated overburden within the cleared landscape of the mine site and currently does not have connectivity with any native vegetation remnants. The nearest remnant native vegetation from the proposed solar array is approximately one kilometre to the north-east and two kilometres to the south-east. The Drayton Wildlife Refuge offset area occurs approximately two kilometres to the north-east of the Proposal site. The conceptual woodland corridor (documented in the project approval for the Drayton Mine Extension) connects this area to the southern rehabilitation areas (refer to figure Figure 7-5 through the Proposal site. To accommodate the Proposal, the woodland corridor has been re-positioned to the east of the Proposal site with no net loss to corridor size and functionality.

7.1.5 Potential impacts

Removal of vegetation

The Proposal will result in the removal of up to 29.93ha of immature revegetated woodland/shrubland and 95.35ha pasture. The positioning of infrastructure required for the Proposal has some flexibility to avoid or minimise impacts on environmental constraints. Existing viable revegetated areas that occur on the Proposal site will be retained where possible and tree clearing will be minimised through optimising the layout.

Threatened fauna and flora

No threatened flora species or threatened ecological communities have been recorded within the Proposal site. Five threatened micro-bat species have been recorded through echolocation analysis, being the Large-eared Pied-bat, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat and the Southern Myotis.

An assessment of habitat suitability for a range of threatened species was undertaken to determine if there would be any potential impact on threatened species as a result of the Proposal. No threatened flora species were found to have potential to occur. A total of 26 species of bird and micro-bat species were considered to have low potential to utilise the marginal foraging habitats opportunistically. Given the condition of the vegetation and the lack of nesting and roosting habitats, it is not likely that any threatened fauna species would be resident in the Proposal site.

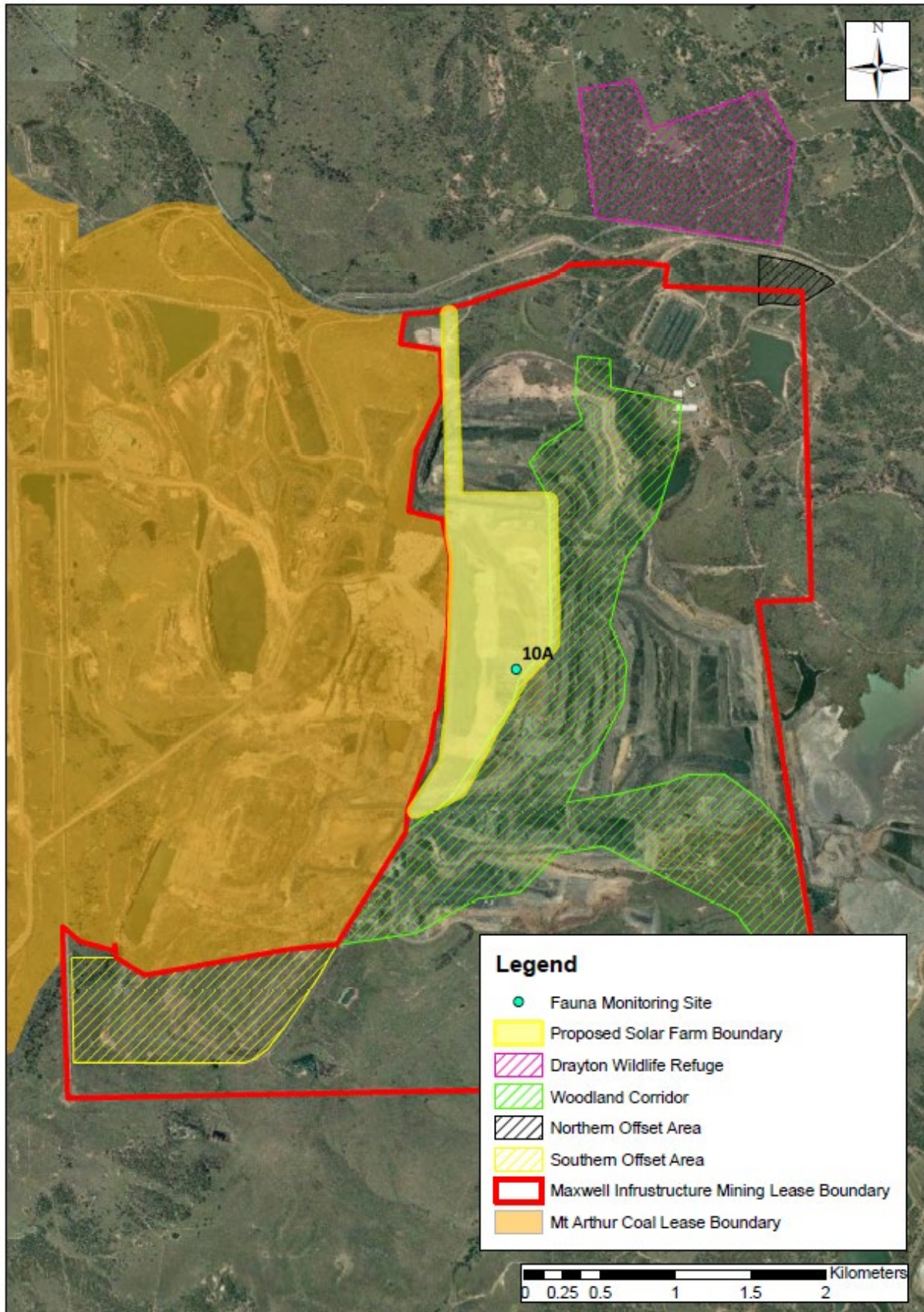


Figure 7-5 Offset areas and connection corridor (Source: Emergent Ecology, 2019)

7.1.6 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise biodiversity risks are provided in Table 7-1.

Table 7-1 Safeguards and mitigation measures for biodiversity impacts

No.	Safeguards and mitigation measures	C	O	D
BD1	<p>The following plans are to be prepared and approved by the relevant authorities:</p> <ul style="list-style-type: none"> • Construction Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. <p>The plans should include but not be limited to the relevant commitments below.</p>	Pre-construction		
BD2	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Weed Management Plan.	C	O	
BD3	Priority weeds shall be managed according to the requirements of the <i>Biosecurity Act 2015</i> , in that they are to be disposed of at a licenced waste management facility or similar. Priority weeds are not to be mulched and repurposed for any landscaping use	C	O	
BD4	Construction areas would be stabilised as soon as practicable (progressively where possible).	C		

C: Construction; O: Operation; D: Decommissioning

7.2 ABORIGINAL HERITAGE

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues.

Heritage –

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents;

OFFICE OF ENVIRONMENT AND HERITAGE REQUIREMENTS

Aboriginal cultural heritage -

- 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 an Aboriginal Cultural Heritage Assessment Report (ACHAR). This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (DPIE 2010), and be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with DPIE regional branch officers.
- Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.
- Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any

conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to DPIE.

AECOM prepared an Aboriginal Cultural Heritage Assessment Report (ACHAR) 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 F and summarised below.

The ACHAR has been undertaken in accordance with the SEARs, clause 60C of the National Parks and Wildlife Regulation 2009 and reference to the following guidelines:

- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011).
- Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010).
- Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2011a).
- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Australia International Council on Monuments and Sites [ICOMOS], 2013).
- Ask First: A Guide to Respecting Indigenous Heritage Places and Values (Australian Heritage Commission, 2002).
- Engage Early (Department of the Environment, 2016).

Aboriginal community consultation for the assessment was undertaken in accordance with DPIE's Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010) (Consultation Requirements) and clause 80C of the NSW National Parks and Wildlife Regulation 2009. Correspondence is provided in Appendices C to I of the ACHAR (APPENDIX F of this EIS).

7.2.1 Background

Formal archaeological interest in the Aboriginal archaeological record of the Hunter Valley can be traced to the late 1930s, with the then Curator of Anthropology at the Australian Museum Fred McCarthy undertaking an archaeological reconnaissance of the Valley in 1939 (Moore, 1970). McCarthy's subsequent investigation, with F.A. Davidson, of an extensive open artefact site on a terrace of the Hunter River at Gowrie, near Singleton, is widely regarded as the first serious archaeological study of stone artefacts in the Hunter Valley proper (McCarthy & Davidson, 1943). McCarthy's early endeavours aside, more detailed investigation of the Valley's Aboriginal archaeological record did not begin until the mid-to-late 1960s, a period that witnessed a series of archaeological surveys and site excavations completed as part of the Australian Museum's long term and wide ranging archaeological research project into the Aboriginal prehistory of the Hunter Valley (Moore, 1970).

Intensive development activities since this time have secured the Hunter Valley's place as one of the most intensively investigated archaeological regions in Australia, with hundreds, if not thousands, of Aboriginal archaeological investigations involving survey and/or excavation having now been undertaken, the majority as part of larger environmental impact assessments associated with coal mining projects. Not surprisingly, these investigations have varied significantly in scale and scope, ranging from targeted small-scale surveys to complex, multi-phase survey and excavation projects over large areas. Nonetheless, together, they have generated a large and diverse body of evidence for past Aboriginal occupation, with thousands of Aboriginal sites now registered on DPIE's AHIMS database.

Database searches

The AHIMS database, administered by the DPIE, contains records of all Aboriginal objects reported to the Secretary of the Department of Premier and Cabinet in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places that have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as ‘Aboriginal sites’.

Searches of the AHIMS database were undertaken on 18 June 2019 for a 5km by 5km area centred on the study area resulting in the identification of 56 Aboriginal sites, comprising 55 open artefact sites (i.e. isolated artefacts and artefact scatters) (four of which have associated areas of Potential Archaeological Deposit (PAD)) and one midden site (Table 7-2).

Consideration of the location of previously recorded Aboriginal sites indicates that none are located within the study area with the closest site – open artefact and PAD site ‘Ramrod R10’ (AHIMS ID#37-2-2347) located 110m from the existing road access.

Table 7-2 AHIMS site search results (20 x 20km area)

Site type	Count	%
Open artefact site (i.e. isolated artefacts and artefact scatters)	51	91.1%
Open artefact site with PAD	4	7.1%
Midden	1	1.8%
Total	56	100

Previous archaeological investigations within the study area

Existing AHIMS data indicates that numerous Aboriginal archaeological investigations incorporating survey and/or test excavation have been undertaken within the study area since the 1970s. Investigations undertaken directly within the study area include targeted surveys in 1978, 1980, 2002 and 2006 as part of Maxwell Infrastructure. In addition to these, one archaeological salvage incorporating surface collection, mechanical grader scrapes and hand excavation was undertaken by ARAS (2010). Summaries of these assessments are provided in Table 7-3.

Table 7-3 Previous Aboriginal Heritage Assessments

Consultant	Year	Project/ location	Assessment type	Summary of results
Kammainga	1978	Drayton Coal Lease	Survey	Kammainga undertook a targeted survey of land within the Drayton Coal Lease as part of the preparation of the EIS for the coal mine. No Aboriginal sites were identified during the survey.
L.K. Dyall	1980	Drayton Coal Lease	Survey	Dyall undertook a survey of an area immediately south of the Bayswater Colliery and north of the study area within the Maxwell Infrastructure area. Three sites, all artefact scatters, were recorded on the banks of Saddlers Creek. The sites contained flakes, cores and backed blades of chert, rhyolite (tuff) and quartz.

Consultant	Year	Project/ location	Assessment type	Summary of results
HLA Envirosciences	2002	Drayton Mine Extension	Survey	HLA Envirosciences completed an archaeological survey for the Drayton Mine extension. A total of 14 artefact scatters were located during survey. Indurated mudstone/tuff was the dominant material (51%), followed by silcrete (39%), quartz (5%) and porcellanite (5%). Artefacts comprised flakes (49%), flaked pieces (41%), cores (9%), and backed blades (1%). All sites were located along creeklines, ridgelines or crests.
Archaeological Risk Assessment Services	2006	Drayton Mine Extension	Survey	ARAS undertook an assessment for the Drayton Mine extension. A total of 480 stone artefacts were recorded from 39 sites that were identified, comprising of 22 artefact scatters and 17 isolated finds. A large proportion of the sites contained less than 10 artefacts, though five sites had over 50 artefacts and were associated with drainage lines or gullies. Of the 480 artefacts identified, 38% were complete flakes, 31% broken flakes, 26% flaked pieces and 5% cores. Most artefacts were of indurated mudstone/tuff (55%), followed by silcrete (25%), porcellanite (14%) and quartz (4.6%).
Archaeological Risk Assessment Services	2010	Drayton Mine Extension	Survey and salvage	ARAS undertook a program of salvage excavation for 26 Aboriginal sites for the Drayton Mine Extension Project. The salvage included surface collection of artefacts at 22 sites, mechanical grader scrapes at 11 locations and hand excavation at three locations. A total of 8505 artefacts were recovered as part of the works. Of these, 7500 artefacts were recovered from three distinct knapping locations at Ramrod Creek, identifying the creek as archaeologically sensitive. OSL (optically stimulated luminescence) dating of deposits at Ramrod Creek and Delpah returned dates of 3-1.4 ka years ago, placing them in the Late Holocene. Raw materials utilised included porcellanite, silcrete, tuff and chert. At Ramrod Creek, porcellanite was the dominant raw material, while at Delpah, silcrete and tuff were dominant. ARAS proposed two main site types, reflecting two differing site functions, were present within the study area: fringe sites representing short-term occupation, and sites principally focused on the manufacture of backed artefacts. On the basis of site size (i.e. number of artefacts) and the ratio of discarded tools to waste material, ARAS (2010) proposed that sites adjacent to ridgelines and overlooking ephemeral water systems were the result of 'short term settlement'. Conversely, ARAS (2010) found sites associated with Ramrod Creek were specific to stone tool manufacturing activities, with emphasis on producing Bondi points from porcellanite.



Figure 7-6 AHIMS sites (Source: AECOM, 2019)

7.2.2 Archaeological survey

Aim and objectives

The archaeological survey contributed to the objectives of the ACHAR, which were:

- to identify the Aboriginal cultural heritage values of the study area by way of background research, archaeological survey and consultation with RAPs.
- to assess the potential impact of the Project on the identified Aboriginal cultural heritage values of the study area.
- to provide an appropriate management strategy for avoiding or minimising potential harm to the identified Aboriginal cultural heritage values of the study area.
- to compile an ACHAR that will assist the Secretary of the DP&E in their assessment of the current SSD application.

To achieve the ACHAR objectives, the archaeological survey aimed to identify, record and map Aboriginal heritage values within the study area. These values include both the tangible remains of past Aboriginal activity (i.e. archaeological evidence) as well as intangible cultural values. The following specific survey objectives were developed:

- To comprehensively survey, by pedestrian transects, land within the study area where topsoil collected prior to open-cut mining has been utilised as part of the rehabilitation process.
- To identify and record Aboriginal archaeological objects within the study area.
- To obtain enough data to facilitate the development of appropriate management and mitigation measures for identified Aboriginal sites and areas of archaeological sensitivity.
- To capture cultural values information

Methodology

A field team of two AECOM heritage specialists (Geordie Oakes and Dr Andrew McLaren) and Registered Aboriginal Party (RAP) representatives completed the archaeological survey within the study area on 10 April 2019. The project methodology issued to RAPs on 10 March 2019 indicated that archaeological survey was proposed within the portions where project related impacts are proposed and where topsoil collected prior to mining has been utilised as part of the rehabilitation process. This portion of the study area was approximately 96 ha in size.

All survey was conducted on foot, with a total of four transects executed across the study area. Participants in the survey (ten) were spaced roughly at 10m intervals during the survey. Areas of steep terrain or where machinery/plant was actively working on rehabilitation of the open cut mine were not surveyed due to restricted access for safety reasons. The location of each transect completed during the survey, including start and end points, was recorded using one of two handheld differential GPS units, with associated transect data entered directly into the same unit upon the completion of each transect.

7.2.3 Survey results

Survey coverage and effective coverage

A total of four pedestrian transects were completed over the study area. Recorded transect data indicate that a total survey coverage of approximately 55ha, representing around 57.2% of the topsoil area, was achieved (refer to Figure 7-9).

Effective coverage estimates for each transect completed during survey, shown in Table 7-4, were good, with three exceeding 10%. Ground Surface Visibility (GSV) across the study area was generally good, ranging from 30-50% due to rehabilitation and limited vegetation cover. Areas of enhanced GSV comprised erosion exposures and areas lacking vegetation. Calculation of the total effective coverage achieved for the current survey indicates that around 12.8% (approximately 7.041ha) of the survey area could be effectively surveyed for surface Aboriginal archaeological materials.

Table 7-4 Effective coverage data for the survey

Survey unit	Landform unit	Survey unit area (ha)	Visibility %	Exposure %	Effective coverage (ha)	Effective coverage %
Transect 1	Crest, slope	13.67	50	20	1.367	10
Transect 2	Crest, slope	12.73	30	30	1.14	8.6
Transect 3	Flat	24.9	40	40	3.984	16
Transect 4	Flat	3.669	50	30	0.55	14.9
Total	-	54.969	-	-	7.041	12.8

Survey findings

Survey within the study area identified a modified landscape with no original landforms present. Soils within the area were assessed in the field as comprising mixed A¹, A² and B soil horizons combined within underlying geological profiles (Figure 7-7 and Figure 7-8). Vegetation comprised grasses as well as patches of planted trees of various ages.



Figure 7-7 Sample of surface soils observed during the archaeological survey (Source: AECOM, 2019)



Figure 7-8 Sample of surface soils observed during the archaeological survey (Source: AECOM, 2019)



Figure 7-9 Aboriginal heritage survey coverage (Source: AECOM, 2019)

No Aboriginal objects were identified during the field survey. Subsurface archaeological sensitivity was assessed as low due to historic disturbances.

RAPs present during the survey likewise suggested that land within the study area was of low sensitivity due to historic disturbances.

During fieldwork, discussions were had with RAP field representatives concerning the Aboriginal cultural values of the study area. RAPs did not provide any Aboriginal cultural values associated with the study area. During consultation on the draft methodology and draft report, RAPs were also invited to provide comments regarding the Aboriginal heritage cultural values of the study area. It is noted that Tocomwall's (acting on behalf of the PCWP) representative did not provide any cultural values for the study area and that Tocomwall has indicated that the study area still retains cultural values despite impacts from open cut mining. These cultural values had not been provided to AECOM at the time of writing this assessment.

7.2.4 Potential impacts

Construction

Given that no Aboriginal objects were identified within the study area, no impacts to Aboriginal objects or heritage values are anticipated to result from the Proposal.

Operation

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

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.

Table 7-5 Safeguards and mitigation measures for Aboriginal heritage impacts

No.	Safeguards and mitigation measures	C	O	D
AH1	Further archaeological assessment would be required if the Proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.	C		
AH2	In the event that previously unrecorded Aboriginal objects are found the following process should be followed: <ol style="list-style-type: none"> 1. All works must cease immediately in the area to prevent any further impacts to the site; 2. Notify the Manager Environment and Community; 3. Engage a suitably qualified archaeologist and RAP representative to determine the nature, extent and significance of the site and provide appropriate management advice. Management action(s) will vary according to the type of evidence identified, its significance (both scientific and cultural) and the nature of potential impacts; and 4. Prepare and submit an AHIMS site card for the site. 	C		

No.	Safeguards and mitigation measures	C	O	D
AH3	<p>In the event that potential human skeletal remains are identified at any point throughout the life of the Proposal, the following standard procedure should be followed:</p> <ol style="list-style-type: none"> 1. All work in the vicinity of the remains should cease immediately; 2. The location should be cordoned off - work can continue outside of this area as long as there is no risk of interference to the remains or the assessment of the remains; 3. Where it is instantly obvious from the remains that they are human, the Manager Environment and Community (or a delegate) should inform the NSW Police by telephone (prior to seeking specialist advice); 4. Where uncertainty over the origin (i.e., human or non-human) of the remains exists, a physical or forensic anthropologist should be commissioned to inspect the exposed remains in situ and to make a determination of origin, ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or modern): <ol style="list-style-type: none"> a. If the remains are identified as modern and human, notify NSW Police; b. If the remains are identified as pre-contact or historic Aboriginal, notify DPIE using their Environment Line (131 555); c. If the remains are identified as historic (non-Aboriginal), notify the NSW Heritage Division; d. If the remains are as identified as non-human but archaeological in nature, engage a suitably qualified heritage specialist to determine the nature, extent and significance of the remains and to provide appropriate management advice; and e. If the remains are as identified as non-human and non-archaeological, resume works. 	C		
AH4	An Aboriginal community representative must be present where it is reasonably suspected burials or human remains may be encountered. If human remains are unexpectedly encountered and they are thought to be Aboriginal, the Aboriginal community must be notified immediately.	C		
AH5	Recording of Aboriginal ancestral remains must be undertaken by or be conducted under the direct supervision of a specialist physical anthropologist or other suitably qualified person.	C		
AH6	Archaeological reporting of Aboriginal ancestral remains must be undertaken by, or reviewed by, a specialist physical anthropologist or other suitably qualified person, with the intent of using respectful and appropriate language and treating the ancestral remains as the remains of Aboriginal people rather than as scientific specimens.	C		

C: Construction; O: Operation; D: Decommissioning

7.3 COMPATIBILITY WITH EXISTING LAND USES

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Land –

- An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:
 - Consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights/tenements (including the Drayton Mine (06_0202));
 - A soil survey to determine the soil characteristics and consider the potential for erosion to occur; and
 - A cumulative impact assessment of nearby developments
- An assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:
 - Consideration of existing approvals, licences, titles, tenures and rehabilitation requirements for the site, including those specified under 06_0202 (as modified) and the Mine Operations Plan;
 - Consideration of the zoning provisions applying to the land, including subdivision;
 - Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and
- A description of measures that would be implemented to remediate the land following decommission in accordance with State Environmental Planning Policy No 55 - Remediation of Land

MUSWELLBROOK SHIRE COUNCIL REQUIREMENTS

Council has a keen interest in ensuring that the rehabilitation of mine sites is completed to high standards, in line with industry best practice and to support post mining land uses. This site is currently in the post mining rehabilitation phase. The application should identify what further rehabilitation is proposed prior to construction of the solar array. The application should also include information on the intended rehabilitation for the site when the solar array is decommissioned. It is requested that consideration be given to the employment of micro-relief to the site, in line with the principles of Geofluv design, to ensure long-term site stability and erosion control, and to create a more natural looking landscape post development.

The nature of a development determines whether a permanent land use change occurs or whether the development is reversible. Apart from direct uses of the land, such as agriculture, electricity generation or mining, associated impacts, such as the degree of visual impact and traffic regimes, can affect the compatibility of alternative land uses. These issues as they relate to the Proposal are discussed below. Given the location of the site, the discussion is centred on agricultural land use, but also considers electricity networks and mining.

The Proposal is consistent with the aims and planning principles of the Primary Production and Rural Development (PPRD) SEPP. State Significant Agricultural Land (SSAL) will be managed by the provisions under Part 2 of the new PPRD SEPP; however, no SSAL is identified in the relevant schedules at this time.

7.3.1 Approach and methods

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

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

7.3.2 Existing environment

The Proposal site is located on land zoned as RU1 Primary Production under the Muswellbrook LEP.

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

- Mining.
- Vegetation.
- Transport and communication.

Existing land uses adjacent to the Proposal site with the potential to be affected by the Proposal, or that may be supported by the Proposal in the future, include:

- Mining and exploration.
- Agricultural activities.
- Industry and commercial use.
- Crown Land and paper roads.
- Residential.

Agriculture and land capability

The rural land within the region is primarily used for agriculture including cropping and grazing. The Maxwell Infrastructure site comprises rehabilitated landforms and vegetation. Land and rehabilitation activities similar to Maxwell Infrastructure site are widespread in the region.

The land is classed as follows under the Land and Soil Capability Assessment Scheme:

- Class 5: sloping lands (10–20% slope) with highly erodible soils and/or significant existing soil erosion, or land that will be subject to wind erosion when cultivated and left bare. Other limitations include shallow soils, stoniness, climatic limitations, acidification, potential for structure decline and salinity hazards.
- Class 6: steeply sloping lands (20–33% slope) that can erode severely even without cultivation, or land that will be subject to severe wind erosion when cultivated and left exposed. Land generally is suitable only for grazing with limitations and is not suitable for cultivation (OEH, 2012).

Class 5 land is considered **Moderate-low Capability Land**: Land that has high limitations for high-impact land uses. The land capability would largely restrict land use to grazing, some horticulture, forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.

Class 6 is considered **Low Capability Land**: Land that has very high limitations for high-impact land uses and is restricted to low-impact land uses such as grazing, forestry and nature conservation.

Approximately 33% of the development site would be classified as Class 5 land.

The NSW Government introduced a range of measures designed to deliver greater protection to agricultural land from the impacts of developments. These measures included the safeguarding of 2.8 million hectares of **Biophysical Strategic Agricultural Land (BSAL)** across the state, and **Critical Industry Clusters (CIC)**. BSAL is land identified with high quality soil and water resources capable of sustaining high levels of productivity, which is critical to sustaining the state's agricultural industry, while CICs are concentrations of highly productive industries within a region that are related to each other, contribute to the identity of that region, and provide significant employment opportunities. The Solar Farm Proposal site is not mapped as being BSAL or CIC, therefore the Proposal would not impact on land critical for agriculture (DPE, 2019).

There are no current exploitation licences relevant to the Proposal area as indicated in the MinView database (DPE, 2018). The proposed Maxwell Solar Farm would be located on land currently subject to Coal Lease No. 229 (CL 229), which is held by Maxwell Ventures (Management) Pty Ltd.

While the activity would impact on land with the potential in the future (once rehabilitated) to be available for primary production, the Proposal would allow for diversification of land use and improved productivity of the land with immediate benefits. The Proposal would be reversible, involve limited ground disturbance, and 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 life (expected to be in the order of 30 years). Additionally, the degree of permanent land disturbance in the construction and operation of Solar Farms is small, and upon decommissioning of the Proposal, the development footprint would be rehabilitated to restore land capability to pasture.

Surrounding land uses

Land use activities surrounding the development site are predominantly mining, agriculture and associated rural dwellings. The development site is zone RU1 (Primary Production), with SP2 (Infrastructure) 1km east and E3 (Environmental Management) 1.5km north of the site. Other land uses in the locality include:

- Bayswater Power Station and Liddell Power Station to the southeast and east.
- Mt Arthur Coal to the west, southwest and northwest.
- The Antiene subdivision and grazing agricultural land to the north and northeast.
- Drayton Wildlife Refuge to the north.
- Thomas Mitchell Drive business district to the northwest including maintenance facilities, a takeaway shop and industrial offices.
- Township of Muswellbrook, approximately 7km north of site, comprising retail, health services, accommodation, schools and community services.

Mineral resources

The Division of Resources & Geoscience (DRG) was consulted regarding biodiversity offsetting, implications for access and prospective mineralisation for the Maxwell Solar Proposal. The SEARs letter from DRG dated 4 March 2019 confirmed that no current mineral or petroleum titles or applications are in the vicinity of the site. There are three coal operations and one extractive quarry for coarse aggregate within the immediate vicinity. The relevant operations are Maxwell Infrastructure (previously Drayton Mine), Mt Arthur Coal, Savoy Hill and Wild Quarry. DRG has no sterilisation concerns or additional issues to be addressed.

7.3.3 Potential impacts

Land use conflict risk assessment

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

The risk ranking in Table 7-6 has been determined using the risk ranking matrix shown in Figure 7-10, and in accordance with the probability table and measure consequence table in Department of Primary Industries LUCRA Guide (DPI, 2011). The matrix ranks the risk of impacts according to the probability of

occurrence and the consequence of the impact. Probability 'A' is described as 'almost certain' to probability 'E', which is described as 'rare'. The level of consequence starts at 1 – Severe to 5 – Negligible. The risk ranking from 1 to 25 is a result of the probability and consequence. For example, a risk ranking of 25 is the highest magnitude of risk (DPI, 2011).

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

Figure 7-10 Risk ranking matrix (Source: DPI, 2011)

Table 7-6 Land use conflict risk assessment summary

Identified potential conflict	Risk ranking	Management strategy	Revised risk ranking
Agricultural land use			
Use of agricultural land (post-rehabilitation)	B3	17 <p>The installation of the Solar Farm equipment is generally limited to a depth of 2.4m. An earth will be required at the 33kV/66kV connection, earth testing will define how deep a hole may need to be drilled. A groundcover plan would ensure erosion and weeds are addressed during the operation of the Proposal. Soil surveys have provided base line information to guide remediation post construction and during decommissioning (refer to Section 7.4).</p> <p>A Rehabilitation Plan has been developed to remove all infrastructure following the decommissioning of the Proposal.</p> <p>The landscape, soil and climatic factors that make this site suitable for agriculture post site rehabilitation would not be impacted by the Proposal.</p> <p>Therefore, following decommissioning of the site, the land can once again be used for agricultural purposes.</p>	D3 9

Identified potential conflict	Risk ranking		Management strategy	Revised risk ranking	
Contaminated surface water runoff	B3	17	Implementation of a soil and water management plan and an erosion and sediment control plan would minimise the potential impact.	D4	5
Dust	B3	17	Dust generation during the construction and decommissioning stages to be managed using water carts when required. Dust is not expected to generate a significant land use conflict during operation.	C5	4
Fire/ Bush fire	C1	22	Implementation of a Bush Fire Management Plan would significantly reduce the probability of Solar Farm operation starting a fire or a bushfire damaging the Solar Farm.	D3	9
Visual amenity	D5	2	The Proposal site was selected with consideration of sensitive receivers and existing vegetation screening.	D5	2
Noise	C3	13	Noise generated during construction and decommissioning would be minimised through the implementation of mitigation measures. Where regular maintenance practices are incorporated into operation, noise is not expected to generate a land use conflict.	D4	5
Traffic generation and disruption	B3	17	Traffic generation and disruptions during construction and decommissioning stages are considered likely, however, the impact would be temporary and able to be managed (refer to Section 7.7). Traffic is not expected to generate a land use conflict during operation.	C4	8
Weed and pest control	A3	20	Implementation of pest and weed management plan during construction and operation phases.	D4	5

Identified potential conflict	Risk ranking		Management strategy	Revised risk ranking	
Mining land use					
Resource extraction/exploration	D3	9	<p>It is unlikely there would be an impact on resource extraction or exploration; the Proposal site is within the previously mined area and has been designed to avoid impacting any future mining on the site.</p> <p>In the long term (after decommissioning), the Solar Farm facilities would be removed, and the site made available for alternate land uses.</p>	D5	2

Construction and operation

The range of scores in the mitigated risk rating were all low, demonstrating that the proposed construction and operation of the Solar Farm will have minimal impact to the area.

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

Once construction of the Solar Farm commences, rehabilitation activities would cease in the areas involved with construction and operation of the Proposal.

There may be some minor disruption to local traffic during construction due to construction traffic movements, which may impact the operation of surrounding land uses (refer to Section 7.7).

Connection of transmission lines to the existing electricity network would be undertaken in consultation with AGL and Ausgrid. Power lines are located within and surrounding the Proposal site and are unlikely to generate a land use conflict with surrounding landholders.

The potential operational land use impact has been assessed in accordance with guidance provided in *Primefact 1063: Infrastructure Proposals on rural land* (DPI, 2013) and *The Land and Soil Capability Assessment Scheme* (OEH, 2012).

Land and soil capability impacts

The Proposal is not expected to adversely affect the biophysical nature of the land which determines its capacity. During any broad area excavations at the site, where applicable topsoil would be removed, stockpiled separately and replaced to restore the original soil profile. Topsoil salvaged from the construction of powerlines would also be securely stored for use in site rehabilitation. Following construction, a perennial cover would be established to protect soils, enhance landscape function and prevent wind and water erosion.

By maintaining perennial cover, the Proposal would benefit the site's soils including increasing soil moisture, building soil carbon levels, allowing structural recovery and improving conditions for soil biota. No loss of productive potential is expected to result from the Proposal in the long term.

Resource loss and fragmentation

The Proposal would not impact on land identified by the NSW Government as BSAL or CIC. Construction works involve only minor excavation with minimal disturbance to soils and soil profiles, and minimal risk of soil loss (refer to Section 7.4 and Section 8.1) for soil and water quality impacts). At the end of the operational period, Solar Farm equipment and infrastructure would be removed, the land would be rehabilitated to its pre-existing condition and available for agricultural use, such as grazing, as intended by the rehabilitation management plan for the site. The Proposal would not result in the permanent removal of agricultural land.

The Proposal has been designed to minimise the development footprint. The Proposal would not result in rural land fragmentation or alienation of resource lands as defined under SEPP (Primary Production and Rural Development) and the Muswellbrook LEP. It is considered that the Proposal would not generate any land use conflicts or have an impact on the nature of existing surrounding agricultural holdings given the Proposal would not alter the existing environment.

Changes in biosecurity risks – pests, diseases and weed risks

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

To assist in the management of weeds, a Weed Management Plan would be prepared for the construction and decommissioning phases, based on Muswellbrook Shire Council and NSW DPI requirements. Management measures would focus on early identification of invasive weeds and effective management controls.

An Operational Weed Management Plan would also be prepared to manage impacts associated with weeds such as the risk of weed ingress along the boundary of the development site and the importation and spread of weeds through vehicle movements.

Resource impacts

Approximately 5,000m³ of gravel would be required to surface the access road and internal service track network, inverter storage areas and substation hardstand. Approximately 1,000m³ of sand would be required to bed cables. Approximately 300m³ of concrete would be required to construct the inverter and switch station (if 66kV option selected). The availability of these resources is not declining or limited in the region.

Materials used in the fabrication and construction of the Solar Farm would include precast masonry products and concrete, steel, aluminium, copper and other metals, glass, plastics, fuels and lubricants. These are common industrial and construction materials. Silicon and silver are the major raw materials for crystalline silicon PV; resource availability is not limiting for these materials. Most components would be reused or recycled when infrastructure is replaced or decommissioned.

In view of the nature of the resources, the limited quantities required and the opportunities for recycling, the Proposal is unlikely to place significant pressure on the availability of local or regional resources for other land uses in the area. It is estimated that approximately 20ML of water per annum would be required during construction, mostly for dust suppression, but also for cleaning, concreting, on-site amenities and

landscaping. The precise amount of water used during construction would be heavily affected by prevailing weather conditions and the need for watering to suppress dust generation.

A small amount of potable (drinking) water (approximately 150kL per annum) would be imported to the site during the construction period. The potable water supply would be trucked to site and stored in temporary tanks at the staff amenities area. Any requirement for potable water would be limited, confined to the construction phase, and would not place pressure on local drinking water supplies.

Decommissioning

As the Proposal would have relatively low levels of impact on the soil surface, both in the installation of infrastructure and the commitment to maintain ground cover vegetation, where practical, during operation, the Proposal is considered to be highly reversible in terms of preserving the agricultural capability of the development site post rehabilitation.

Following decommissioning, the site would be restored to pasture or other beneficial use. At the end of the project, all above-ground equipment and infrastructure would be removed, and agricultural activities could recommence.

7.3.4 Safeguards and mitigation measures

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

Table 7-7 Safeguards and mitigation measures for land use impacts

No.	Safeguards and mitigation measures	C	O	D
LU1	Consultation with adjacent landholders will be ongoing to manage interactions between the Proposal and other properties.	C	O	D
LU2	Consultation will be undertaken with AGL and Ausgrid regarding offsite energy transmission infrastructure.	C	O	D
LU3	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: <ul style="list-style-type: none"> • Removal of all above ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the Solar Farm is decommissioned.			D
LU4	A Pest and Weed Management Plan will be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Muswellbrook Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	C	O	
LU5	Construction and operations personnel will drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and ground disturbance.	C	O	D

C: Construction; O: Operation; D: Decommissioning

7.4 SOILS AND EROSION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Land –

Including:

- An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:
 - Consideration of agricultural land, flood prone land, Crown lands, mining, mineral or petroleum rights/tenements (including the Drayton Mine (06_0202));
 - A soil survey to determine the soil characteristics and consider the potential for erosion to occur; and
 - A cumulative impact assessment of nearby developments
- A description of measures that would be implemented to remediate the land following decommission in accordance with State Environmental Planning Policy No 55 – Remediation of Land

Water –

Including:

- 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).

MUSWELLBROOK SHIRE COUNCIL REQUIREMENTS

Soils and Land Degradation -

Council understands that there are erosion issues in the area, low soil fertility, high salinity and structural issues. Detailed assessment of the soils and geology of the site, and areas that will receive stormwater flows from the site, will need to be included in the application to establish mechanisms for erosion and sediment control, inform the site's management during operation, and intended rehabilitation strategies once the solar array is decommissioned.

DPIE REQUIREMENTS

Water and soils –

The EIS must map the following features relevant to water and soils including:

- Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).
- Rivers, streams, wetlands, estuaries (as described in Section 4.2 of the Biodiversity Assessment Method).
- Wetlands as described in Section 4.2 of the Biodiversity Assessment Method.
- Groundwater.
- Groundwater dependent ecosystems.
- Proposed intake and discharge locations.

7.4.1 Approach

A Soil Survey Report was undertaken by NGH in July 2019. The Soil Survey Report is provided in APPENDIX G and summarised below.

A desktop assessment and site visit were undertaken to determine the soil characteristics and consider the potential for erosion to occur on site. The soil survey focusses on areas and strata that are likely to be disturbed during construction of the Proposal.

The soil survey included a test pitting program using an excavator. The test pitting program included seven test pits, and the level of investigation was carried out in accordance with the *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2009) for a moderately high (detailed) intensity level.

Three topsoil samples and nine subsoil/overburden soil samples were dispatch to a National Association of Testing Authorities (NATA) accredited laboratory for testing across a suite of analytes. Details are provided in the Soil Survey Report (APPENDIX G).

7.4.2 Existing environment

The proposed location for the works is a rehabilitated portion of a heavily disturbed open cut mining operation. The Proposal would be constructed on rehabilitated overburden.

Observations recorded during the site inspection include two distinct areas. Rehabilitated areas where the solar panels are to be located has minimal erosion. Areas yet to be rehabilitated, including the access and powerline easement, had signs of erosion on un stabilised slopes.

Topography

The topography of the Proposal area has been heavily modified by mining and rehabilitation activities.

Site observations confirmed that rehabilitation works that have already been undertaken on the site generally include limited topsoil with grasses and weeds. Some biosolids have been used to ameliorate topsoil. Negligible erosion was observed on previously rehabilitated areas of the site. Gravel, cobbles and boulders were observed in the overburden material at the surface which would reduce sediment detachment.

The site also included unrehabilitated areas for both the powerline corridor and Solar Farm access. The access is to be rehabilitated as part of the mine rehabilitation programme (during 2019 and 2020).

Potential contamination

There is a risk that contamination associated with previous mining and rehabilitation activities. could be present in the Proposal site. However, no evidence of contamination was observed during the field work hence this risk is considered low.

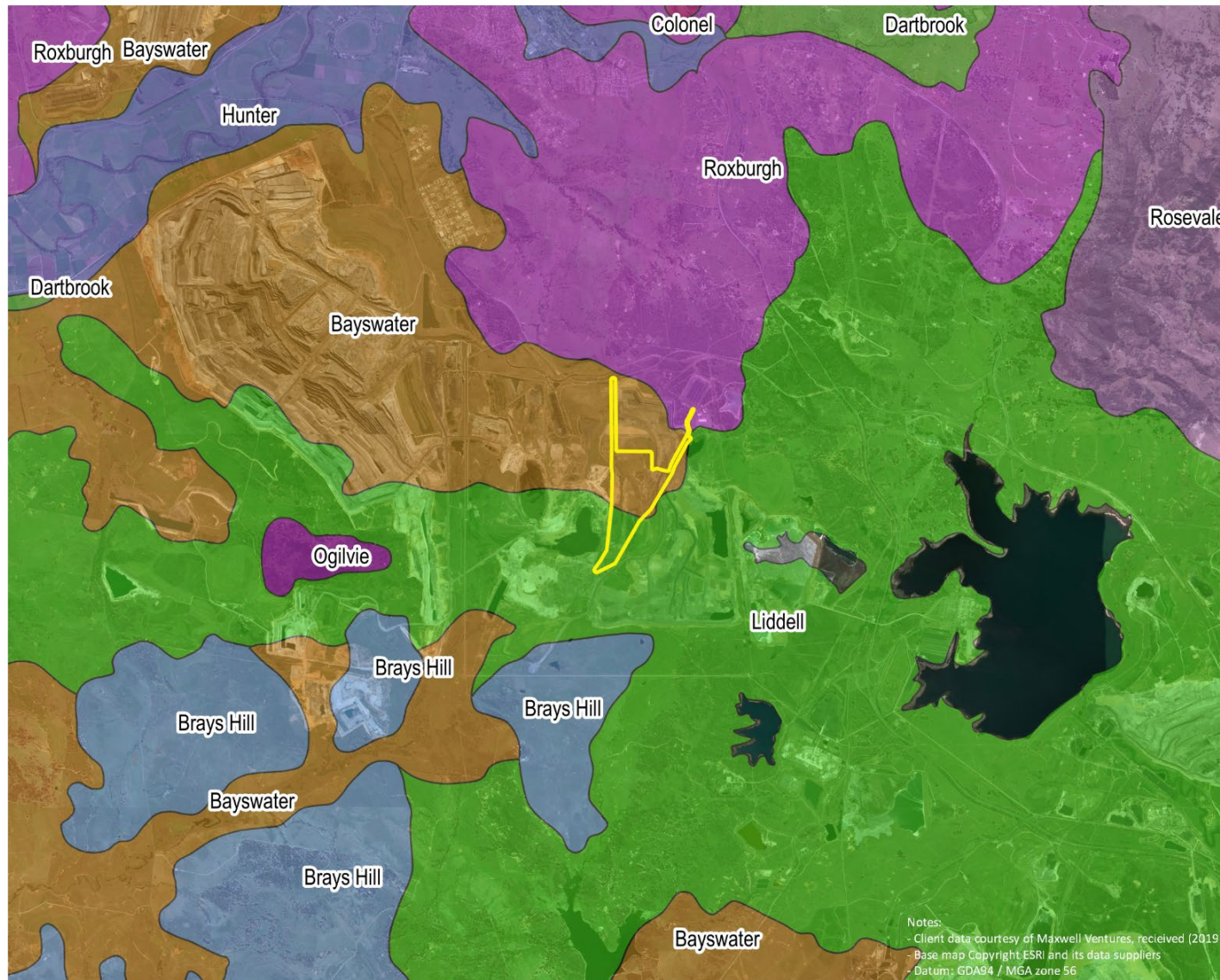
Regional soil landscapes

The pre-mining regional soil landscapes are presented on Figure 7-11. The soil landscape maps are managed by DPIE and describe the properties of soils and the landscapes in which they occur. Descriptions of these soil landscapes are attached as Appendix A of the Soil Survey (APPENDIX G of this EIS) and key points are summarised in Table 7-8.

Overburden used at the Proposal site is likely to have been sourced from the Bayswater and/or Liddell soil landscapes (refer to Figure 7-11). The overburden may also include a small proportion of the Roxburgh soil landscape.

Table 7-8 Soil landscapes data (Source: DPIE eSpade, 2019)

Soil landscape	Geology	Typical Soil erosion (pre-mining environment)
Bayswater	<p>Geological Unit as described in the Soil Landscape: Singleton Coal Measures</p> <p>Parent Rock: Sandstone, shale, mudstone, conglomerate and coal.</p> <p>Parent Material: In situ weathered parent rock with alluvium in the drainage lines.</p>	<p>Moderate sheet and gully erosion are common on slopes. Gullies (to 3m) are associated with the highly erodible yellow solodic soils. Salt scalds and associated erosion are common in some areas.</p>
Liddell	<p>Geological Unit as described in the Soil Landscape: Singleton Coal Measures</p> <p>Parent Rock: Lithic sandstone, shale, mudstone, conglomerate, siltstone and coal seams.</p> <p>Parent Material: In situ weathered parent rock and some derived colluvium.</p>	<p>Minor to severe sheet erosion is common, with some minor rill erosion. Moderate gully erosion (to 1.5m) in drainage line where salting may be a feature.</p>
Roxburgh	<p>Geological Unit as described in the Soil Landscape: Singleton Coal Measures</p> <p>Parent Rock: Sandstone, shale, mudstone, conglomerate and coal.</p> <p>Parent Material: In situ weathered parent rock and derived colluvium.</p>	<p>Minor to moderate sheet erosion is common. Some gullies up to 3m deep are associated with the dispersible soloths and solodic soils.</p>



0 1 2 3 km

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Author: zoe.q
Date created: 15.10.2019



Figure 7-11 Pre-mining soil landscapes (Proposal site is shown in yellow)

Soil Investigation, sampling and analysis

Site observations

Site observations recorded during the soil investigation indicate that the rehabilitated area comprises sown grasses along with weeds. The available topsoil utilised was ameliorated in places with biosolids prior to seeding. Negligible erosion was observed on the rehabilitated areas of the site. Gravel, cobbles and boulders present in the material at the surface act to reduce sediment detachment.

The site also included unrehabilitated areas for both the powerline corridor and Solar Farm access. The access is to be rehabilitated as part of the mine rehabilitation programme (during 2019 and 2020).

Soil investigation

The soil investigation included a test pitting program utilising an excavator supplied by Maxwell Solar Pty Ltd. The program included eight test pits (TP1 to TP8) Figure 7-12 (TP7 was abandoned as it was located on an active internal road and the proposed work in this area would be the overhead transmission lines and so unlikely to disturb soils).

The level of investigation was carried out in accordance with the *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2008) for a moderately high (detailed) intensity level (refer Table 7-9).

Table 7-9 Recommended soil survey intensity

Intensity level	Inspection density	Publication scale	Objectives
Moderately high (detailed)	1 per 5 ha to 25 ha i.e. 4 to 20 per km ²	1:25 000	Moderately intensive uses at 'field' level, detailed project planning

Test pit logs were recorded during the soil investigation and are attached as Appendix B of the Soil Survey (APPENDIX G of this EIS). Photos from the soil survey are attached as Appendix C of the Soil Survey.

Test pits TP1, TP2, TP4 and TP8 had topsoil ranging from 50 mm to 300mm depth. The topsoil was underlain by fill consisting of clay (with silt or sand) or gravel (with sand and/or silt) to the maximum depth of the test pit investigation. Topsoil was described as well graded silty sand. Little topsoil was observed in three test pits (TP3, TP5 and TP6).

Table 7-10 details the subsoil material observed during test pitting. All test pits comprised fill with some proportion of fine sediments.

Table 7-10 Fill descriptions

Test pit	Depth (m)	Material
1	0.3 – 1.5	FILL, Silty CLAY, medium to high plasticity, brown with mottled grey, with sand, gravel and boulders
2	0.2 – 1.4	FILL, Silty CLAY, low to medium plasticity, brown with mottled grey, yellow and red, with fine to medium grained sand, some boulders and cobbles
3	0.0 – 0.5	FILL, Gravelly Sandy CLAY, medium plasticity, brown, with roots to 0.2 m
	0.5 – 1.4	FILL, Sandy GRAVEL, coarse grained, grey, fine to coarse sand
4	0.05 – 0.5	FILL, Sandy CLAY, low to medium plasticity, brown with mottled grey, dark grey and yellow
	0.5 – 1.4	FILL, Sandy CLAY, low plasticity, dark grey and grey, some coal and boulders
5	0.0 – 1.3	FILL, Silty Sandy GRAVEL, coarse grained gravel, fine to medium grained sand, light brown and brown, with cobbles
6	0.0 – 1.25	FILL, Silty Sandy GRAVEL, fine to coarse gravel, fine to coarse sand, dark grey, with coal fragments, cobbles and boulders
8	0.3 – 1.3	FILL, Silty CLAY, low to medium plasticity, mottled grey, brown and red

Results summary

Desktop assessment

The desktop assessment indicates that the pre-mining subsoil and topsoil may include one, or a combination of, the Bayswater, Liddell and/or Roxburgh soil landscape/s. Without suitable erosion and sediment control measures these soil landscapes have the potential for sheet erosion, rill erosion and gully erosion.

Based on site observations and laboratory results, it is likely that the pre-mining subsoil soil landscapes described above now comprise the mining overburden (fill). Similarly, the topsoil observed onsite is similar to the topsoil properties of the Bayswater, Liddell and Roxburgh soil landscapes data sheets (Appendix A of the Soil Survey (APPENDIX G of this EIS)). It is expected that the topsoil and subsoil (fill) observed on site would respond to erosion and sedimentation in a similar manner to the Bayswater, Liddell and/or Roxburgh soil landscapes.

Laboratory analysis

The results of topsoil laboratory analysis indicate that the topsoil has similar properties and is consistent across the site. The topsoil analysis results indicate:

- Slightly alkaline soil with pH ranging from pH 8 to pH 8.8. Increasing soil alkalinity leads to some plant nutrients becoming unavailable. The observed pH range is unlikely to impact rehabilitation using this topsoil.
- Very low to low salinity. Increased salinity can adversely affect the growth of most plants.

- Cation analysis indicates that the topsoil may be deficient in Calcium, Magnesium and Potassium. The CEC ranges from 6.2 to 9.6 meq/100g. CEC is the soil's ability to hold cations by electrical attraction and is a useful indicator of soil fertility because it shows the soil's ability to supply three important plant nutrients: Calcium, Magnesium and Potassium.
- Topsoil at TP1 and TP2 recorded 41% and 60% passing 0.075 mm particle size respectively. This indicates the topsoil contains 39% and 40% clays and silts. Clays and silts are more susceptible to erosion.
- The Exchangeable Sodium Percentage (ESP) was <0.2 in two of three topsoil samples (TP1 and TP2). This is due to a non-detection of sodium. Topsoil from TP8 recorded an ESP of 15. Soil material with an ESP of 15 is strongly sodic. Sodic soils can have structural problems that lead to clay particles being dispersive (and increasing the risk of erosion).
- Emerson aggregate test results indicate a range from 3 to 4 and is slightly to non-dispersible soils. The Emerson aggregate test classifies the behaviour of soil aggregates, when immersed, on their coherence in water. The results are categorised 1 (extremely dispersive) to 8 (non-dispersive).
- The topsoil organic carbon content (0.9-1.7%) was below average for dryland soils (0.7-4.0%). Total organic carbon is a measure of the carbon contained within soil organic matter. Total organic carbon is an indicator of topsoil quality.

The results of subsoil laboratory analysis indicate that the subsoil has similar properties and is consistent across the site. The sub soil analysis results indicate:

- Slightly alkaline sub soil with a pH range of pH 8.3 to pH 9.
- Very low to low salinity.
- Cation analysis indicates that the subsoil may be deficient in Calcium, Magnesium and Potassium. The CEC ranges from 3.9 to 11.9 meq/100g.
- The particle size analysis indicates that the subsoil contains 46% to 57% particles less than 0.075 mm. This indicates that the subsoil has a significant proportion of clays and silts that are more susceptible to erosion.
- The ESP is less than <0.2% at five of nine subsoil samples. This is due to a non-detection of sodium. The remaining subsoil samples recorded an ESP of 10% to 15.6%. Soil material with an ESP in this range is considered sodic. Clay particles can be dispersive in sodic soils.
- Emerson aggregate test results indicate slightly to non-dispersible soils.









The results of the laboratory analysis indicate that topsoil and subsoil is consistent with the Bayswater, Liddell and/or Roxburgh soil landscapes and include non-dispersive fines that are susceptible to erosion. The laboratory analysis also indicates sodic soils that may contribute to dispersive fines.

In conclusion, the topsoil and subsoil (fill) have erosion potential if not stabilised. Therefore the mitigation measures recommended below should be implemented to minimise the risk of erosion and sedimentation.



Test pit locations

19-069 Maxwell Solar Farm

-  Test pit
-  Project boundary
-  Indicative solar array
-  Indicative battery storage
-  Proposed 66kV line
-  Proposed 33kV line
-  Existing 33kV line
-  Existing access road

0 200 400 800 Meters

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Author: L.B 14.5.19



Figure 7-12 Test pit locations

7.4.3 Potential impacts

Construction and decommissioning

Construction activities, such as excavation and earthworks, have the potential to disturb soils, and cause soil erosion and subsequent sedimentation. Earthworks required during the construction phase include the construction of; access roads, compound, laydown and parking areas, pile erection, trenching, boring, and fencing. Factors that may contribute to potential erosion impacts are presented in Table 7-11.

The short duration of disturbance and small disturbance area indicate a low risk of erosion potential. Implementation of mitigation measures recommended below, the potential risk of erosion will be further minimised, (see Table 7-11).

Table 7-11 Design and construction elements that contribute to the erosion potential

Factor	Input
Duration of disturbance	6 months (peak disturbance)
Area of disturbance	The area of disturbance has been estimated as 26,000 m ² . Calculated as 25% disturbance of the 105 ha solar array area. Depending on the construction methodology implemented by the construction contractor the disturbance of existing ground cover may be more or less.
Slopes	The solar arrays would be located on flat areas with slopes up to 10%. The power lines would be located on steeper slopes up to 30%.

Regarding assumed impacts for the establishment of electricity transmission, it is noted that:

- Where overhead transmission options are utilised, actual soil impacts would be minor, restricted to pole footings and minor compaction due to access.
- Where underground options are utilised, actual impact areas would be greatly reduced; a 3m wide trench will be excavated within a 15m easement.

Excavation of trenches for cabling will also be required up to 1.2m deep and up to 3m wide.

These activities would remove the existing ground cover and disturb soils, potentially decreasing their stability and increasing their susceptibility to erosion. Most of these activities require only detailed earthworks or earthworks limited to a small defined area. As mentioned above, excavation of subsoils in unrehabilitated areas would be limited where possible, and excavated subsoils will be stockpiled and contained to avoid potential dispersion and sediment transfer.

Ground disturbance resulting from the Proposal would also be limited, given no major earthworks are required due to the relief of the landscape. Groundcover would be retained as far as practicable prior to and during construction. A Rehabilitation and Revegetation Management Plan would be prepared to ensure stability post construction for the operation of the Proposal.

Soil compaction would occur as hardstands and internal access roads are created, which would reduce soil permeability thereby increasing run off and the potential for concentrated flows. During excavations mixing of different soil horizons can retard plant growth due to an inadequate topsoil layer. Overall, these impacts would occur in small, discrete parts of the development site (in unrehabilitated areas) and are not considered substantial.

Most soils on site are classified as 'non-sodic' and are of low salinity except for TP8 (refer to Figure 7-12 above). The risk of salt build-up in discharge areas is low. However, changing direction of surface waters should be avoided as local changes in the water regime are likely to mobilise any salt stores in the soil.

Pile driving/screwing of steel posts supporting the arrays and the installation of fencing uses light equipment within a small and discrete footprint and is unlikely to result in substantial disturbance of soils. The areas of disturbance would be sparsely distributed, and groundcover would be retained as far as possible prior to, during and post-construction.

Overall, the risk of erosion is considered low. With limited topographic relief, runoff is readily manageable and unlikely to cause substantial erosion or lead to substantial sediment loads entering any natural waterways or voids. With limited relief, existing drainage and good water infiltration, the use of drainage designs such as geofluff is unnecessary. Concrete spill risk is unlikely due to no overland flow paths or waterways present within the development footprint for solar panels and infrastructure.

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

The Muswellbrook LGA is not classed as an area identified by NSW EPA mapping as containing naturally occurring asbestos (NOA). Therefore, it is unlikely that the minor earthworks required during construction would impact on any NOA.

A Rehabilitation and Revegetation Plan is a commitment of the Proposal, relevant to decommissioning. The objective is to ensure the array site is returned to its pre-mining land capability. Cropping, other forms of agriculture, or alternative land uses could occur. The plan would be developed with reference to soil testing results that have been undertaken (APPENDIX G) and with input from an agronomist. The site would be left stabilised, under a cover crop or other suitable ground cover.

Operation

The primary risk of erosion during operation is from concentrated runoff from the panels. Such runoff could lead to increased soil erosion below the solar array modules during significant rain events and could be influenced by seasonal droughts. The soils have a high erosion risk and retaining groundcover vegetation underneath the panels would assist in reducing erosion from rainfall run-off.

Operational maintenance activities and vehicles would be largely confined to the formalised access tracks, minimising impacts to soils. Occasional vehicle access in between panel arrays would require traversing undisturbed soils. This is expected to be infrequent and not likely to increase the erosion risk.

There would remain a risk of soil contamination in the event of a chemical spill (fuels, lubricants, herbicides), although there would be only small quantities of such chemicals kept on site.

Vegetation and ground habitats are also likely to be affected by reduced insolation and temperature and increased humidity underneath the solar modules. Wind speeds may also be reduced.

Impacts to soils during operation of the Proposal are expected to be minimal and would be limited to the following:

- Localised soil erosion under the panels from rainfall and cleaning water runoff, if ground cover is not maintained beneath the array infrastructure. The risk is also influenced by rainfall and groundcover management.
- Ongoing erosion from disturbed areas such as unsealed tracks and drainage structures.

Within the proposed solar array site exotic pasture and vegetation may decline initially due to shading following PV array installation. A reduction in cover may lead to bare ground and susceptibility of the soil to erosion. The selection of a more suitable shade tolerant pasture species for planting would address this issue if bare areas develop.

Soil underneath the PV modules would likely receive less rainfall than surrounding soil. Evapotranspiration losses would also be lower due to shading and reduced air movement. Lateral movement of surface and subsurface water from adjacent rain-exposed areas would be likely to occur. As such, the net amount of moisture available to vegetation under the PV modules should not be substantially altered.

Ground cover would be established and maintained in line with the Rehabilitation and Revegetation Management Plan.

On completion of the Proposal, further soil disturbance or vegetation removal (exotic pastures or re-established native grasses) would not occur until decommissioning, thus improving overall quality of the soil structure and reducing erosion potential.

7.4.4 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise the risk of erosion potential are provided in Table 7-12.

Table 7-12 Safeguard and mitigation measures for soil impacts

No.	Safeguards and mitigation measures	C	O	D
SO1	A construction Erosion and Sediment Control Plan (ESCP) should be prepared in accordance with <i>Landcom Soils and Construction: Managing Urban Stormwater</i> (2004).	C		
SO2	The design and construction of the Proposal should minimise ground disturbance and avoid disturbing steep slopes.	Design		
SO3	Where ground disturbance is required the vegetation (organic matter) should be retained and reused during rehabilitation.	C		
SO4	Topsoil should be stockpiled separately and treated with ameliorants as soon as practicable to encourage topsoil quality for reuse during rehabilitation.	C		
SO5	A rehabilitation and revegetation plan should be prepared and include stabilisation and topsoil amelioration.	C		D
SO6	Soils disturbed during construction and with an exchangeable sodium percentage above 6% should be treated with gypsum to increase the levels of calcium and magnesium, and thus lowering the exchangeable sodium percentage.	C		
SO7	Unrehabilitated areas on the powerline easement and access road should be rehabilitated in accordance with the conditions of the current mining approval.	C		D

C: Construction; O: Operation; D: Decommissioning

7.5 VISUAL IMPACT ASSESSMENT

SECRETARY'S REQUIREMENTS

The EIS must also address the following specific issues:

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;

NGH completed a Visual Impact Assessment (VIA) of the Proposal. 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.
- Addressing requirements of the SEARs.

The report is provided in full in APPENDIX H and is summarised below.

7.5.1 Approach

This VIA provides a full assessment of the visual impacts associated with the Proposal. The VIA is used to identify and determine the value, significance and sensitivity of a landscape.

The assessment was undertaken as follows:

- Description of the existing environment and values of the local community.
- Objective assessment of the relative aesthetic value of the landscape; defined as visual quality and expressed as high, medium or low. This assessment generally relates to variety, uniqueness, prominence and naturalness of the landform, vegetation and water forms within each character type.
- Determination of the landscape sensitivity and its ability to absorb different types of development on the basis of physical and environmental characters.
- An assessment of viewer sensitivity to change. This includes how different groups of people view the landscape (for example, a resident as opposed to a tourist), and how many people are viewing the Proposal and from how far away.
- Viewpoint a to identify areas likely to be affected by development of the site and a photographic survey using a digital camera and a handheld GPS unit to record position and altitude.
- Cross sectional analysis was completed by Xenith Consulting to determine the potential visual impacts of the proposed Maxwell Solar Farm as part of a supplemental visibility analysis. The cross-sectional analysis complements the field assessment and Zones of Visual Influence (ZVI) modelling.
- Assessment of visual impacts. Suggestions are made for suitable development patterns that would maintain the area's visual quality.
- The consideration of reflectivity and glare.

7.5.2 Results

Existing environment and landscape character

The Proposal site is a rehabilitated portion of an open cut mining operation. The topography of the Proposal site has been modified by mining and rehabilitation activities.

The solar array area of the Proposal would be constructed on an area known as the 'North Tip', as described in the Rehabilitation and Offset Management Plan (Anglo American, 2013). Rehabilitation of the North Tip was undertaken prior to 2013.

Approximately 22 residences are located within 3 km of the Proposal site (including transmission line options). The closest residences are located approximately 1.3 km from the Proposal site.

Notable features within the region include:

- Hunter Valley Energy Coal (HVEC) located outside the town of Muswellbrook and adjacent to the Proposal. HVEC includes Mount Arthur North, Bayswater No. 2 and Bayswater No. 3 Mines and is the largest individual coal production site in the NSW Hunter Valley.
- Bengalla open cut mine, located outside the town of Muswellbrook and approximately 9.5km northwest of the Proposal.
- Bayswater Power Station (BPS) located approximately 5km south southeast. BPS is a coal fuelled thermal power station with four generators.
- Liddell Power Station (LPS) located approximately 5km southeast of the Proposal. LPS is a coal fuelled thermal power station with four generators.
- Lake Liddell, which was expanded to accommodate the needs of the Liddell Power Station.

The Hunter River is a major river which originates in the Liverpool Ranges and flows generally south and then east reaching the Tasman Sea at Newcastle. Muswellbrook is a major town along the Hunter River. The river flows approximately 8km northwest of the Proposal site.

Values of the local community

A high percentage (77%) of Australians believe that large-scale Solar Farms could supply a significant source of Australia's energy requirements (ARENA, 2015). Attitudes in Australia are greatly divided about the visual impacts of large-scale Solar Farms; 30% agree and 26% disagree that large-scale Solar Farms have a negative visual impact (ARENA, 2015). While most members of the community are aware of large-scale solar energy, many do not know a great deal about its impacts (ARENA, 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 site the Solar Farm and the additional value the installation allows for (ARENA, 2015).

The VIA endeavoured to address these issues.

Maxwell Solar Pty Ltd has conducted an extensive consultation process, leading to an understanding of the priorities of the impacts of the development. Consultation has included direct contact with residential neighbours, consultation with adjacent mines and businesses, consultation with representative bodies, two

open days, three newsletters and consultation with Aboriginal groups. Throughout this process, the only time visual impact was raised was by the Maxwell Infrastructure Community Consultative Committee. A full account of consultation activities is given in Section 6 of the EIS.

7.5.3 Potential impacts

Criteria

Visual sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas. The assessment is based on the number of people affected, land use, and the distance of the viewer from the proposed development (EDAW, 2000). Sensitivity ratings are defined as high, moderate or low and are shown in Table 7-13.

Table 7-13 Visual sensitivity criteria

Land use	Distance zones				
	Foreground		Middle Ground		Background
	0-1km	1-2km	2-4.5km	4.5-7km	>7km
Tourist/Recreation	High	High	High	Moderate	Low
Residential: Rural or Urban	High	High	High	Moderate	Low
Main Travel Corridor	Moderate	Moderate	Low	Low	Low
Minor/Local Roads	Moderate	Moderate	Low	Low	Low
Railway Line (Freight)	Low	Low	Low	Low	Low
Industrial Areas	Low	Low	Low	Low	Low

Visual effect

Visual effect is the interaction between a Proposal and the existing visual environment. It is often expressed as the level of visual contrast of the proposed development against its setting or background in which it is viewed. The visual effects are assessed as:

- **Low visual effect:** occurs when development blends in with its existing viewed landscape due to a high level of integration of one or several of the following: form, shape, pattern, line, texture or colour. It can also result from the use of effective screening often using a combination of landform and landscaping.
- **Moderate visual effect:** occurs where development is visible and contrasts with its viewed landscape, however, there has been some degree of integration (e.g. good siting principles employed, retention of significant existing vegetation, provision of screen landscaping, appropriate colour selection and/or suitably scaled development).
- **High visual effect:** results when development has a high visual contrast to the surrounding landscape with little or no natural screening or integration created by vegetation or topography.

Visual impact

Visual impact is the combined effect of visual sensitivity and visual effect. Various combinations of visual sensitivity and visual effect would result in high, moderate and low overall visual impacts as suggested in Table 7-14 (URBIS, 2009).

Table 7-14 Visual impact criteria.

Visual sensitivity levels	Visual effect zone		
	High	Moderate	Low
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

Methods

Zones of Visual Influence (ZVI) Modelling

Zones of Visual Influence (ZVI) modelling was undertaken to determine areas in which the Solar Farm infrastructure may be visible, within 5km of the project. ZVI modelling (provided as Figure 7-13 and Figure 7-14) interpreted the Infrastructure as a matrix of evenly spaced points at a height of 4.5 m above ground level with viewers at 1.5m height. This is a conservative approximation of the height of proposed buildings and structures associated with the development, as these are expected to be no greater than 3.5m in height. The modelling undertaken is based on the infrastructure layout provided. Two different ground level heights for the Proposal site were mapped, i.e. 250 m AHD and 296 AHD, as the site slopes gently from 296m AHD in the north to 250m AHD in the south.

The visibility is then modelled based on the number of points of the infrastructure block that can be seen. 100% visibility means all points can be seen and equates to the highest visibility. The lowest score is 0%; none of the points of the infrastructure block can be seen.

It is noted that the topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours and that the ZVI does not take into account existing screening from vegetation or infrastructure and, on this basis, is considered a 'worst case' model.

The findings of the ZVI modelling informed the viewpoint analysis. Viewpoints were not selected in areas predicted to be shielded from views of the Solar Farm.

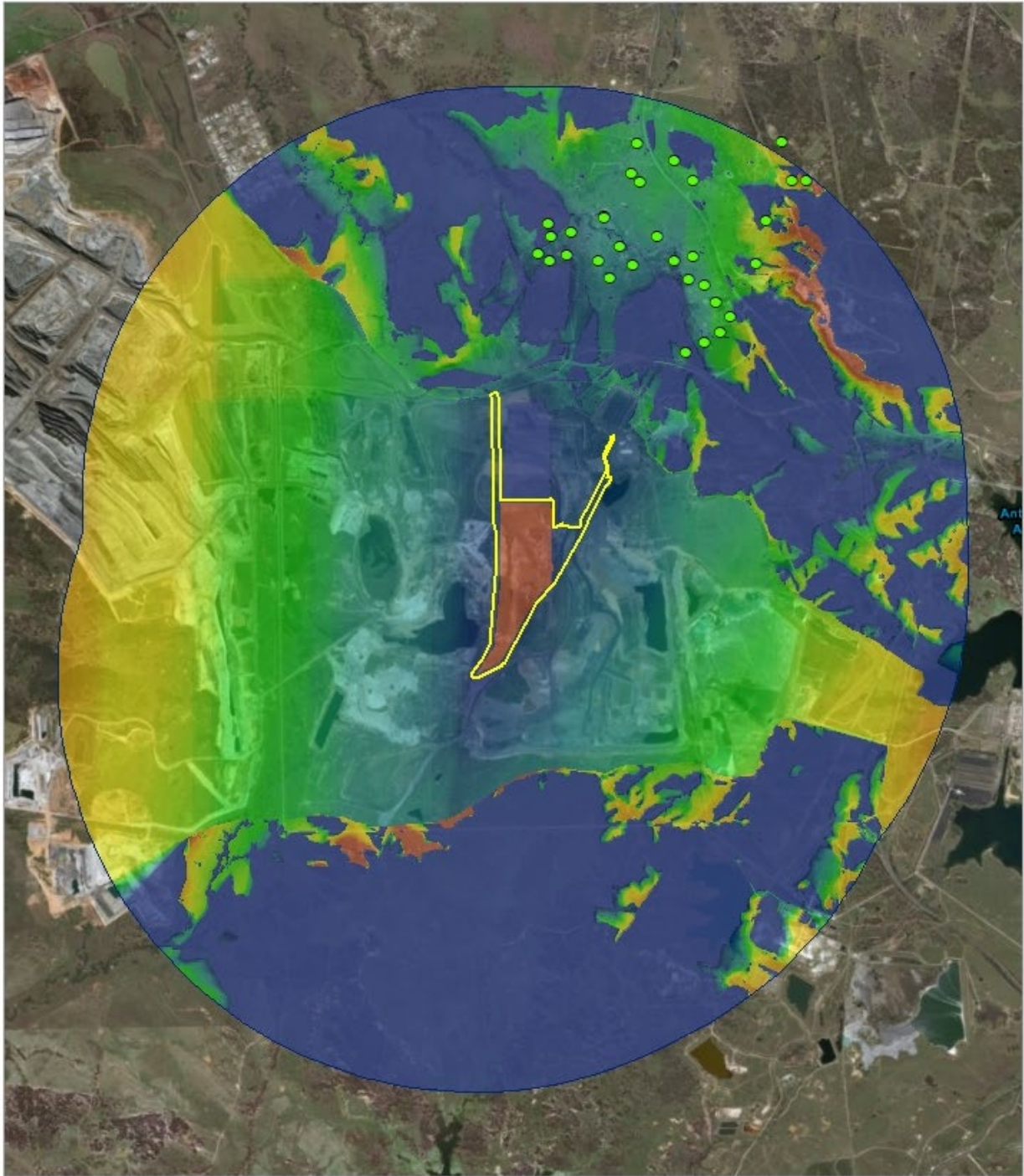
As a result of the modelling, a total of eight viewpoints were selected and assessed (Figure 7-15). The viewpoints were taken from publicly accessible roads surrounding the site. The viewpoints which have been included represent areas where the development would appear most prominent, either based on the degree of exposure or the number of people likely to be affected, or where sensitive receivers are located.

Cross sections

In addition to zones of visual influence (ZVI) modelling and photomontage development, cross sectional analysis was completed by Xenith Consulting to determine the potential visual impacts of the proposed Maxwell Solar Farm as part of a supplemental visibility analysis. The cross-sectional analysis complements the field assessment and ZVI modelling.




Cross sectional analysis enables the landscape to be considered across relevant elevated features to determine whether topographic features were able to screen the Proposal. The cross sections also gave a relative scale to the proposed Maxwell Solar Farm components in relation to the landscape.



A series of cross sections were completed for seven of the eight viewpoint locations (excluded viewpoint eight due to its distance from the Proposal site) (Refer to Figure 7-15).



Sensitive receivers - 296m AHD

19-069 Maxwell Solar Farm

-  Project boundary
-  5km buffer of solar array
-  Residences within 5km

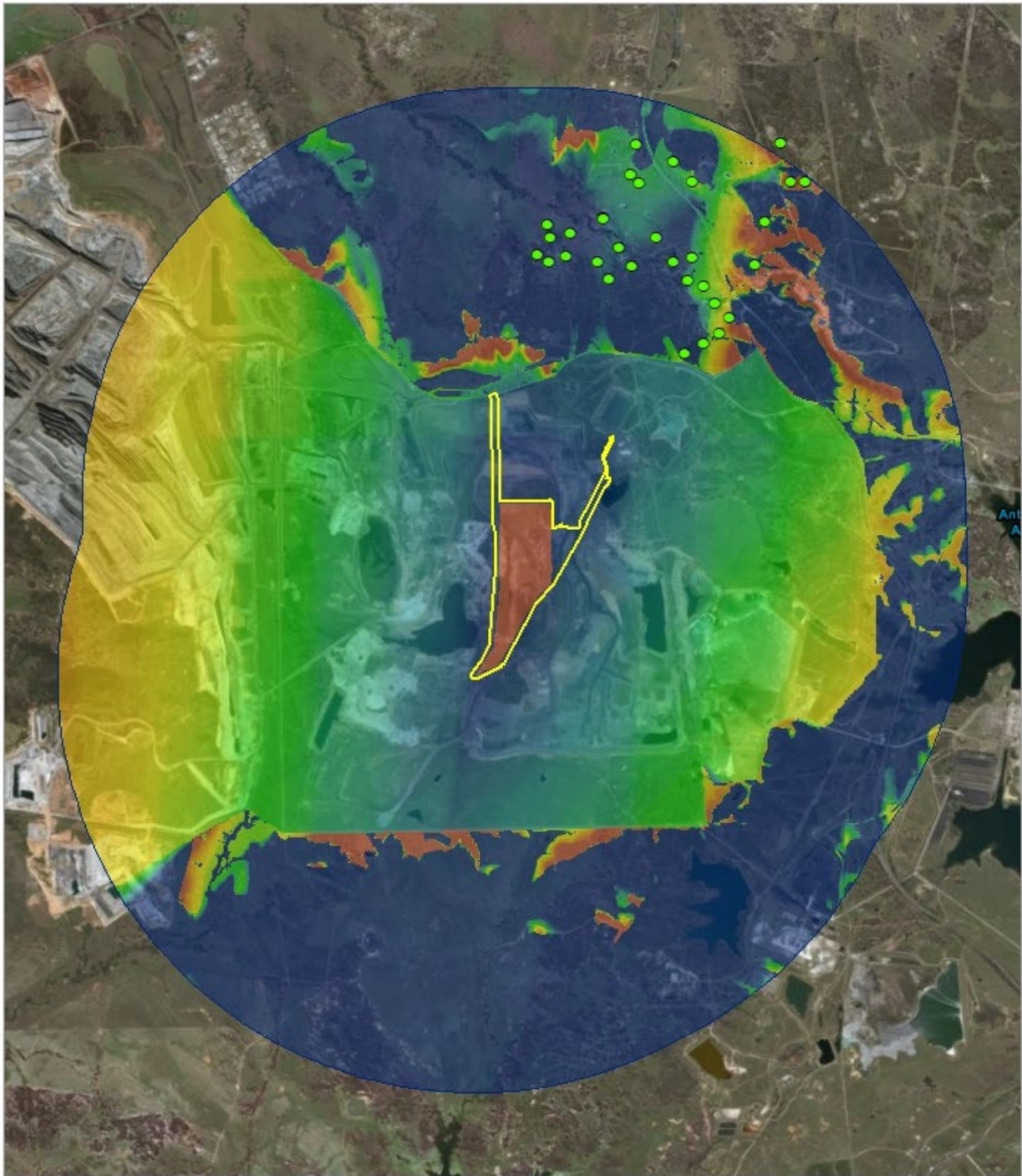
Relative visibility:
 High visibility: 370
 Low visibility: 1

0 0.25 1.25 2.5 Kilometers

A4 @ 1:65000
Ref: 19-069
Author: L.B 23.5.19








Figure 7-13 ZVI viewshed model of Proposal site – 296m AHD



Sensitive receivers - 250m AHD

19-069 Maxwell Solar Farm

-  Project boundary
-  5km buffer of solar array
-  Residences within 5km

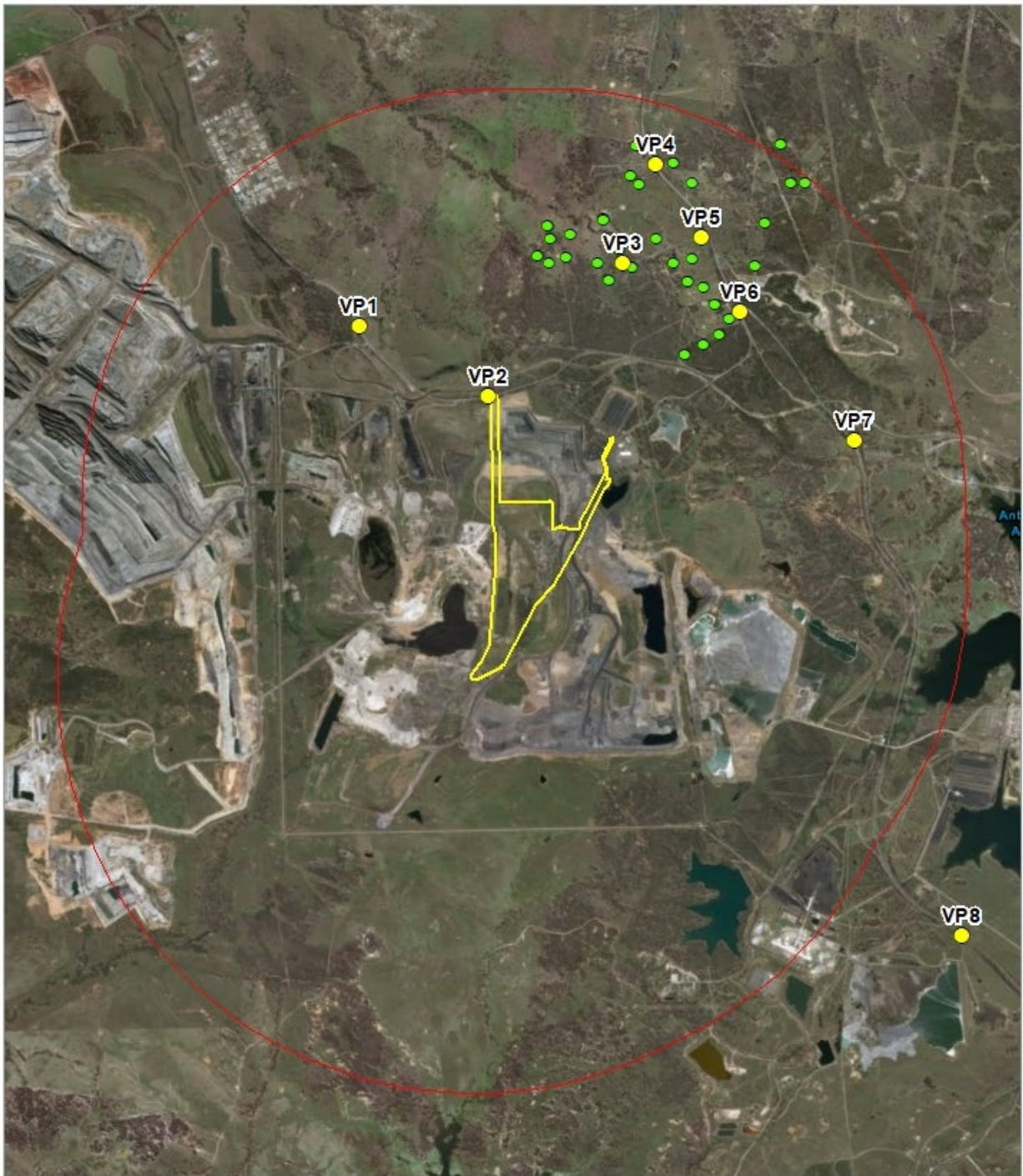
Relative visibility:
 High visibility : 370
 Low visibility : 0

0 0.25 1.25 2.5 Kilometers

A4 @ 1:65000
Ref: 19-069
Author: L.B.23.5.19







Figure 7-14 ZVI viewshed model of Proposal site - 250m AHD



Viewpoints

19-069 Maxwell Solar Farm

-  Project boundary
-  5km buffer of solar array
-  Viewpoint (VP)
-  Residences within 5km

0 0.25 1.25 2.5 Kilometers

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Author: L.B.23.5.19



Figure 7-15 Viewpoints identified in the Visual Impact Assessment



Cross sections

19-069 Maxwell Solar Farm

- ▭ Project boundary
- ▭ 5km buffer of solar array
- Viewpoint (VP)
- Viewpoint cross section 1a
- Viewpoint cross section 1b
- Viewpoint cross section 1c

0 0.5 1 2 Kilometers

A4 @ 1:68660
Ref: 19-069
Author: LT 19.8.19



Figure 7-16 Viewpoint cross sections showing line of sight to Proposal site

7.5.4 Viewpoint Analysis

The Viewpoint Analysis assesses the visual impact of the Solar Farm at each viewpoint using the photomontages and the cross sections of each viewpoint.

Viewpoint 1

Table 7-15 Viewpoint 1

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
1	Traffic along Thomas Mitchell Drive	Middle Ground, 2 to 4.5 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Minor local road/ agriculture/ industrial	Low	Low
<i>Visual impact</i>		
<p>Low impact</p> <p>Viewpoint 1 is situated on Thomas Mitchel Drive, which passes to the north of the Proposal site. The viewpoint is on the north side of the road, which corresponds to the view of traffic travelling East towards the Proposal site. Figure 7-17 shows the view of the Proposal site at Viewpoint 1. From Figure 7-17 it appears that the plateau on which the Proposal site is located is visible from Viewpoint 1. However, cross sections 1A (Figure 7-18), 1B (Figure 7-19) and 1C (Figure 7-20) show that the area of the Proposal site is not actually visible due to land formations between Viewpoint 1 and the Proposal site. Therefore, the section of the plateau that is visible in Figure 7-17 is only the northern edge of the plateau and not the area of the plateau where the Solar Farm is proposed.</p> <p>The proposed Solar Farm would be set back from the northern edge of the plateau and hence not visible in the cross sections 1A, 1B, and 1C.</p> <p>Motorists along Thomas Mitchell Drive would not have views of the Solar Farm directly in front as they travel southwest along the road.</p> <p>The solar infrastructure would be a new structure in the area that would be consistent with the existing industrial/mining landscape character, especially the adjacent Mt Arthur mine infrastructure which is highly visible from Thomas Mitchell Drive.</p> <p>Mitigation recommended:</p> <p>The solar infrastructure would not be visible and therefore no mitigation measures are recommended.</p>		



Figure 7-17 View of Proposal site from viewpoint 1; the Proposal site can partially be seen and is highlighted with a red circle

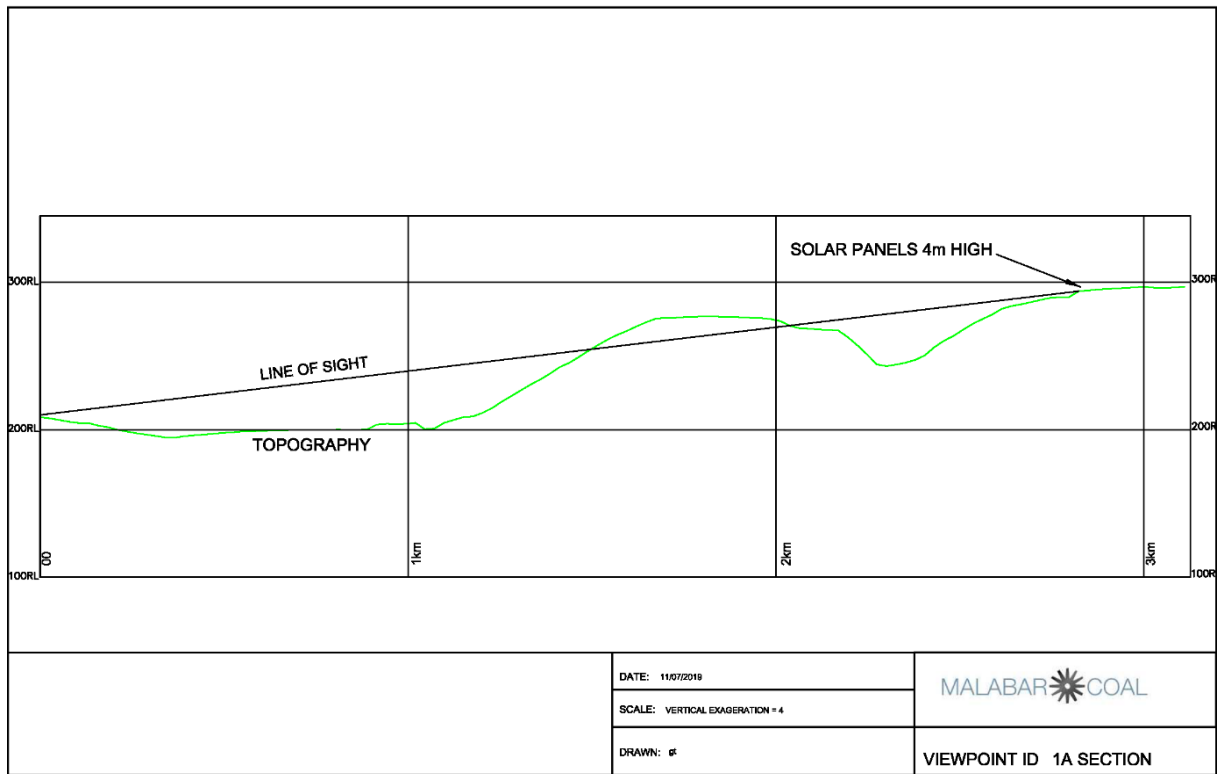


Figure 7-18 Cross section 1A of line of sight from Viewpoint to the Proposal site

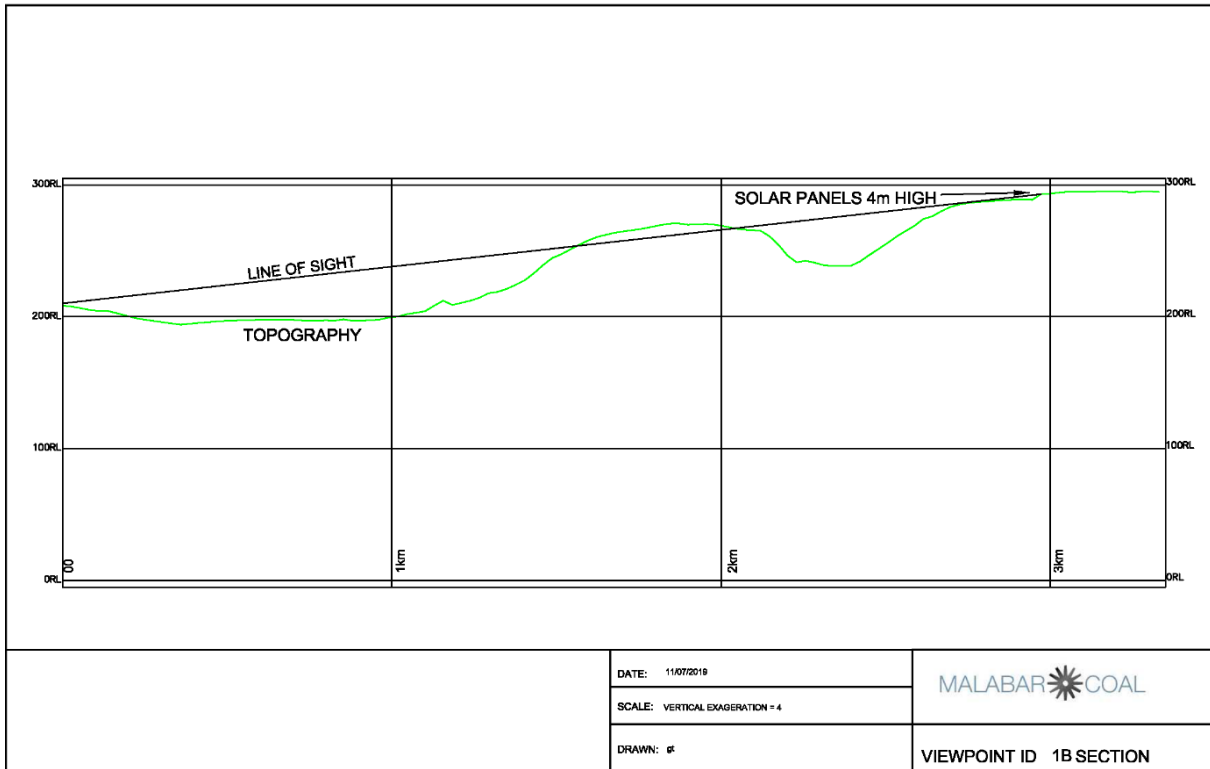


Figure 7-19 Cross section 1B of line of sight from Viewpoint 1 to the Proposal site

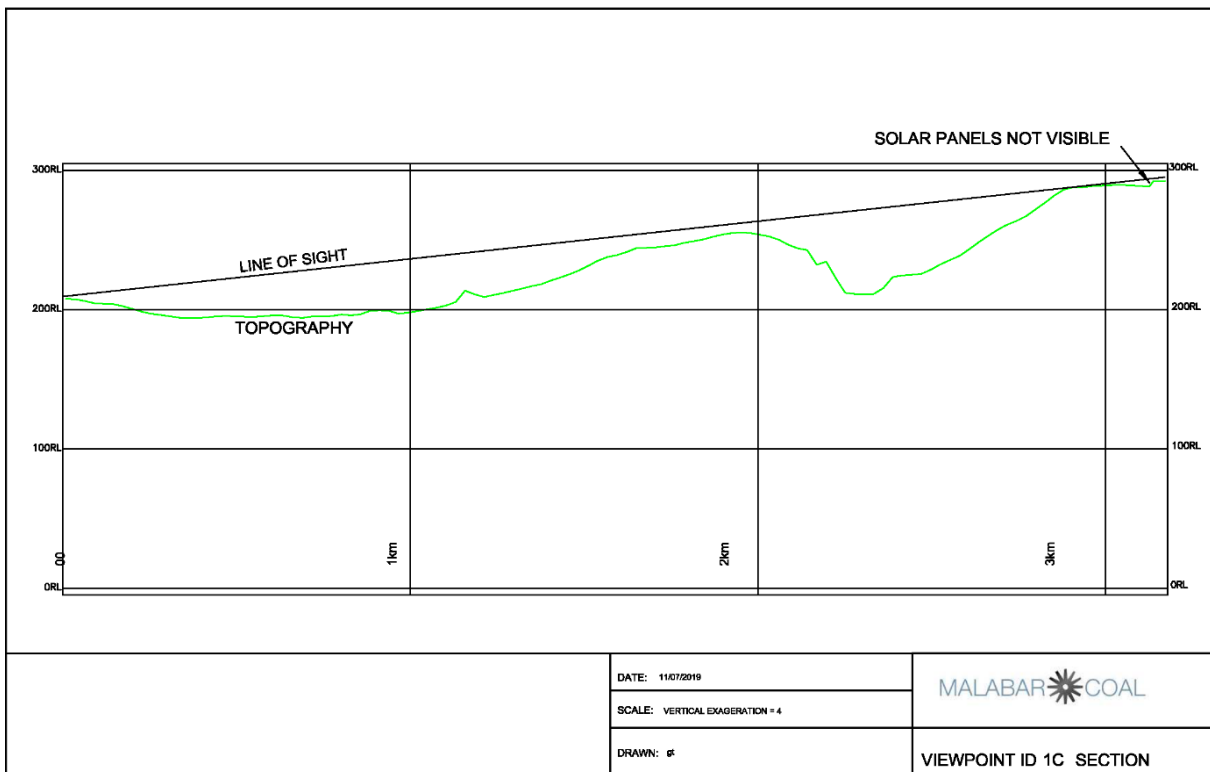


Figure 7-20 Cross section 1C of line of sight from Viewpoint 1 to the Proposal site

Viewpoint 2

Table 7-16 Viewpoint 2

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
2	Traffic along Thomas Mitchell Drive	Foreground, 1 to 2 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Minor local road/ agriculture/ industrial	Moderate	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 2 is situated on Thomas Mitchell Drive, which passes by to the North of the Proposal site. Viewpoint 2 is on the Northern side of the road, with Figure 7-21 looking South towards the Proposal site.</p> <p>In Figure 7-21 the top of the plateau where the Proposal site would be located is visible. However, cross section 2 in Figure 7-22 shows that the Proposal site is set back from the edge of the plateau and consequently would not be visible from Viewpoint 2 on Thomas Mitchell Drive. Traffic along Thomas Mitchell Drive would not have views of the Solar Farm as they travel in either direction.</p> <p>The solar infrastructure would be a new structure in the area that would be consistent with the existing industrial/mining landscape character.</p> <p>Mitigation recommended:</p> <p>The Proposal site is not visible from Viewpoint 2 and therefore no mitigation measures are recommended.</p>		



Figure 7-21 View of the Proposal site from Viewpoint 2; the Proposal site is located 1.4 km behind the trees is highlighted by the red ellipse.

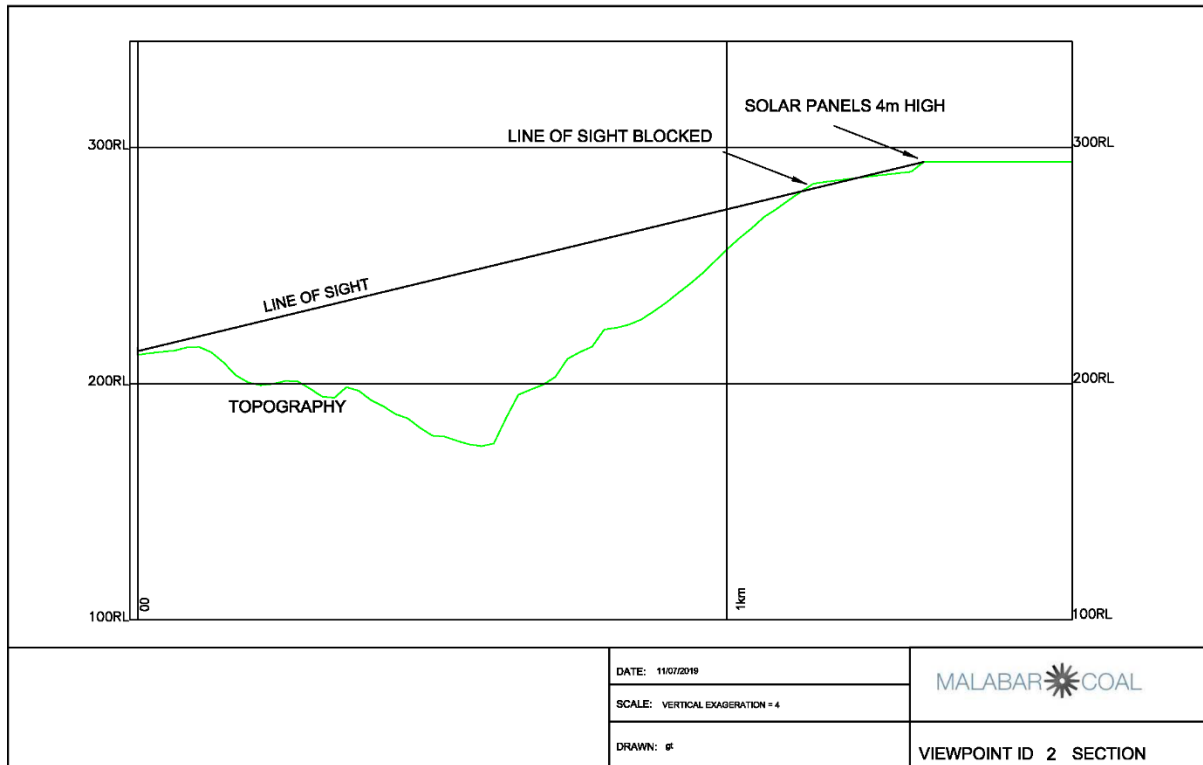


Figure 7-22 Cross section 2 of the line of sight from Viewpoint 2 to the Proposal site.

Viewpoint 3

Table 7-17 Viewpoint 3

Viewpoint ID	Representative receivers	Proximity
3	8 Residents along Pamger Road	Middle Ground, 2 to 4.5 km
Land use	Visual sensitivity	Visual effect
Residential: rural/minor local road/ agriculture	Moderate	Low
Visual impact		
<p>Low Impact</p> <p>Viewpoint 3 is located on the southern side of Pamger Road and is in proximity to four residents on Pamger Road. The view of the Proposal site from Viewpoint 3 is shown in Figure 7-23. The viewpoint is on the southern side of the road, with the image below looking south towards the Proposal site.</p> <p>Figure 7-24 shows the line of sight form Viewpoint 3 to the Proposal site, which indicates that the proposed Solar Farm may be partially visible from Viewpoint 3. The Solar Farm is proposed to be set back from the edge of the plateau, which would reduce its visibility. Vegetation and large trees present between Viewpoint 3 and the Proposal site would also assist in reducing any possible view of the proposed Solar Farm from Viewpoint 3. As the proposed Solar Farm would be mostly hidden from view at Viewpoint 3 due to the topography, its location on the plateau and vegetation present, any visual impact at Viewpoint 3 is likely to be negligible.</p> <p>The solar infrastructure would be a new structure in the area that would be consistent with the existing industrial/mining landscape character.</p>		

Mitigation recommended:

Due to the likely negligible visual impact of the proposed Solar Farm no mitigation measures are recommended.



Figure 7-23 View of Proposal site from Viewpoint 3; of the Proposal site (highlighted by the red ellipse) is located c. 3.1km from the trees in the foreground.

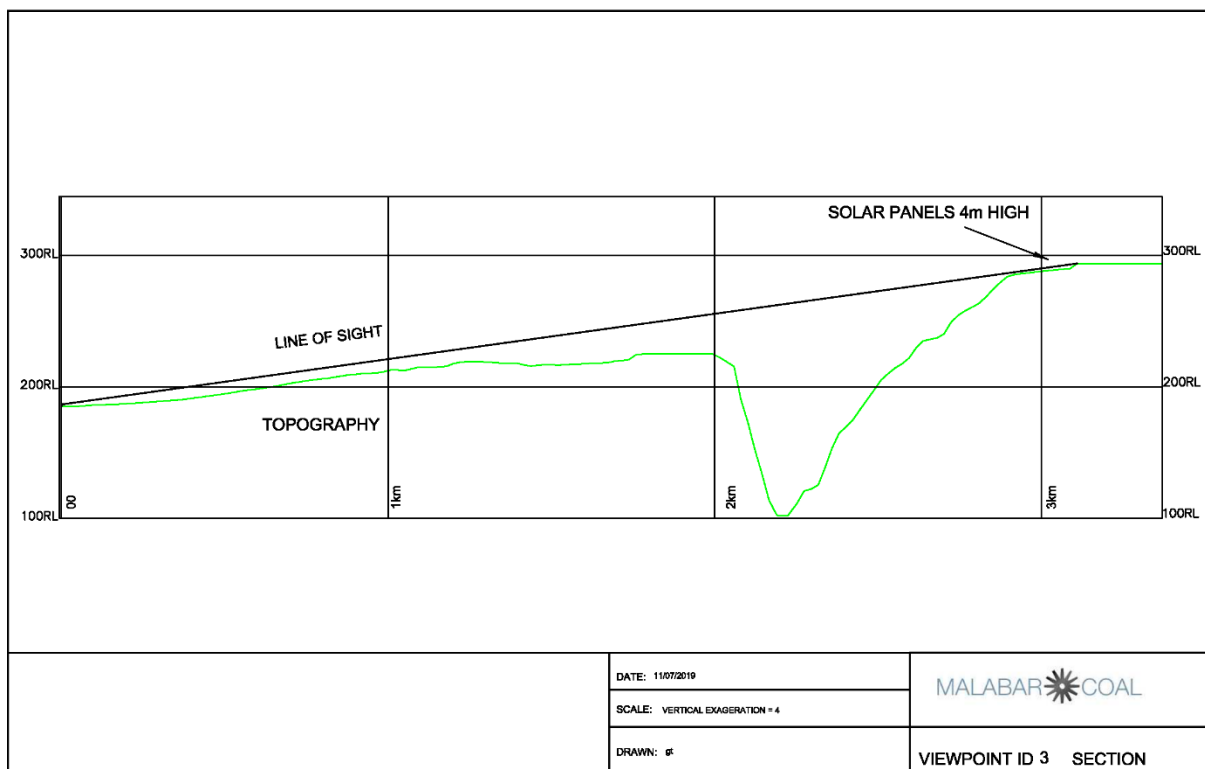


Figure 7-24 Cross section 3 of line of sight from Viewpoint 3 to Proposal site

Viewpoint 4

Table 7-18 Viewpoint 4

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
4	5 residents in along the New England Highway in the vicinity of VP 4, New England Highway Motorists	Middle Ground, 2 to 4.5 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Residential: rural/ main travel corridor / agriculture	Moderate / Low	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 4 is located on the New England Highway. Viewpoint 4 is located on the north-eastern side of the New England Highway in proximity to three residents. Figure 7-25 shows the view of the Proposal site from Viewpoint 4.</p> <p>The Proposal would be partially visible in between the large trees present between the viewpoint and the Proposal site. Figure 7-26 shows the line of site between Viewpoint 4 and the Proposal site, which also shows that the proposed Solar Farm would be partially visible from Viewpoint 4.</p> <p>The solar infrastructure would be a new type of structure in the area that would be consistent with the existing industrial/mining landscape character. The area between the viewpoint and the Proposal site is heavily vegetated in parts, which disrupts and shields the New England Highway residents’ view of the Proposal site. The Proposal site is also <4km away from Viewpoint 4 and therefore, would have minimal impact on residents’ view. The proposed Solar Farm would have a low to negligible visual impact at Viewpoint 4.</p> <p>Motorists would be unlikely to notice the Solar Farm from this location due to the distance, disrupted view and temporary nature of their view.</p> <p>Mitigation recommended:</p> <p>Due to the distance from the Proposal site and vegetation present between the Proposal site and the residents along New England Highway, no mitigations are recommended for this viewpoint.</p>		



Figure 7-25 View of Proposal site from Viewpoint 4; the Proposal site is highlighted by the small red ellipse. It will be c. 4km from this location.

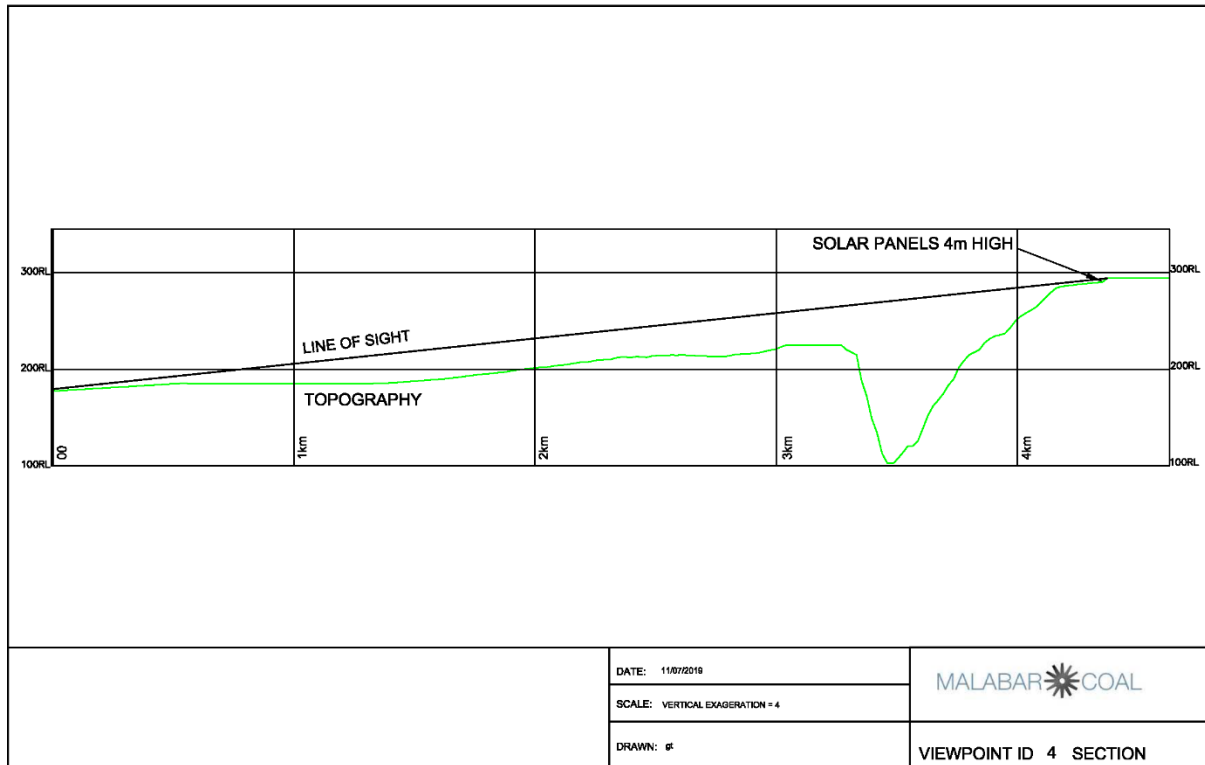


Figure 7-26 Cross section of line of sight from Viewpoint 4 to the Proposal site

Viewpoint 5

Table 7-19 Viewpoint 5

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
5	8 Residents along Pamger Road	Middle Ground, 2 to 4.5 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Residential: rural/minor local road/ agriculture	Moderate	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 5 is located on Pamger Road where it intersects with the New England Highway. Viewpoint 5 is on the south side of Pamger Road, with Figure 7-27 looking southwest towards the Proposal site. Viewpoint 5 represents approximately five residents to the south and the southwest of Viewpoint 5.</p> <p>Figure 7-28 shows that due to the topography of the land between Viewpoint 5 and the Proposal site, proposed Solar Farm is not visible from Viewpoint 5.</p> <p>Mitigation recommended:</p> <p>No mitigation measures are recommended as the proposed Solar Farm would not be visible from Viewpoint 5.</p>		



Figure 7-27 View of the Proposal site from Viewpoint 5 on the southern side of Pamger Road; the Proposal site location is more than 3.5km from this location and highlighted by the red ellipse.

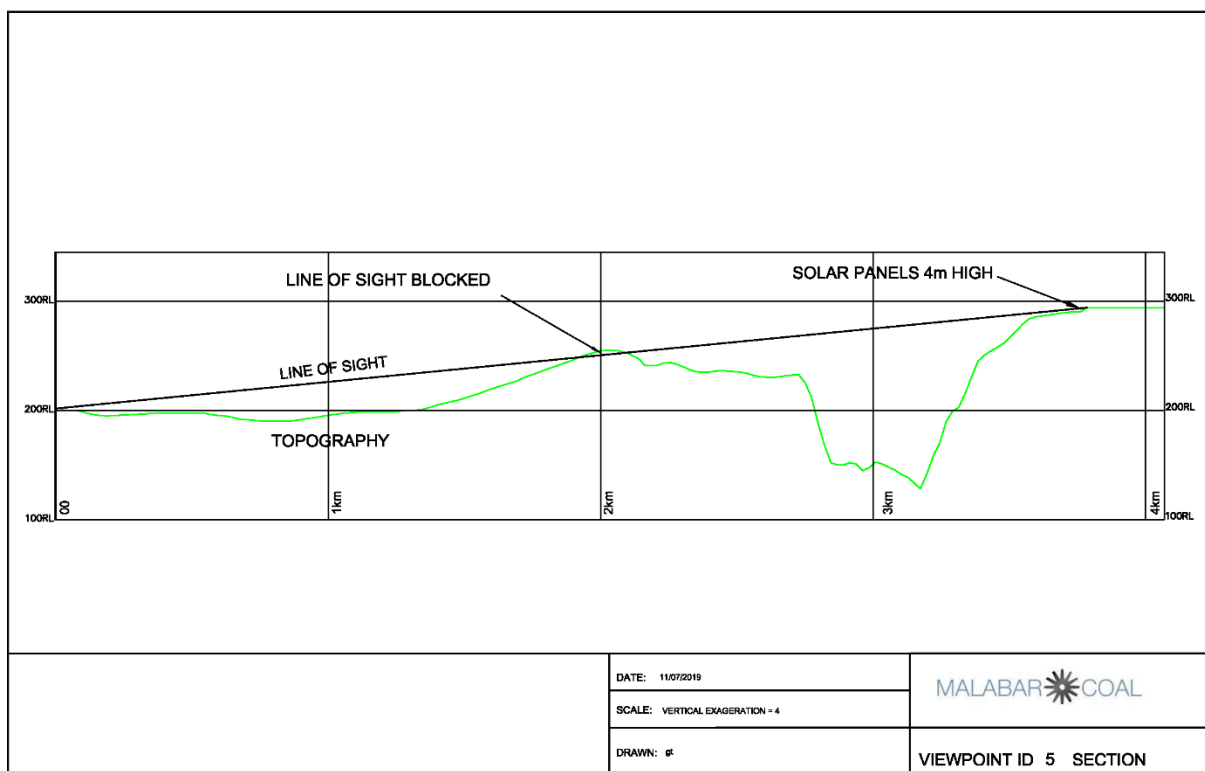


Figure 7-28 Cross section 5 of line of sight from Viewpoint 5 to the Proposal site

Viewpoint 6

Table 7-20 Viewpoint 6

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
6	4 to 5 Residents along New England Highway, New England Highway and Thomas Mitchell Drive motorists	Middle Ground, 2 to 4.5 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Residential: rural/minor local road/ agriculture	Moderate	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 6 is situated on Hassall Road looking southwest towards the Proposal site. Viewpoint 6 represents approximately six nearby residents and the view of motorists travelling on the New England Highway and Thomas Mitchell Drive.</p> <p>Figure 7-30 shows that when considering only the topography between the Viewpoint 6 and the Proposal site, there would be a line of site from Viewpoint 6 to the Proposal site. However, as shown in Figure 7-29, the proposed Solar Farm would not be visible due the large trees present between the viewpoint and the Proposal site.</p> <p>The solar infrastructure would be a new type of structure in the area that would be consistent with the existing industrial/mining landscape character.</p> <p>Mitigation recommended:</p> <p>Due to the heavy vegetation between the Proposal site and Viewpoint 6, no mitigation measures are recommended.</p>		



Figure 7-29 View of Proposal site approximately 3.4km from Viewpoint 6; the Proposal site location is highlighted by the red ellipse

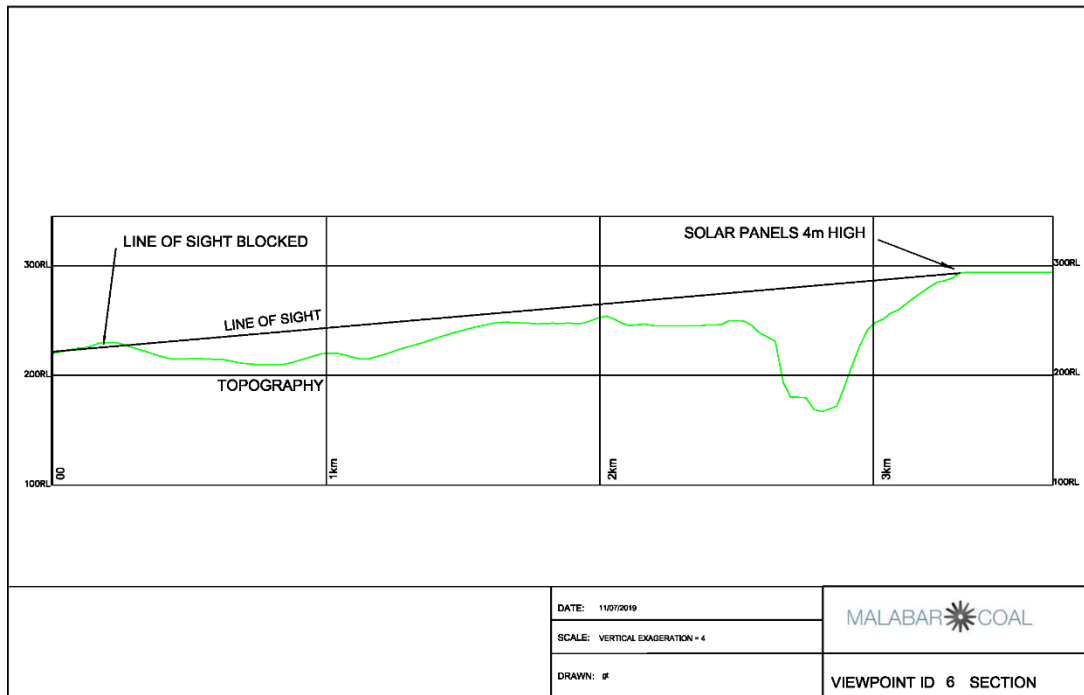


Figure 7-30 Cross section 6 of line of sight from Viewpoint 6 to the Proposal site

Viewpoint 7

Table 7-21 Viewpoint 7

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
7	New England Highway and Hebden Road Motorists	Middle Ground, 2 to 4.5 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Main travel corridor / minor local road	low	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 7 occurs at the intersection of Hebden Road and the New England Highway. The viewpoint is on the eastern side of the New England Highway, with Figure 7-31 looking west towards the Proposal site. Viewpoint 7 represents the view of motorists travelling on the New England Highway and Hebden Road.</p> <p>Figure 7-32 shows that the topography between the Viewpoint 7 and the Proposal site blocks the view of the proposed Solar Farm at Viewpoint 7.</p> <p>The solar infrastructure would be a new type of structure in the area that would be consistent with the existing industrial/mining landscape character.</p> <p>Mitigation recommended:</p> <p>As the view of the proposed Solar Farm is blocked by the land topography no mitigation measures are recommended.</p>		



Figure 7-31 View of Proposal site more than 3.5km from Viewpoint 7; the Proposal site is highlighted by a red ellipse

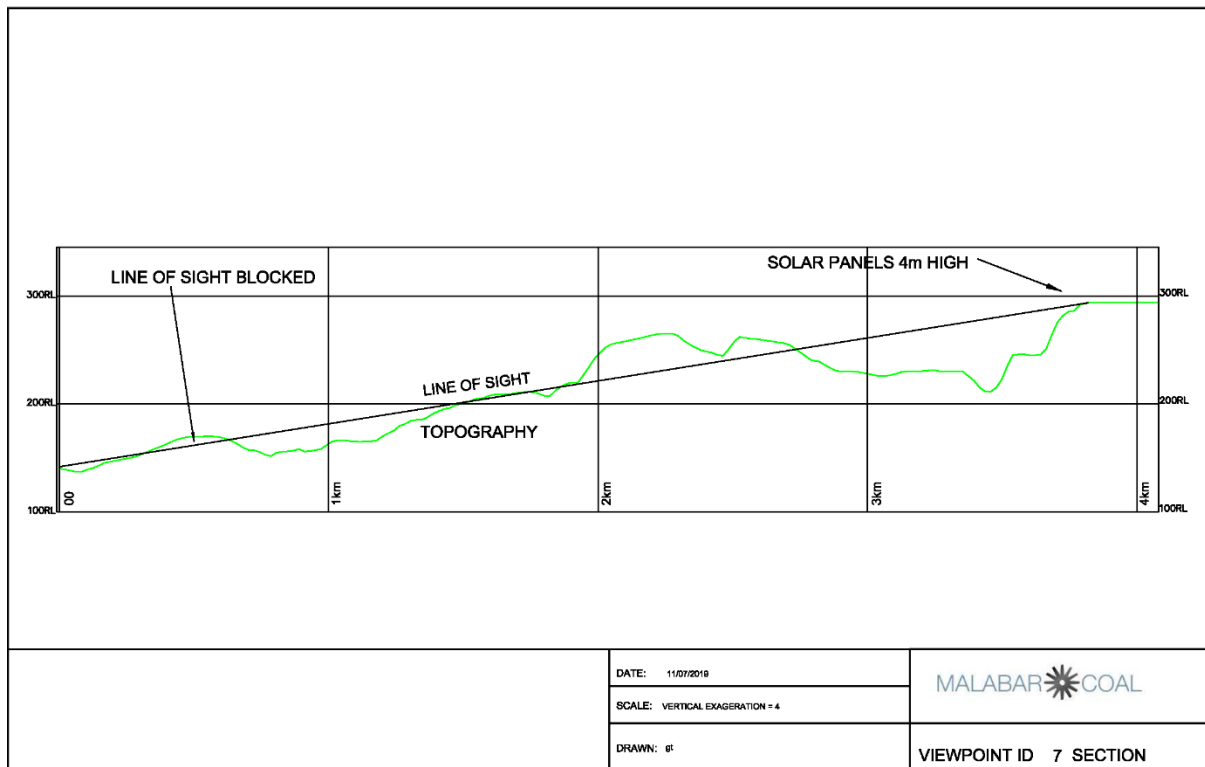


Figure 7-32 Cross section 7 of the line of sight from Viewpoint 7 to the Proposal site

Viewpoint 8

Table 7-22 Viewpoint 8

<i>Viewpoint ID</i>	<i>Representative receivers</i>	<i>Proximity</i>
8	New England Highway motorist	Background, <7 km
<i>Land use</i>	<i>Visual sensitivity</i>	<i>Visual effect</i>
Main travel corridor	Low	Low
<i>Visual impact</i>		
<p>Low Impact</p> <p>Viewpoint 8 is located on the southern side of the New England Highway. Figure 7-33 is the view at Viewpoint 8 looking Northwest towards the Proposal site.</p> <p>The Proposal would be visible from this viewpoint and is shown clearly in Figure 7-33; however, the Proposal site is approximately 7.5 km away and therefore, is not close enough to have a visual impact on New England Highway motorists.</p> <p>The solar infrastructure would be a new type of structure in the area that would be consistent with the existing industrial/mining landscape character.</p> <p>Mitigation recommended:</p> <p>Due to the distance between the viewpoint and the Proposal site mitigation measures are not recommended.</p>		



Figure 7-33 View of Proposal site c. 7.5km from Viewpoint 8; the Proposal site is highlighted with a red ellipse.

7.5.5 Visual impact assessment at representative viewpoints

Low visual impact

All eight viewpoints were assessed to have a low visual impact. These viewpoints were assessed as low impact due to the location of the Proposal the top of a plateau, undulating terrain, distance from the Proposal site, and / or existing vegetation between the site and receivers.

No further mitigation measures were recommended.

7.5.6 Glare and glint

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

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

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

The panels would not generally create noticeable glare compared with an existing roof or building surfaces. Figure 7-34 compares the reflectivity of various common surfaces. Seen from above (such as from aircraft) the panels appear dark grey and do not cause a glare or reflectivity hazard. Solar PV farms have been installed on a number of airports around the world and in Australia including Karratha in Western Australia and Darwin in the Northern Territory. Therefore, it is not likely the Proposal will have a visual impact from glint/glare and no mitigation measures are recommended.

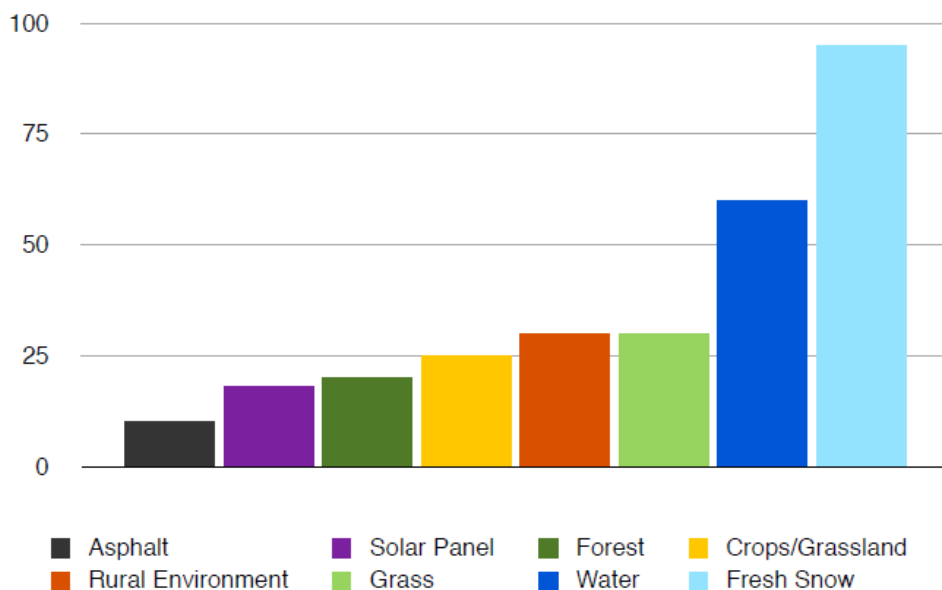


Figure 7-34 Comparative reflection analysis (Spaven Consulting, 2011)

7.6 NOISE AND VIBRATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Noise –

Including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and cumulative noise impacts (considering other development in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.

A desktop Noise Assessment (NA) was undertaken to quantify potential environmental noise levels associated with the construction and operation of the Proposal and identify mitigation measures, where required.

7.6.1 Policy setting

Noise impacts have been assessed with reference to the following key policies, guidelines and standards (where relevant):

- NSW Department of Environment and Climate Change - Interim Construction Noise Guideline (ICNG) (DECCW, 2009).
- Environment Protect Authority (EPA) - Noise Policy for Industry (NPI) (EPA, 2017).
- NSW Department of Environment, Climate Change and Water (DECCW) - Road Noise Policy (RNP) (DECCW, 2011).
- Assessing Vibration: A Technical Guideline (DEC, 2006).
- Roads and Maritime Services (RMS) - Construction Noise and Vibration Guideline (RMS, 2016).

Construction noise

The Interim Construction Noise Guideline (DECCW, 2009) is intended to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints. The guidelines identify sensitive receivers, including residences, classrooms, hospitals, places of worship and recreational areas such as parks and sports grounds.

The guidelines provide that works which are not likely to affect an individual or sensitive land use for more than three weeks can be assessed using a qualitative method. A quantitative noise assessment is required where construction noise affects sensitive receivers for more than three weeks.

The construction of the Proposal would occur over a 12-18-month period, although noise-producing activities and sources would be episodic, related to discrete construction stages. The project would therefore require quantitative assessment under the guideline and is provided below.

The guideline specifies noise management levels for residences and other sensitive receivers, based on time (within or outside standard work hours) and Rating Background Level (RBL) (Table 7-23). Above the prescribed noise management levels (NMLs), the proponent needs to implement all feasible and reasonable work practices, as defined in the guideline, to minimise noise impacts.

Table 7-23 Noise Management Levels at residential receivers as per the Interim Construction Noise Guideline (DECCW, 2009)

Time of day	Management level
Recommended standard hours: Monday to Friday 7 am to 6 pm	Noise affected RBL + 10dB(A)
Saturday 8 am to 1 pm	Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected RBL + 5dB(A)

Background noise monitoring for the purpose of this NA has not been undertaken at receivers around the Proposal site. For the purposes of the quantitative assessment, background noise levels have been used from the Noise Management Plan (Maxwell Infrastructure (Malabar Coal), 2018) implemented for the management of noise aspects associated with the Maxwell Infrastructure Site.

On this basis, Table 7-24 identifies the construction NMLs as prescribed in the Interim Construction Noise Guideline (DECCW, 2009) that apply to the assessment of noise impacts on sensitive receivers around the Proposal site. In addition, a highly affected noise objective of 75 dB(A) applies to all receivers during standard construction hours. Above this level, there may be strong community reaction to noise and other feasible and reasonable ways to reduce noise need to be considered, such as providing respite periods for affected residences.

Table 7-24 Construction Noise Management Level (Maximum allowable noise level) at Residential Receivers as prescribed in the Interim Construction Noise Guideline (DECCW, 2009)

Receiver	Day L_{A90} Background Noise Level (RBL)	Day Noise Management L_{A90} (15min) Maximum allowable noise level
Residential	40 ¹	50

Operational noise

The NSW Noise Policy for Industry (NPI) (EPA, 2017) provides a process for industrial noise management involving the following steps (summarised):

1. Determine the project noise trigger levels, above which noise management measures are required to be considered. They are based on intrusiveness and amenity criteria.
2. Predict or measure the noise levels produced by the development.
3. Compare the predicted or measured noise level with the project noise trigger level and assess the need for noise mitigation and management measures.
4. Consider residual noise impacts, after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts and include consultation with the affected community.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

The trigger levels are tailored for each specific circumstance to take into account a range of factors that may affect the level of impact.

The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Generally, the intrusiveness level will be most significant areas with little industry or ambient noise, whereas the amenity level will be important in areas with higher existing background noise.

Criteria

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

Intrusiveness level

The minimum assumed RBLs set by the policy are provided in Table 7-25

Table 7-25 Minimum assumed RBLs and project intrusiveness noise levels (EPA, 2017)

Period	Minimum assumed rating background noise level (dB[A])	Minimum project intrusiveness noise levels (LAeq,15min dB[A])
Day (7am-6pm)	35	40
Evening (6pm-10pm)	30	35
Night (10pm-7am)	30	35

Amenity level

To maintain recommended amenity noise levels, a project amenity noise level applying for each new source of industrial noise is calculated as the recommended amenity noise level, minus 5 dB(A); refer to Table 7-26.

Table 7-26 Amenity noise levels for residential receivers in a rural setting (EPA, 2017)

Period	Recommended level LAeq dBA	Project level LAeq dBA
Day (7am-6pm)	50	45
Evening (6pm-10pm)	45	40
Night (10pm-7am)	40	35

Road traffic noise

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) (DECCW, 2011). The RNP provides traffic noise criteria based on the road category and type of project or land use; refer to Table 7-27.

Based on functionality, Thomas Mitchell Drive can be categorised as an arterial road, being a road connecting a freeway (New England Highway) with local roads nearby. The RNP road traffic noise criteria for existing residences affected by additional traffic on arterial roads are provided in Table 7-27

Table 7-27 RNP Road Traffic Noise Criteria dB(A)

Road category	Type of project/land use	Assessment criteria dB(A) (external)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway Arterial Sub-arterial	Existing residences affected by additional traffic on existing roads	LAeq (15 hour) 60	LAeq (9 hour) 55

The RNP provides that, if the relevant assessment criteria are not achievable after taking feasible and reasonable mitigation measures, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. The 2dB limit is applied to both the relevant day and night assessment criteria.

Vibration

The potential for vibration impact in terms of human comfort, cosmetic damage and structural damage were assessed with reference to *Assessing Vibration: A Technical Guideline* (DECCW, 2009) and the *Construction Noise and Vibration Guideline* (CNVG) (RMS, 2016). Recommended safe buffer distances from relevant construction equipment were obtained from the CNVG.

7.6.2 Existing environment

Background noise levels

Maxwell Infrastructure

The Proposal site is in an industrial setting surrounded by mining activities. Historically, Drayton Mine, now called Maxwell Infrastructure, relied on several items of fixed and mobile equipment to uncover, extract, process and transport coal. Noise emissions from the operation of mobile equipment, coal processing and transport had the potential to adversely affect the acoustic environment and surrounding residences.

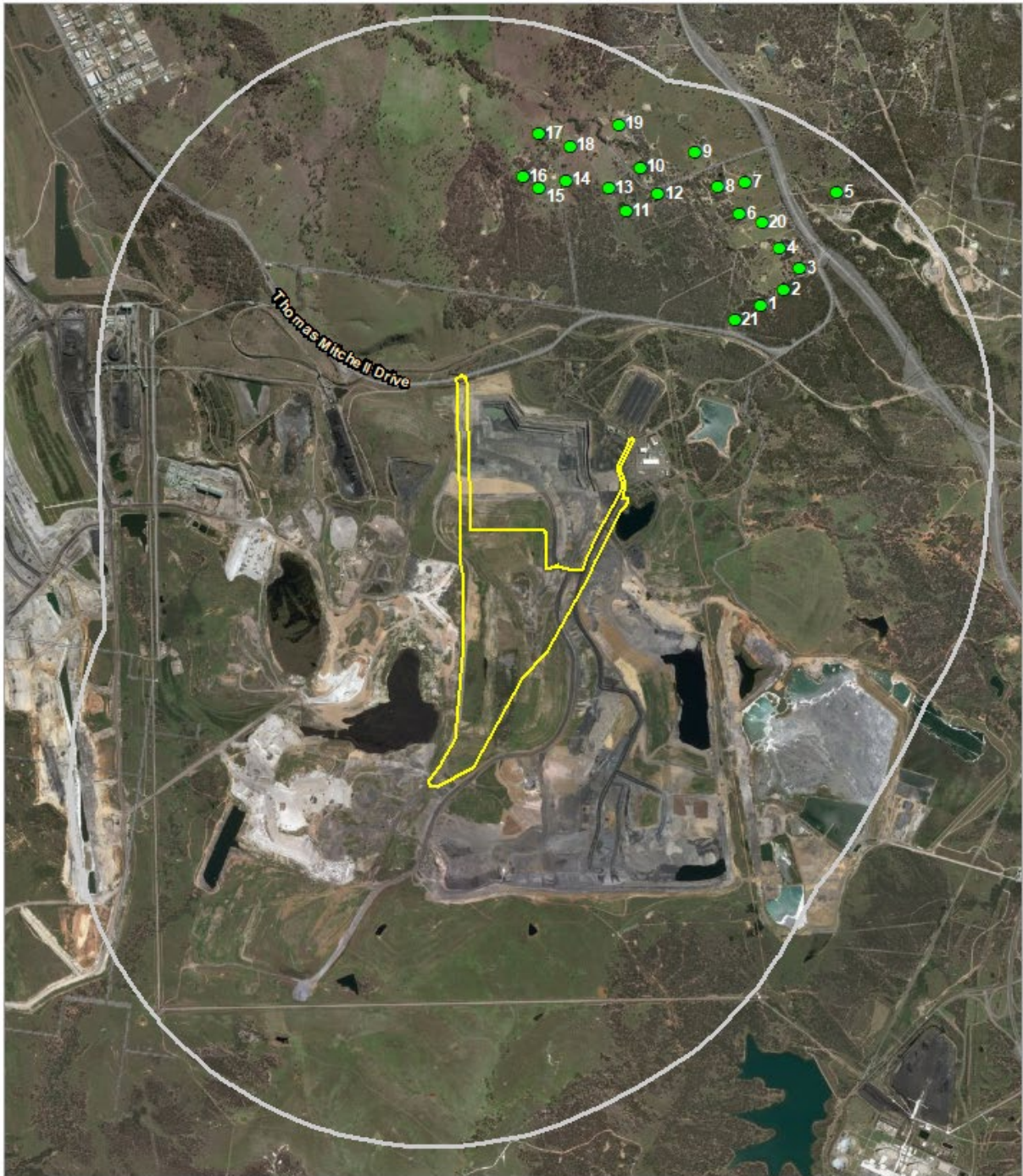
Current operations include rehabilitation activities. Bulk earthworks that are required to undertake mine site rehabilitation activities requires the operation of a small fleet of plant and equipment that includes dozers, excavators, haul trucks, graders and water carts.

Sensitive receivers

Sensitive receivers within 3km of the Proposal site were identified from aerial photography and topographic maps. The sensitive receivers are primarily residences which include those owned by Maxwell Infrastructure and private properties. The closest receivers, within 3km of the Proposal site, are listed in Table 7-28 and shown in Figure 7-35. The identified receivers surrounding the Proposal site are classified as rural under NPI guidelines, although background noise levels may be elevated due to proximity to mining activities, the New England Highway and Thomas Mitchell Drive.

Table 7-28 Receivers within 3km of the Proposal boundary

Receiver ID	Approx. distance from solar array site (m)	Receiver type	Ownership
R1	2591	Residence	Private
R2	2824	Residence	Private
R3	3054	Residence	Private
R4	3060	Residence	Private
R5	3736	Residence	Private
R6	3124	Residence	Private
R7	3354	Residence	Private
R8	3219	Residence	Private
R9	3392	Residence	Private
R10	3153	Residence	Private
R11	2743	Residence	Private
R12	2956	Residence	Maxwell Infrastructure owned
R13	2894	Residence	Private
R14	2915	Residence	Private
R15	2856	Residence	Private
R16	2935	Residence	Maxwell Infrastructure owned
R17	3292	Residence	Maxwell Infrastructure owned
R18	3209	Residence	Private
R19	3459	Residence	Private
R20	3123	Residence	Private
R21	3142	Residence	Private
R22	2340	Residence	Private



Residences within 3km

19-069 Maxwell Solar Farm

- Residence
- 3km buffer of project boundary
- ▭ Project boundary

0 200 400 800 Meters



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Ref: 19-069
Author: L.B 20.5.19



Figure 7-35 Residences within 3km of the project boundary

7.6.3 Potential impacts

Construction and decommissioning noise

Construction works would be restricted to daytime, standard work hours. The construction noise management level for the project would be 50dB(A) (i.e. 10dB(A) above the background noise level). Actual noise levels produced would be well below this level consistent with the analysis below.

The proposed construction activities include the following:

- Site establishment.
- Installation of steel post and rail foundations for solar panels.
- Installation of underground cabling and cable crossings.
- Construction of control room and storage building.
- Construction of switch station (if 66kV option is selected) and associated connections.

Table 7-29 lists typical plant and equipment likely to be used by the contractor to construct the Proposal. The sound power levels for the majority of activities presented in Table 7-29 are 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 or information obtained from past projects. Sound power levels are anticipated to be the same for the decommissioning of the Proposal.

Table 7-29 Typical plant and equipment and sound power levels

Plant item	Indicative number of items	LAeq Sound Power Levels, dB(A) re. 1pW (single item)
Small pile driving rig ¹	2	114
Crane	1	110
Drum roller	1	109
Padfoot roller	1	109
Wheeled loader	1	109
Dump truck	1	108
30t Excavator	1	107
Grader	1	107
Chain trencher	1	104
Water truck	1	104
Telehandler	1	98
Forklift	1	90
Light vehicles	3	88

¹ Pile driving rigs used for the installation of solar array posts. Alternatively, posts may be installed by boring, which produces less noise.

Noise levels at receivers would vary substantially over the duration of construction due to the transient nature and range of plant and equipment that may be used. It should also be noted that nearby industrial activities, including mining operations by Mount Arthur Mine, and rehabilitation operations by Maxwell Infrastructure, would be happening concurrently.

Noise at receiver locations are influenced by:

- 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).
- Attenuation from barriers (natural and purpose built).
- Nearby activities including operations at Mount Arthur Mine west of the Proposal.

Recent noise modelling conducted for larger Solar Farm Proposals in rural areas predicted that construction noise management levels could be exceeded for a residential receiver located 270m from the site (52 LAeq 15min) (NGH Pty Ltd, 2017a). Another noise assessment modelled 52 LAeq 15min at 135m and 50 LAeq 15 min at 330m, with no exceedance at 710m (NGH Pty Ltd, 2017). This modelling is based on a worst-case scenario with up to three of the noisiest construction plant operating concurrently, positioned close to the Proposal site boundary in proximity to the residence. A further assessment for a large Solar Farm predicted 59 LAeq 15 min at 50m from the development site and 51 LAeq 15 min at 100m, based on the use of the pile driving method for array installation (RPS, 2017).

As the closest residences are located approximately 1.3km from the proposed Maxwell Solar Farm site none of the receivers are likely to experience construction noise approaching the noise affected level of 50dB(A).

Although exceedance of the construction noise management level is unlikely for residential receivers, nonetheless reasonable noise management measures are recommended. Possible noise control methods indicated in AS 2436-2010 (R2016) *Guide to noise and vibration control on construction, demolition and maintenance sites* are summarised in Table 7-30. It is noted that the noisiest construction process is the use of pile driving rigs to install solar array posts. Alternatively the post holes could be bored, so creating less noise.

The potential exceedances at receiver locations are expected to be short-term and unlikely to exceed three weeks because works producing noise would be intermittent and move progressively around the Proposal site.

Table 7-30 Possible noise control methods outlined in AS 2436

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

Operational noise

The minimum day time project intrusiveness noise level is 35 LAeq, 15min dBA and the daytime project amenity level 45 LAeq dBA is 45.

A combination of fixed-tilt panels and / or motorised single-axis trackers would be used in the solar arrays comprising of approximately 4,500 strings each containing 30 panels. It is understood that the tracking

technology produces a very low (2dBA) noise level at source. This is therefore not likely to have any impact on any sensitive receivers and is below that which is required to be assessed in the Noise Policy for Industry. Inverter stations would also produce some noise but would similarly be unlikely to affect any sensitive receivers. Typical operating noise levels for solar farm infrastructure are provided in Table 7-31.

Table 7-31 Operation noise from Solar Farm equipment

Plant description	L _{Aeq} Sound Power Levels, dB(A) re. 1pW (Sound Power Reference Levels)
Tracker motor	2 (each)
Solar farm PCU	88 (each)
Substation	83
Light vehicle	88 (each)

Operation noise modelling for a larger 170 MW solar farm proposal using similar technology in an open rural landscape predicted noise levels up to 35 LAeq, 15min dBA for receivers 50m from the development site (RPS, 2017). Therefore as the nearest sensitive receiver to the Maxwell Solar Farm site is 1.3km, no exceedance of the day-time project intrusiveness noise level is expected, and additional noise mitigation measures are unwarranted.

Road traffic noise

The adopted assessment criteria for the project for day-time traffic noise on Thomas Mitchell Drive is LAeq (15 hour) 60 dB(A) (external). Construction work would be confined to standard day-time work hours. An indication of the number and type of vehicle movements during the 12-18 month construction period is provided in Section 7.7.

The closest residential receivers on the proposed haulage route on Thomas Mitchell Drive are located 150m and 200m from the road.

Road traffic noise predictions for a larger 195MW Solar Farm Proposal on a local road, with correspondingly more vehicle movements, indicated that the predicted noise level at a receiver location 25m from an arterial road with a 100 km/hr speed limit would be 52 dB(A), and 39 dB(A) for a location 200m from a local road with an 80 km/hr speed limit. This suggests the additional traffic generated by the proposed Maxwell Solar Farm would be unlikely to exceed the project road traffic noise criteria.

Operation phase traffic would be largely restricted to light vehicles and would not be likely to significantly affect local road noise.

Vibration

Vibration impacts attenuate with distance, with studies involving railway noise showing a rapid decrease in vibration disturbance as the distance increases from 25m to 150m, a slower rate of reduction over 200m, and no vibration disturbance at 500m (DEC, 2006).

Vibration generating activities would occur only during the construction phase of the project. The construction activities which would produce vibration at the site include the use of vibrating padfoot rollers and array post boring or pile driving. Safe buffer distances to comply with human comfort, cosmetic damage and structural damage criteria sourced from the CNVG (RMS, 2016) are presented in Table 7-32.

The closest residential receiver to the Proposal site is located approximately 1.3km from site development area where the panels would be installed. The works would not impinge on the recommended buffer

distances in the CNVG and are not likely to result in significant vibration impacts in terms of cosmetic damage or human comfort.

Table 7-32 Safe buffer distances for vibration impacts for relevant equipment (RMS, 2016)

Plant	Description	Cosmetic damage (BS 7385)	Human response (OH&E vibration guideline)
Vibratory Roller	<50 kN (typically 1-2 tonnes)	5m	15m to 20m
	<100 kN (typically 2-4 tonnes)	6m	20m
	<200 kN (typically 4-6 tonnes)	12m	40m
	<300 kN (typically 7-13 tonnes)	15m	100m
	>300 kN (typically 13-18 tonnes)	20m	100m
	>300 kN (> 18 tonnes)	2m	100m
Vibratory pile driver	Sheet piles	2m to 20m	20m
Pile Boring	≤ 800 mm	2m (nominal)	4m

7.6.4 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise noise and vibration risks are provided in Table 7-33.

Table 7-33 Safeguards and mitigation measures for noise and vibration impacts

No.	Mitigation strategies	C	O	D
NS1	Works should be undertaken during hours: <ul style="list-style-type: none"> Monday – Friday 6am to 6pm. Saturday 6am to 1pm. No work on Sundays or public holidays. 	C		D
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	C	O	D
NS3	Letters would be provided to residents within 3km of the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	C	O	D
NS4	Implement noise control measures that are suggested in Australian Standard 2436-2010 <i>“Guide to Noise Control on Construction, Demolition and Maintenance Sites”</i> , to reduce predicted construction noise levels.	C		D
NS5	In addition to physical noise controls, the following general noise management measures should be followed: <ul style="list-style-type: none"> 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		D

No.	Mitigation strategies	C	O	D
	<ul style="list-style-type: none"> 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. 			
NS6	Establish a noise management procedure 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.	C	O	D
NS7	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	C		D
NS8	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. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.	C		D

C: Construction; O: Operation; D: Decommissioning

7.7 TRAFFIC TRANSPORT AND SAFETY

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Transport –

- An assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;*
- An assessment of the likely transport impacts to the site access route (including Thomas Mitchell Drive, New England Highway and Denman Road), site access point, rail safety issues, any Crown land, particularly in relation to the capacity and condition of the roads;*
- A cumulative impact assessment of traffic from nearby developments;*
- A description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and*
- A description of the measures that would be implemented to mitigate any transport impacts during construction;*

MUSWELLBROOK SHIRE COUNCIL REQUIREMENTS

Traffic -

A traffic impact assessment should be prepared in relation to the project, which investigates the effect of additional traffic movements associated with the construction, operational and decommissioning phases of the project on the local and regional road network.

ROADS AND MARITIME SERVICES REQUIREMENTS

Roads and Maritime recommends that the EIS should refer to the following guidelines with regard to the traffic and transport impacts of the proposed development:

- Road and Related Facilities within the Department of Planning EIS Guidelines, and,*

- *Section 2 Traffic Impact Studies of Roads and Maritime's Guide to Traffic Generating Developments 2002.*

A traffic and transport study shall be prepared in accordance with the Road and Maritime's Guide to Traffic Generating Developments 2002 and is to include (but not be limited to) the following:

- *Assessment of all relevant vehicular traffic routes and intersections for access to/ from the subject properties.*
- *Current traffic counts for all of the traffic routes and intersections.*
- *The anticipated additional vehicular traffic generated from both the construction and operational stages of the project.*
- *The distribution on the road network of the trips generated by the proposed development. It is requested that the predicted traffic flows are shown diagrammatically to a level of detail sufficient for easy interpretation.*
- *Consideration of the traffic impacts on existing and proposed intersections, in particular, the intersections of Thomas Mitchell Drive / New England Highway and Thomas Mitchell Drive /Denman Road, and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development during both the construction and operational stages. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area.*
- *Identify the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network for the development. In this regard, preliminary concept drawings shall be submitted with the EIS for any identified road infrastructure upgrades. However, it should be noted that any identified road infrastructure upgrades will need to be to the satisfaction of Roads and Maritime and Council.*
- *Traffic analysis of any major / relevant intersections impacted, using SIDRA or similar traffic model, including:*
 - *Current traffic counts and 10 year traffic growth projections*
 - *With and without development scenarios*
 - *95th percentile back of queue lengths*
 - *Delays and level of service on all legs for the relevant intersections*
 - *Electronic data for Roads and Maritime review.*
- *Any other impacts on the regional and state road network including consideration of pedestrian, cyclist and public transport facilities and provision for service vehicles.*

A Traffic Impact Assessment for the proposed construction and operation of the Maxwell Solar Farm was prepared by Amber Organisation. The report is summarised below and provided in full in APPENDIX I.

7.7.1 Existing environment

The proposed Maxwell Solar Farm is located approximately 10km south of Muswellbrook, New South Wales. Access to the proposed site would be provided via Thomas Mitchell Drive, a local road which runs in a northwest-southeast alignment between the New England Highway to the east and Denman Road to the west.

Existing road network characteristics

Thomas Mitchell Drive accommodates one lane of traffic in each direction, with a sealed width of approximately 7 metres. It provides access to the Mt Arthur Mine, the Muswellbrook Industrial Area, and the Maxwell Infrastructure site, and has a posted speed limit of 80km/hr.

Denman Road and the New England Highway are State arterial roads under the management of RMS. The intersection of Denman Road and Thomas Mitchell Drive is priority controlled with a Give Way sign provided for vehicles exiting Thomas Mitchell Drive. An Auxiliary Left Turn (AUL) turning treatment is provided for vehicles turning into Thomas Mitchell Drive, and widening of the northbound carriageway allows northbound vehicles to pass around vehicles waiting to turn right into Thomas Mitchell Drive.

The intersection of New England Highway with Thomas Mitchell Drive is a seagull intersection with a Give Way sign provided for vehicles exiting Thomas Mitchell Drive. Channelised deceleration lanes are provided for vehicles turning into Thomas Mitchell Drive, and acceleration lanes are provided for vehicles turning into New England Highway in both directions. Vehicles turning right into Thomas Mitchell Drive have priority over those turning left into Thomas Mitchell Drive, which are provided with a Give Way signed slip lane.

It is to be noted that Condition 47(c) of the Project Approval for the Mt Arthur Coal Mine Open Cut Consolidation Project requires upgrading of the intersection of Denman Road and Thomas Mitchell Drive by the end of December 2019. Therefore, it can be expected that the intersection will be upgraded before the construction of the proposed Maxwell Solar Farm commences.

7.7.2 Potential impacts

Construction impacts

On average, the Proposal will generate approximately 12 vehicle movements during construction in the peak hours, assuming 10% of the total vehicle movements for the site occur during the peak hours.

The construction of the proposed solar farm would generate approximately 120 vehicle movements per day during construction in the peak hours. Peak hours are anticipated to be between 5:00am and 7:30am and between 4:30pm and 7:00pm. The types of vehicle movements expected are summarised in Table 7-34 refer to the Traffic Impact Assessment (Appendix K). It is concluded that the small increase in traffic during construction would be readily accommodated by the surrounding road network and would be within the daily variation of traffic movements at the nearby intersections. For cumulative impacts to traffic during construction, refer to Section 8.7.

Table 7-34 Estimated vehicle movements per day during peak construction, by vehicle type

Vehicle type	Vehicle movements per day
Light vehicles – Workforce	90
Light vehicles – Visitors, consultants	10
Semi-Trailer/heavy vehicle	16
Cranes	4
Total	120

Operation

Operating traffic volumes would be significantly less than during construction, with approximately 10 vehicle movements generated per day. It is concluded that the small increase in traffic would be readily accommodated by the surrounding road network and would be within the daily variation in traffic movements at the nearby intersections. The Maxwell Underground Project Report also concludes that all related intersections are expected to operate at good levels of service with short delays and spare capacity, except for the intersection of Thomas Mitchell Drive and Denman Road.

Decommissioning

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

7.7.3 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise traffic risks are provided in Table 7-35.

Table 7-35 Safeguards and mitigation measures for traffic, transport and safety impacts

No.	Safeguards and mitigation measures	C	O	D
TT1	<p>A Traffic Management Plan will be developed and implemented during construction and decommissioning. The plan will be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the Proposal. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. • A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the code. • Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. • Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. • Water to be used on unsealed roads to minimise dust generation through increased traffic use. 	C		D

C: Construction; O: Operation; D: Decommissioning

8 ASSESSMENT OF ADDITIONAL ISSUES

8.1 HYDROLOGY AND FLOODING

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Water –

- An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;
- Details of water requirements and supply arrangements for construction and operation; and
- A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction (Landcom 2004)*;

DOI – WATER REQUIREMENTS

- The identification of an adequate and secure water supply for the life of the project. This includes confirmation that water can be sourced from an appropriately authorised and reliable supply. This is also to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.
- Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.
- Proposed surface and groundwater monitoring activities and methodologies.
- Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans.

DPIE REQUIREMENTS

Water and soils –

The EIS must map the following features relevant to water and soils including:

- Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).
- Rivers, streams, wetlands, estuaries (as described in Section 4.2 of the Biodiversity Assessment Method).
- Wetlands as described in Section 4.2 of the Biodiversity Assessment Method.
- Groundwater.
- Groundwater dependent ecosystems.
- Proposed intake and discharge locations.

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 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 (Water Quality Objectives) 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.

Water quality –

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.

Hydrology –

- 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 and coastal erosion -

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).

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.

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.
- 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.

The EIS must assess the impacts on the proposed development on flood behaviour, including:

- Whether there will be detrimental increases in the potential flood affection of other properties, assets and infrastructure.
- Consistency with Council floodplain risk management plans.
- Compatibility with the flood hazard of the land.
- Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
- Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
- Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
- Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.
- Whether the Proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.
- Emergency management, evacuation and access, and contingency measures for the development considering the full range 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.

- *Any impacts the development may have on the social and economic costs to the community as consequence of flooding.*

8.1.1 Existing environment

Surface water

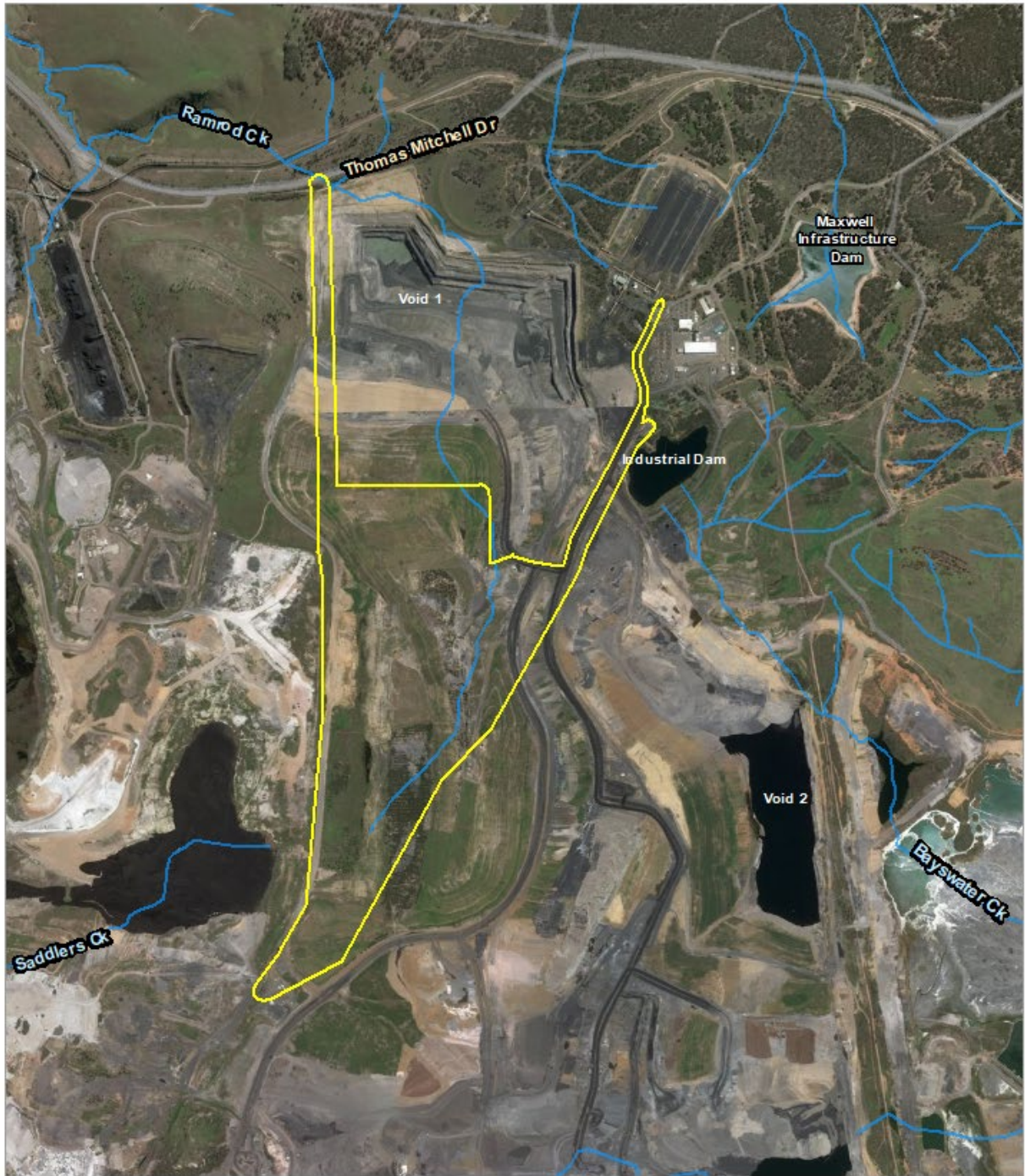
The Proposal site is within the Hunter Local Land Services area and upper section of the Hunter Catchment. The site is located approximately 8km southeast of the Hunter River. First and second order ephemeral creeks drain away from the Proposal site which include Ramrod Creek, Saddlers Creek and Bayswater Creek (refer to Figure 8-2). Lake Liddell to the east and Plashett Reservoir to the south both act as receiving water bodies to surface water and groundwater flow. No natural watercourses or prescribed streams run through the Proposal site as the topography has been altered.

The site is in proximity to three final voids which are used as water storages in the post-mining landscape (Figure 8-1 and Figure 8-2).

Surface water within the Maxwell Infrastructure site is currently monitored on a monthly basis at eight locations as per the EPL requirements.



Figure 8-1 Existing void (void 2 on Figure 8-2)



Hydrology

19-069 Maxwell Solar Farm

- Project boundary
- Waterway/ drainage line

0 200 400 800 Metres

A4 @ 1:22500
Ref: 19-069
Author: L.B 20.5.19



Figure 8-2 Pre-mining surface water, waterways and drainage lines within the Proposal site

Hunter catchment area

The Hunter catchment covers 22,000 square-kilometres (km²) and comprises the region popularly known as the Hunter Valley (DOI, 2019). It is bound by the Manning and Karuah catchments in the north, and by the Lake Macquarie and Hawkesbury-Nepean catchments in the south. The dominant surface water feature within the catchment is the Hunter River, located approximately 8km north-west of the Proposal site and the Goulburn River, approximately 22km south-west of the Proposal site.

The catchment supports a large population and a diverse range of water uses. Key users include major coal mines, power generating industries, other heavy industry, horse and cattle studs and irrigated agriculture. Water sharing plans have been developed in the Hunter catchment to address environmental requirements and to ensure sustainable use of water by all water users.

Groundwater

The Proposal is within the Hunter Valley Alluvial Aquifer Groundwater Management Unit (GMU) and situated above Quaternary alluvial deposits and Permian coal measures.

- Quaternary alluvial deposits – Residual soils and colluvium units including all blanketing sandy, loamy and clay soils.
- Permian coal measures – Coal seams (including Whybrow, Redbank Creek, Wambo, Whynot and Blakefield), claystone, tuff, siltstone, sandstone and conglomerate.

The Hunter Valley Alluvial Aquifer GMU provides water to the Hunter River as baseflow during periods of above average rainfall and is an important source of groundwater for agricultural activities. The Proposal site is subject to two Water Sharing Plans (WSP); the Hunter Unregulated and Alluvial Water Sources WSP and the Hunter Regulated River Water Source WSP.

The Maxwell Infrastructure site currently undertakes groundwater monitoring in accordance with its Environmental Approval (DoP, 2009). Maxwell Infrastructure has had a groundwater monitoring network in place for the life of the mine. As mining has progressed, a number of bores have been removed over time. The groundwater monitoring network covering the Maxwell Infrastructure site currently consists of 15 bores. Long-term data is available from all these bores, with some bores providing data in excess of thirty years.

Maxwell Infrastructure does not actively draw water from any ground or surface water sources. Maxwell Infrastructure holds Water Access Licence (WAL), WAL 41559, for the passive intake of aquifer water associated with the mine excavation.

Groundwater within the Maxwell Infrastructure site is currently monitored on a monthly basis at one location and quarterly at three additional locations as per the EPL requirements.

Groundwater Dependant Ecosystems (GDEs)

Potential GDEs within the vicinity of the development site are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2019). There are no listed terrestrial GDE sites within the development site (Figure 8-3). Small patches of terrestrial GDE of low potential surround the development site.

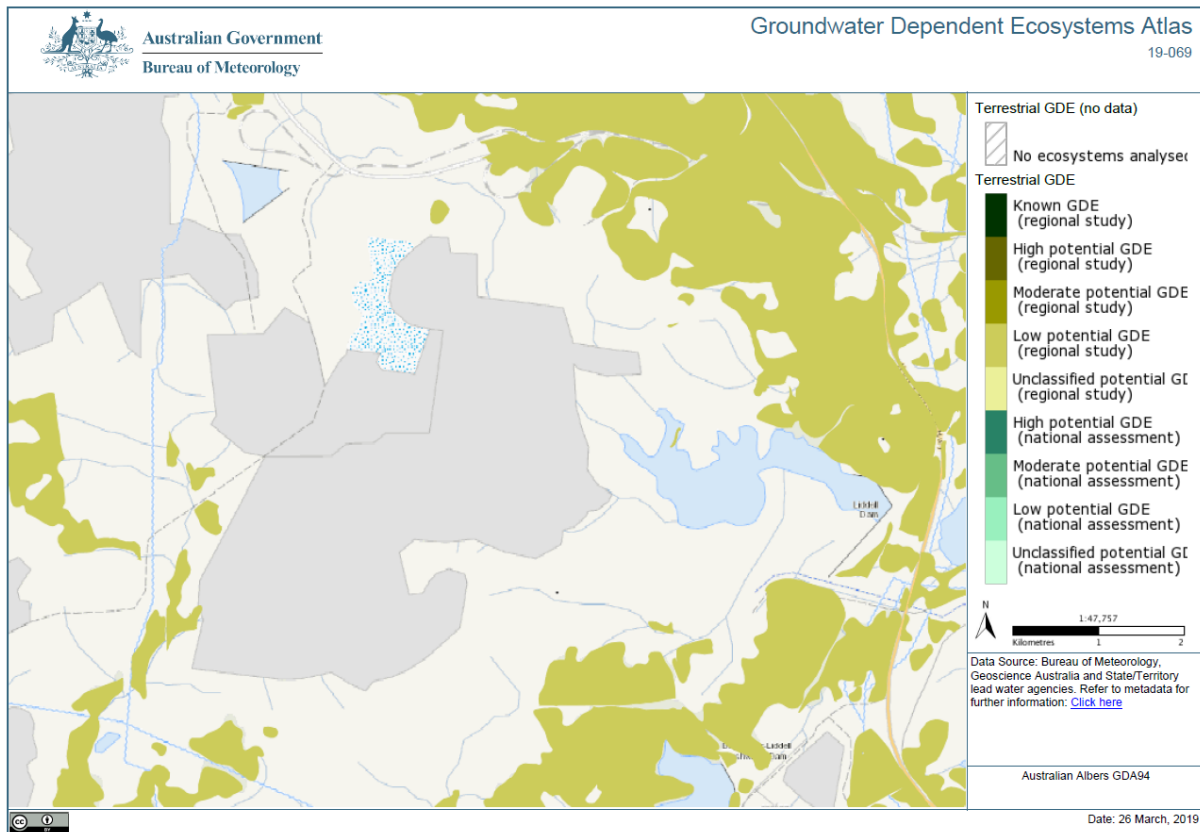


Figure 8-3 Terrestrial GDEs within the Proposal locality (BOM, 2019)

Flooding

The development site is located within the Hunter Catchment. The site for the solar panels is situated on the generally flat top of a rehabilitation mound which features a contemporary natural looking landform mound. Elevation ranges from 240 to 290 AHD. The proposed alignment for the 66kV option is via a previously disturbed corridor north of the solar panels towards Thomas Mitchell Drive. Elevation drops towards the north to 220 AHD. The proposed 33kV alignment is east of the solar panels to connect to the existing Maxwell Infrastructure substation. Elevation drops to approximately 220 AHD at the lowest point near the mine void and increases to 250 AHD at the substation.

No flood liable land mapping is currently available in the Muswellbrook LEP. A flood study of the Hunter River floodplain from Muswellbrook to Denman (Worley Parsons, 2015) has been produced for the Muswellbrook Shire Council, however, the Proposal site falls to the west of the flood study area. A flood inundation map produced by the NSW Water Resources Commission in 1984 for Muswellbrook shows that the Hunter River is prone to flooding and a one-kilometre buffer of the river is inundated by a 1 in 100 years flood. The Proposal solar array area is located approximately 8.7km from the Hunter River.

Due to the height of the site for the solar panels it is unlikely that this area would be classified as flood prone.

8.1.2 Potential impacts

Construction and decommissioning

Water use

Water use during construction and decommissioning would be minimal and largely used for dust suppression on unsealed roads. The water requirement would vary, dependent on weather conditions, and is estimated to be up to 10ML in total per annum. About 15kL of potable water would be required for employees and contractors per annum (refer to Table 8-1).

Table 8-1 Water requirements during construction and decommissioning

Water quality	Construction water requirement (ML)	Potential sources	Availability
Potable (drinking)	0.15	Truck delivered and temporarily stored on site, bottled water	Available as required – commercial supply
Non-potable	15	Sourced from a dam on the adjacent Maxwell Infrastructure site	Available as required

Impacts to adjacent licensed water users, including Maxwell Infrastructure and Bayswater Power Station, are considered negligible due to the amount of water required and proposed sources.

Surface water quality

Indirectly, the Proposal would involve a range of activities that would disturb soils and potentially lead to sediment laden runoff, affecting local drainage lines, waterways and open voids during rainfall events. These potential impacts are discussed in Section 7.4 and Section 8.1 and are unlikely to significantly impact on water quality.

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

Existing surface water drainage patterns could be slightly altered by construction; however, these would be managed by ensuring flow is directed to the existing locations. Surface water would drain from the site through the ephemeral drainage lines, including rock lined drainage lines.

Detention ponds, if required to manage surface water during construction and operation, would be detailed in the design phase, specific to the array layout. Erosion and sediment control measures would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater* (Landcom, 2004); refer to Section 7.4.

Groundwater

It is considered that the Proposal would have negligible impact on groundwater quality given the low pollution potential of the Solar Farm. Impacts to groundwater as a result of the Proposal are unlikely.

Flooding

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

Parts of the site may be at risk of temporary minor flooding during high rainfall events and high flows through north and north-east portions of site. Temporary localised flooding has the potential to interfere with construction and poses a safety risk for workers onsite. The Proposal has potential to create the following hazards in the event of a localised flood:

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

The design of buildings (e.g. switch station, if 66kV option is selected), equipment foundations and footings would consider the potential for flooding at the site. No components are considered susceptible to becoming mobile and entering waterways during construction. All potential pollutants stored on-site during construction would be stored in accordance with HAZMAT requirements and banded. A flood response plan would be developed to manage the safety of workers and equipment in the event of extended flooding in the region.

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

Operation

Water use

Water use volumes during operation would be minimal, estimated at approximately 15kL of potable water per year for staff amenities at the switch station (if 66kV option selected). Non-potable water during operation would be required for panel cleaning, which is weather dependent and expected to be 10L/ year. Some Solar Farms are never cleaned, others require more than two cleanings per year. Should water be required, it would be sourced from a dam on the adjacent Maxwell Infrastructure site or trucked in from an offsite standpipe.

Surface water quality

During operation, there is minimal potential for any impact to surface water quality. Appropriate drainage features would be constructed where required to minimise the risk of dirty water leaving the site or entering waterways. Except for internal roads and parking areas, the site would be largely vegetated with grass cover. Risks to water quality impacts during operation would therefore be low.

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

Groundwater

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

8.1.3 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise hydrology and flooding risks are provided in Table 8-2.

Table 8-2 Safeguards and mitigation measures for hydrology and flooding

No.	Safeguards and mitigation measures	C	O	D
WA1	All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA2	All fuels, chemicals, and liquids will be stored at least 50m away from any waterways or drainage lines and will be stored in an impervious bunded area.	C	O	D
WA3	Adequate incident management procedures will be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 <i>Protection of the Environment Operations Act 1997</i>).	C	O	D
WA4	The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas.	C	O	D
WA5	Machinery will be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA6	Erosion and sediment control measures that will be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils and Construction</i> (Landcom, 2004).	C	O	D
WA7	Ensure appropriate drainage controls are incorporated into the design.	Design		
WA8	An Emergency Response Plan incorporating a Flood Response Plan will be prepared prior to construction covering all phases of the Proposal. The plan will: <ul style="list-style-type: none"> • Detail who will be responsible for monitoring the flood threat and how this is to be done. • Detail specific response measures to ensure site safety and environmental protection. • Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). • Consider site access in the event that some tracks become flooded. • Establish an evacuation point. • Define communication protocols with emergency services agencies. 	C	O	D

No.	Safeguards and mitigation measures	C	O	D
WA9	<p>The design of buildings, equipment foundations and footings for electrical componentry and panel mounts will be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including:</p> <ul style="list-style-type: none"> • The solar array mounting piers are designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event, giving regard to the depth and velocity of floodwaters. • The mounting height of the solar module frames will be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. • All electrical infrastructure, including inverters, will be located above the 1% AEP flood level. • Where electrical cabling is required to be constructed below the 1% AEP flood level it will be capable of continuous submergence in water. • The proposed perimeter security fencing will be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater. 		Design	

C: Construction; O: Operation; D: Decommissioning

8.2 HAZARDS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Hazards and Risks –

Including:

- A preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), and if the preliminary risk screening indicates the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011); and
- An assessment of all potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure;

FIRE AND RESCUE NSW

Should a fire or hazardous material incident occur, it is important that first responders have ready access to information which enables effective hazard control measures to be quickly implemented. Without limiting the scope of the emergency response plan (ERP), the following matters are recommended to be addressed:

- That a comprehensive ERP is developed for the site.
- That the ERP specifically addresses foreseeable on-site and off-site fire events and other emergency incidents (e.g. fires involving solar panel arrays, bushfires in the immediate vicinity) or potential hazmat incidents.
- That the ERP detail the appropriate risk control measures that would need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders (including electrical hazards). Such measures would include the level of personal protective clothing required to be worn, the minimum level of respiratory protection required, decontamination

procedures, minimum evacuation zone distances and a safe method for shutting down and isolating the photovoltaic system (either in its entirety or partially, as determined by risk assessment).

- *Other risk control measures that may need to be implemented in a fire emergency (due to any unique hazards specific to the site) should also be included in the ERP.*
- *That two copies of the ERP (detailed in recommendation above) be stored in a prominent 'Emergency Information Cabinet' located in a position directly adjacent to the site's main entry point/s.*
- *Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council.*

An environmental hazard is a thing or situation which can threaten the environment or human health. Hazards may be natural or created or result from the interaction between human activity and the natural environment. Hazards relevant to the Proposal and Proposal site include risks associated with hazardous goods, electromagnetic fields and fire.

8.2.1 Hazardous materials and development

SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 Guidelines lists industries that may fall within SEPP 33, which does not include Solar Farms and energy storage facilities. Appendix 2 of the guidelines provides a risk screening procedure and a checklist to identify Hazardous and Offensive Development in instances where the applicability of SEPP 33 is not immediately apparent. The Applying SEPP 33 Guideline is, however, a guide only and final determination is made based on considerations if the development would fall under the definition of potentially hazardous in the actual SEPP 33.

Risk screening

SEPP 33 screening procedure considers the quantity of dangerous goods stored or transported, the frequency of transportation movements, and in some cases the distance of the materials from the site boundary. The guidelines require goods to be classified according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

A development which exceeds the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required. For quantities that fall below the stated thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

The dangerous goods that would require transportation and storage for the Proposal include inert fire suppression gas, fuel, pesticides, and lithium-ion batteries. The future battery storage location (not being assessed in this EIS) would be indicatively 30m to the subject land boundary and transportation and storage of dangerous goods would not exceed SEPP 33 thresholds, and therefore would not be considered potentially hazardous. The Proposal does not require a PHA.

Other risk factors

The Proposal would not involve the storage or transport of incompatible materials, generation of hazardous wastes, generation of dusts within confined areas, activities involving hazardous materials, incompatible, reactive or unstable materials and process conditions, or storage or processing operations involving high (or extremely low) temperatures.

Potentially offensive industry

The Proposal would result in relatively minor vehicle and machinery exhaust emissions during the construction phase. The emissions occur outside, in a rural locality, and would be readily dispersed. The

emissions would not be considered hazardous within the context of SEPP 33. Noise impacts would be largely confined to standard working hours during the construction phase (Section 7.6); noise emissions would not be hazardous to neighbouring residents. Water pollution risks have been assessed as low (Section 8.1), subject to identified mitigation measures, with longer term benefits following cessation of cultivation and maintenance of groundcover across the site. Based on these factors and the implementation of mitigation measures, the Proposal is not considered a potentially offensive industry.

8.2.2 Bushfire

Bushfire presents a threat to human life and assets and can adversely impact ecological values. Bushfire risk can be considered in terms of environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines and other electrical components).

Existing environment

The site for the solar array is generally flat with elevation decreasing along the two proposed transmission line routes. Native vegetation on the site is from prior mine rehabilitation (refer to Section 7.1). The site is identified as high bushfire risk in the Muswellbrook Bush Fire Risk Management Plan (Muswellbrook Bush Fire Management Committee, 2011).

The local bush fire danger period occurs between October and March, where conditions are most conducive to bushfire ignition: hot and dry. The harvest period of November to mid-December on adjacent land is considered a prime risk period due to the use of machinery (ignition source) in crops (fuel) and the generally high activity in the rural sector. January and February present the highest temperatures, coupled with low humidity and dry crop stubble over extensive areas.

In terms of resources to fight fire, there are operational coal mines near the Proposal site with heavy machinery frequently running. Muswellbrook Rural Fire Service (RFS) is located approximately 8km north of site in the township of Muswellbrook. Firefighting equipment, including a 20,000L water storage tank, are located and maintained onsite.

Existing internal access tracks are 10m to 12m wide and proposed internal access on the solar array site would be 5m to 10m wide to ensure safe operational access and egress for emergency service personnel.

In terms of receivers and assets at risk from bushfire near the Proposal, 22 dwellings are located within 3km of the Proposal boundary with high density residential areas located within 10km of the site. Additionally, farm sheds, watering points and equipment are common in the local area.

Planning for Bushfire Protection Guidelines

According to the *Planning for Bushfire Protection (PBP) guidelines* (RFS, 2006), an acceptable level of protection from bushfires is achieved for developments through a combination of strategies which:

- *Control the types of development permissible in bushfire prone areas.*
- *Minimise the impact of radiant heat and direct flame contact by separating the development from the bushfire hazard.*
- *Reduce the rate of heat output (intensity) of a bushfire close to a development through control of fuel levels.*
- *Minimise the vulnerability of buildings to ignition from radiation and ember attack.*
- *Enable relatively safe access for the public and facilitate fire-fighting operations.*

- *Provide adequate water supplies for bushfire suppression operations.*
- *Implement community education programs, focusing on property preparedness, including emergency planning and property maintenance requirements.*
- *Facilitate the maintenance of Asset Protection Zones (APZs), fire trails, access for firefighting and on-site equipment for fire suppression.*

The PBP guidelines provide six key Bushfire Protection Measures for developments:

- a) The provision of clear separation of buildings and bushfire hazards in the form of fuel reduced APZ (comprising inner and outer protection areas and defensible space).*
- b) Construction standards and design.*
- c) Appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation.*
- d) Adequate water supply and pressure.*
- e) Emergency management arrangements for fire protection and/or evacuation.*
- f) Suitable landscaping to limit fire spreading to a building.*

Draft Planning for Bushfire Protection 2018

The draft *Planning for Bushfire Protection* (RFS, 2018) provides the following bushfire management objectives for National Construction Code Class 5 to 8 buildings (including commercial and industrial facilities) and Class 10 non-habitable buildings and structures (such as garages and fences):

- *To provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress with evacuation.*
- *To provide adequate supplies of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*
- *To provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development.*
- *Consideration of storage of hazardous materials away from the hazard wherever possible.*

The draft guidelines do not specifically address Solar Farms but, in relation to wind farms, provide for a 10m Asset Protection Zone (APZ) from structures, and adequate firefighting access. The draft guidelines require a bush fire emergency management and operation plan covering the suspension of work involving risk of ignition during total fire bans, the availability of fire-suppression equipment, storage and maintenance of flammable materials, notification of the local NSW RFS Fire Control Centre for any works during the fire danger period that have the potential to ignite surrounding vegetation, and bush fire emergency management planning.

8.2.3 Potential fire impacts

Construction and decommissioning

Specific activities that would be associated with the construction of the Proposal that may cause or increase the risk of bush fire include:

- Smoking and careless disposal of cigarettes on site.
- Site maintenance activities such as mowing, slashing and using other petrol-powered tools.
- Hot works, including welding and soldering activities.

- Operating a petrol, LPG or diesel-powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.

Considering the low-moderate vegetation cover as a fuel source over the site and other factors discussed above, it is considered unlikely that construction of the Solar Farm would pose a significant uncontrollable bush fire risk. Site access would be formalised at the beginning of the construction stage during civil works, which would increase the ability to access and suppress any fire onsite or on adjoining sites.

The bush fire hazard associated with the activities listed above is considered highly manageable. Risks would be minimised through the implementation of fire and bushfire mitigation measures outlined in Section 8.2.6.

Potential impacts from decommissioning activities would be similar to those for construction. As for construction, any bush fire risk associated with decommissioning of the project would be highly manageable.

Operation

Maintenance activities

Repairs and maintenance activities during operation could increase bush fire risk. All electrical components would be designed to minimise potential for ignition. Ground cover beneath panels would be maintained and not permitted to accumulate into high fuel loads.

An Asset Protection Zone (APZ) would be maintained around buildings and the entire Proposal site including inverters, delivery station and solar switching station. Internal access tracks are 5m wide allowing adequate access for emergency vehicles including fire trucks.

Bush fire risks during operation of the Solar Farm and connection infrastructure would be manageable.

Bush fire and compliance with PBP guidelines

Asset Protection Zones

Appendix 2 of the PBP guidelines provides minimum APZ requirements for habitable buildings in residential developments designated as bush fire prone. While the Proposal is not residential, these APZ prescriptions would be applied to the Solar Farm infrastructure to provide defensible space and to manage heat intensities at the infrastructure interface.

The PBP guidelines indicate a minimum APZ width of 10m for grassy woodlands (total fuel load 15 tonnes/hectare) on flat ground in the Greater Hunter with a Fire Danger Rating of 100. This setback is based on the need to conform to Level 3 construction (AS3959 – 1999) for a building of Class 1 or 2 under the BCA.

The *Planning for Bush Fire Protection* (RFS, 2018b) specifies the following minimum APZ widths for residential subdivisions on all upslope and flat ground in FDI 100 areas:

- Grassy woodlands 11m

An APZ of minimum width of 10m would be provided around the Solar Farm buildings, switching station and around the outside perimeter of the solar array. All Solar Farm APZ would be managed as an Inner Protection Area. The APZ surrounding the proposed power conversion stations and switching station (should the 66kV option be selected) would include gravel surfacing to minimise the risk of fire escaping from the facilities and the risk of external fire affecting the facilities.

Fuel hazard management

According to the PBP guidelines, the APZ should provide a tree canopy cover of less than 15% located greater than 2m from any part of the roofline of a dwelling and should not overhang any building. Trees should have lower limbs removed up to a height of 2m above the ground. The understorey should be managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season.

There would be no trees or shrubs within the APZ established for the Solar Farm, or within the solar array area. Grassland Fuel Hazard is a function of grass height and cover, with variation according to curing and species fuel characteristics. Grass fuel would be monitored and managed using stock grazing or mowing to maintain safe fuel levels. Grass height within the APZ would be maintained at or below 5cm throughout the October-April fire season. Grass height outside the APZ, including beneath the solar array, would be maintained at or below 15cm throughout the fire season.

The overhead powerlines at the Proposal site would be managed by maintaining appropriate vegetation clearances to minimise potential ignition risks, in accordance with the *ISSC 3 Guideline for Managing Vegetation Near Power Lines* (Industry Safety Steering Committee, 2005).

Access

Safe and efficient access (suitable for firefighting appliances) would be established and maintained over the Proposal site. The APZ around the perimeter of the site would incorporate a 4m wide gravel access track. The perimeter track would comply with the requirements for Fire Trails in section 4.1.3 of the PBP guidelines, including:

- A minimum carriageway width of 4m with an additional 1m wide strip on each side of the trail clear of bushes and long grass.
- Minimum vertical clearance of 4m.
- Capacity for passing using reversing bays and/or passing bays every 200m suitable for fire tankers.
- Connection to the property access road and/or to the through road system at frequent intervals of 200m or less.

The turn radius and swept path clearance on access roads would be suitable for Category 1 Tankers (Medium Rigid Vehicle).

Fire-fighting resources and preparedness

A steel or concrete water storage tank would be installed adjoining the main internal access road for firefighting and other non-potable water uses, with a 65mm Storz outlet, a metal valve and a minimum of 20,000 litres reserved for fire-fighting purposes. Rainwater tanks installed beside site buildings for staff amenities would also enable RFS connectivity. Suitable fire extinguishers and PPE would be maintained at site buildings.

A Bushfire Management Plan would be developed prior to commissioning in consultation with the local NSW RFS District Fire Control Centre to manage fire risks, resources and preparedness. Following commissioning of the Solar Farm, the preparedness of local RFS and Fire and Rescue brigades would be enhanced through; (i) site orientation, and (ii) information events, and (iii) the facilitation of training in the management of battery fires for the future battery storage facility. An Emergency Response Plan, including an Evacuation Plan and Emergency Fire Response Plan (with a specific battery fire response section) would also be developed to enable rapid, safe and effective incident response.

8.2.4 Electric and magnetic fields

This section addresses potential hazards and risks associated with electric and magnetic fields (EMFs). While a low risk to the public, in terms of the levels produced by the Proposal, it is an issue that is often of concern to the public, as evidenced by Solar Farm feedback collected by NGH over the last several years.

About EMFs

EMFs consist of electric and magnetic fields and are produced whenever electricity is used. EMFs also occur naturally in the environment, e.g., from a build-up of electric charge in thunderstorms and Earth's magnetic field (WHO, 2019).

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

Fields of different frequencies interact with the body in different ways. In Australia, transmission lines and other electrical devices and infrastructure, including substations, operate at a frequency of 50Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300Hz.

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

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, 2019). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project has thus far concluded that there are no substantive health consequences from exposure to ELF electric fields at the low levels generally encountered by the public (WHO, 2007), such as those that would be produced by electricity generation at the proposed Solar Farm and along the transmission line.

Whether exposure to ELF magnetic fields is also harmless is unclear. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) advises that 'the scientific evidence does not firmly establish that exposure to 50Hz 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' (ARPANSA, 2015).

Australia does not currently have a standard regulating exposure to ELF electric or magnetic fields. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300GHz) in 1998. The guidelines were updated in 2010. The objective of the paper was to establish guidelines for limiting EMF exposure that would provide protection against known adverse health effects.

To prevent health-relevant interactions with ELF fields, ICNIRP recommends limiting exposure to these fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects inside the body is never reached. The exposure limits, called basic restrictions, are related to the threshold showing adverse effects, with an additional reduction factor to consider scientific uncertainties pertaining to the determination of the threshold. They are expressed in terms of the induced internal electric field strength in V/m. The exposure limits outside the body, called reference levels, are derived from the basic restrictions using worst-case exposure assumptions, in such a

way that remaining below the reference levels (in the air) implies that the basic restrictions would also be met (in the body). These are not the actual limits, they are simply guidance figures for when it is necessary to investigate the basic restriction. Reference levels for occupational and general public exposure are shown in Table 8-3.

Table 8-3 ICNIRP reference levels for electric and magnetic fields. Values are for 50Hz

Exposure characteristics	Electric fields	Magnetic fields
Occupational		
	ICNIRP reference level: 10kV/m	ICNIRP reference level: 1mT
	field actually required: 24.2kV/m	field actually required: 3.03mT
General public		
	ICNIRP reference level: 5kV/m	ICNIRP reference level: 200µT
	field actually required: 9.9kV/m	field actually required: 606µT

The Proposal includes three main types of infrastructure that could create EMFs:

1. Solar panels/arrays.
2. Power conversion stations (up to 8MW capacity).
3. Underground cables
4. Overhead 66kV transmission line (or 33kV).
5. Switch station.

Typical and maximum EMF levels for these types of infrastructure are discussed below. Strength attenuates with distance from the infrastructure and electric field levels for underground infrastructure are lessened by the shielding that the fill (approximate depth of 900mm) provides.

Solar panels/arrays

Research into electric and magnetic fields undertaken at utility scale PV installations in California³ by Chang and Jennings (Chang & Jennings, 1994), indicated that magnetic fields were significantly less for solar arrays than for household applications. Chang and Jennings found magnetic fields from solar arrays were not distinguishable from background levels at the site boundary, suggesting the health risk of EMFs from solar arrays is minimal.

The Proposal would require installation of DC wiring between panels and the inverters. This cabling would be underground or above ground on cable. The potential for electromagnetic interference as a result of the solar array cabling is negligible.

Power Conversion Stations

Up to 12 PCSs would be installed across the site. The stations would have a total output between 2MW and 8MW. The PCSs would have an AC power frequency range between 47 and 63Hz and fall into the Extremely Low Frequency (ELF) range of 0-300Hz. Within this range, EMFs are not considered to be hazardous to human health. In addition, the PCSs would be located within the Proposal site with no public access and would operate only during the day reducing the total time that EMFs are generated by the infrastructure.

³ Note the U.S.A electricity supply operates at 60 Hz frequency.

Underground cabling

Underground cabling does not produce external electric fields due to the shielding effects of the soil, however, magnetic fields still occur. They are expected to be minimal and restricted to the Proposal site.

Overhead powerlines

Figure 8-4 displays the typical electric fields emitted from different voltage overhead powerlines. The Proposal site has existing 33kV powerlines to the east of the Proposal site. If the 33kV option is selected, a section of overhead electrical cabling would be used to connect the panels to the existing 33kV powerline. If the 66kV option is selected, a section of overhead electrical cabling would be used to connect the panels to the proposed switch station on the north of site towards Thomas Mitchell Drive. The existing and proposed overhead powerlines are less than the recommended 5kV/m and 10kV/m limits.

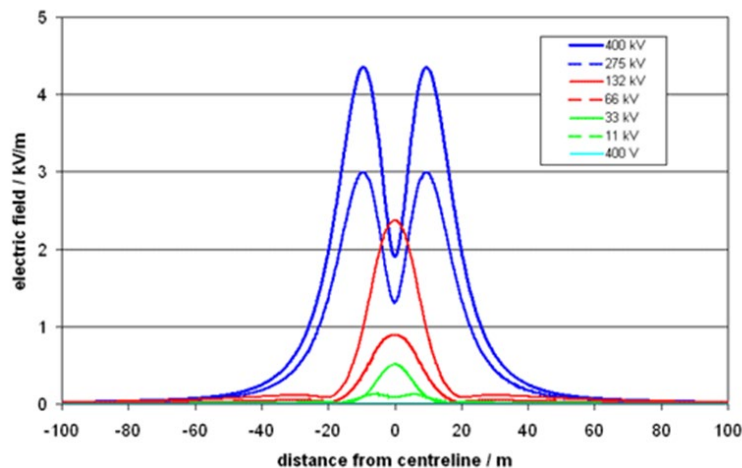


Figure 8-4 Typical electric fields from overhead powerlines (EMFs info, 2017)

Switch station

The switch station is classified as an intermediate substation (rated maximum capacity of 66kV). The highest electromagnetic field is usually produced by the lines and cables supplying the switch station and not by the equipment inside the switch station itself. If the switch station itself produces a field outside its perimeter, it usually falls away over the first few metres (WHO, 2019). Works undertaken to facilitate the connection of the transmission line would require mitigation measures to ensure reduced exposure.

8.2.5 Potential EMF impacts

Construction and decommissioning

There is low potential for EMF impacts during the construction and decommissioning phases of the Proposal. The maximum magnetic field of the proposed transmission line is well under the 200 μ T and 1000 μ T limits respectively recommended for public and occupational exposure.

Staff would be exposed to EMF's over intermittent periods during works at and around the existing 33kV overhead transmission line. Exposure to EMFs during the construction of the switch station and its connection to the existing transmission line would be short term, therefore the effects are likely to be negligible.

The construction site would be fenced to protect the public from construction health and safety risks.

Operation

During operation, EMF sources would include overhead transmission lines and the solar array incorporating inverters.

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

The site is surrounded by industrial/mining land. Public access would be restricted by Maxwell Infrastructure site fencing during the operational phase. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the Maxwell Solar Farm are likely to be indistinguishable from background levels.

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

8.2.6 Safeguards and mitigation measures

The following safeguards and mitigation measures would be implemented to reduce any further risks associated with hazards (Table 8-4).

Regarding EMF, ICNIRP sets out a number of protective measures to reduce personal harm from EMFs if the basic restrictions are expected to be exceeded. These include engineering design, administrative controls and personal protective clothing. The works undertaken for the Proposal are not expected to exceed the basic restriction levels.

Table 8-4 Safeguards and mitigation measures for health and safety

No.	Safeguards and mitigation measures	C	O	D
HA1	An Emergency Response Plan, incorporating an Evacuation Plan and Emergency Fire Response Plan will be developed prior to commissioning the Solar Farm. Two copies of the plan will be kept on site in an 'Emergency Information Cabinet' in a prominent position adjacent to the site entry point at all times.	C	O	D
HA2	Dangerous or hazardous materials will be transported, stored and handled in accordance with AS1940-2004: <i>The storage and handling of flammable and combustible liquids</i> , and the ADG Code where relevant. All potential pollutants kept on-site will be stored in accordance with relevant HAZMAT requirements and banded.	C	O	D
HA3	All design and engineering will be undertaken by qualified competent persons with the support of specialists as required.	C		
HA4	All electrical equipment will be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
HA5	Design of electrical infrastructure to minimise EMFs through the solar array.	C		

No.	Safeguards and mitigation measures	C	O	D
HA6	<p>A Bush Fire Management Plan will be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to:</p> <ul style="list-style-type: none"> • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of <i>Planning for Bush Fire Protection 2006</i>: <ul style="list-style-type: none"> ○ Identifying asset protection zones. ○ Providing adequate egress/access to the site. ○ Emergency evacuation measures. <p>Operational procedures relating to mitigation and suppression of bush fire relevant to the Proposal.</p>	C	O	D
HA7	<p>A comprehensive Emergency Fire Response Plan will be developed and implemented during construction, operation and decommissioning, and include but not be limited to:</p> <ul style="list-style-type: none"> • Address foreseeable on-site and off-site fire events. • Detail appropriate risk control measures that will need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. <p>Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.</p>	C	O	D
HA8	<p>Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council.</p>	C	O	

C: Construction; O: Operation; D: Decommissioning

8.3 SOCIAL AND ECONOMIC IMPACTS

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Socio-Economic –

Including an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation.

MUSWELLBROOK SHIRE COUNCIL REQUIREMENTS

Economic Opportunities -

Council is interested in ensuring the local community would be the beneficiaries of reported economic and employment opportunities. Accordingly, it is requested that the application considers measures that can be put in place to ensure that the project supports local jobs and businesses and results in opportunities for local people to gain skills in the construction and maintenance of solar arrays. Apprenticeships for local young people would be welcomed.

The *Muswellbrook Community Strategic Plan 2017 – 2027* identifies the community's main priorities and aspirations for the future. It is considered that the Proposal meets the principles of the Community Strategic Plan, with reference to supporting economic development and the natural environment.

Large and new types of developments can produce social and economic impacts on local communities. These can be positive, such as the provision of employment and increased retail trade. They can also produce unintended impacts, such as creating strains on existing infrastructure (such as public transport or accommodation facilities during construction, or social infrastructure such as volunteer services, social ties and networks). This section investigates the socio-economic profile of the region to understand the potential impacts of the Proposal on the socio-economics of the local community.

8.3.1 Background

The Proposal is located within the Muswellbrook LGA of the Upper Hunter Valley region approximately 110km north-west of Newcastle and 180km north of Sydney. The LGA covers over 3,400km², of which 40% is national parks (Muswellbrook Shire Council, 2016).

Muswellbrook LGA consists of two main town centres, Muswellbrook and Denman, which surround smaller rural communities. The region is known for its vineyards, international horse studs, mines and power generation. Thomas Mitchell Drive and the New England Highway run adjacent to the Proposal site which provides for regional freight distribution servicing the surrounding agricultural and mining industries as well as providing a link between the Hunter and the central west.

Socio-economic profile

The Muswellbrook LGA has a population of 16,431 (ABS, 2016). In the 2011 Census, the population was 15,791, which represents approximately a 4% increase in population over a period of five years. The percentage of people of Indigenous origin in 2016 was 8.3%, which is high in comparison to the Australian average of 2.8%. The overseas immigrant population is small with 92.1% of the population born in Australia compared to the Australian average of 66.7% (ABS, 2016).

The local economy is based primarily on mining and agriculture. Agriculture has one of the lowest employment rates, only employing 6.9% of the overall workforce (ABS, 2016). Mining is the largest employer in the Muswellbrook LGA, employing 21.9% of the overall workforce.

The unemployment rate in Muswellbrook LGA is relatively high at 8.2% which is above the Australian average of 6.8% (ABS, 2016). The Proposal is likely to require 50 direct jobs during construction and would employ one to two full time staff during the operation and maintenance phase (expected to be 30 years) who would be employed locally. Specialist roles may be sourced outside of the local area. As such the Proposal would provide new short-term opportunities (including unemployed persons – subject to appropriate skill match) and some long-term maintenance contracts.

The skill base in the area is reflected in its occupational structure, with 25.3% of workers occupied in activities associated with the types of skills required for the construction of a Solar Farm (i.e. technicians and trade workers, machinery operators and labourers).

Commercial and private accommodation

Muswellbrook LGA and the surrounding area has a reasonable supply of commercial accommodation as measured by the ABS Tourism Accommodation series for year-ending June 2015. The data which identifies supply for hotels, motels and apartment with 15 rooms or more shows the area contains 8 establishments and 227 rooms. Room occupancy rate of 40.3% is lower than the NSW State average of 66.9%, indicating the Proposal would boost the commercial accommodation sector.

In addition to commercial accommodation, the area provides a range of additional options such as caravan and holiday parks, boutique serviced apartments, bed and breakfast facilities, pubs/hotels and guest houses.

Private accommodation is often used to support construction worker's needs, especially long term. ABS Census data for 2016 indicates an above-average level of vacant dwellings of 15.3%, indicating potential for private accommodation opportunities.

Township services

Workers locating temporarily to the Proposal site would require a wide range of other convenience services, and the Proposal would also need to source trade and other services from businesses located in the immediate region. Services located in Denman, Singleton and Newcastle would be the bulk supply of services, with other smaller settlements likely to support the Proposal.

The township of Muswellbrook, given its proximity, would service most of the Proposal needs such as trade supply, transport services, machinery hire and repair, and retail services. Singleton would also provide a supporting project role.

Community attitudes to renewable energy

Research indicates there is widespread support for solar energy as a source of energy for electricity generation in Australia (ARENA, n.d.); 78% of respondents to the ARENA survey were in favour of large-scale solar energy facilities and 87% are in favour of domestic installations. The large-scale solar energy sector is still at a relatively early stage of development in Australia. However, while most members of the community are aware of large-scale solar energy, many do not know a great deal about their impacts (ARENA, n.d.).

Three approaches to improving community understanding of the visual impacts of large-scale installations include:

- Provision of images (from many angles) of large-scale solar facilities, particularly in the early stages of a Proposal.

- Understanding of the similarities between highly supported domestic scale installations and large-scale facilities.
- Understanding of the current function of the land proposed for the facility and the additional value the installation provides (Source: extracted from ARENA, n.d.).

Section 7.4.1 and APPENDIX H of this EIS assess the visual impacts of the Proposal on the rural landscape and visual amenity of the area.

Community feedback on the Proposal

The proponent has undertaken extensive preliminary consultation with surrounding neighbours and the broader community. Engagement has occurred via community open days and direct engagement via; letters, emails, phone calls and meetings. The proponent also created a dedicated website and email address for the Proposal to provide information and enable communication and feedback to be received.

Direct engagement

Direct engagement was offered to the nearest neighbours of the boundary of the development site. This occurred through letter drops, phone calls and face to face meetings. Questions raised during the engagement include:

- Community impacts.
- Visual impact.
- Effects on land use.
- Heating of surrounding land.
- Loss of agricultural jobs.
- Dust.
- Health.

Visual impacts were addressed with the concerned individuals through direct correspondence. In some instances, visual montages were provided to those residents to show the before and after impacts of the Proposal, and in certain situations, proposed vegetative screening. The screening was developed with input from the residents.

Open days

Two community information sessions were held on 21 and 22 November 2018 incorporating both the proposed Maxwell Underground Project and the proposed Maxwell Solar Farm.

For respondents that provided details, concerns were addressed through direct correspondence. All other questions raised were addressed via; (i) the dedicated website, (ii) project update mail-outs, and (iii) public notices.

Website

The proponent has established a dedicated project website, which provides information on the Proposal. The website (<https://malabarcoal.com.au/projects/maxwell-solar>) includes a 'contact us' link which allows anyone interested to contact the proponent.

8.3.2 Potential impacts

Construction

During construction, it is considered the Proposal would generate some adverse socio-economic impacts, however, significant positive impacts are also likely. Likely positive impacts include:

- Significant boost to the local and regional economies through generation of employment. About 100 direct and indirect full-time staff would be employed during peak construction, and many of these could be drawn from the local area.
- Significant boost to the local and regional economies through increased demand for accommodation, goods and services.
- A range of employment and contracts including landscaping, catering, trenching, maintenance, piling and electrical work.
- It is estimated that \$390,000 in wage spending would be directed at local and regional businesses and service providers during the construction period. Spending would include housing expenditure, retail, recreational spending, and personal, medical and other services.

Likely adverse impacts include:

- Increased traffic on local roads and hazards associated with construction traffic (refer to Section 7.7.2).
- Change in the rural landscape character and visual amenity of the area (refer to Section 7.5.3).
- Influx of workers may put pressure on local accommodation, health and broader services.
- Demand for accommodation and increase in traffic movements may have an impact on tourism if the construction phase coincides with local festivals or events.

Muswellbrook and surrounding areas provide many visitor accommodations. It is possible that, in conjunction with other major projects, shortages of accommodation may occur at times during the construction stage. It is, however, important to note that some construction staff would be local and would not require commercial accommodation. The project would engage with local accommodation providers, if necessary, to provide additional short term and temporary accommodation at these businesses.

It is considered that the demand for health care and other services would also be dispersed throughout the surrounding towns and cities to coincide with where workers are staying.

Overall, it is considered that the Proposal would have a positive socio-economic impact given the significant economic boost the Proposal would generate. It is considered that the expected adverse impacts would be minimal given the temporary nature of the construction phase and that impacts would be managed through the implementation of safeguards.

Operation and decommissioning

Approximately one to two full-time equivalent jobs would be supported on an ongoing basis through the operation and maintenance of the Proposal. These jobs would be associated with landscaping and ground care, panel cleaning, electrical and technical services and security.

The development of rural land uses compatible with agricultural activities, such as solar power generation, have potential to provide increased economic security to rural economies through diversification of employment opportunities and income streams. They also provide a substitute for carbon emission

producing electricity production that is stable, renewable and consistent with State and National greenhouse emission reduction objectives.

Rates payable to Muswellbrook Shire Council associated with the operation of the Proposal would also be applicable.

Minimal adverse impacts are anticipated during operation and decommissioning. During operation, maintenance staffing and activities would be consistent but at low levels. The additional accommodation, traffic and healthcare impacts of operational staff are not likely to be noticeable.

Although the number of employees required during decommissioning would be less than that for construction, it is considered likely to offer a similar economic benefit in terms of opportunities for local staff and industries. Decommissioning may also include local recycling of infrastructure components.

The American National Renewable Energy Laboratory (NREL, 2018) notes that the impact of Solar Farms on neighbouring property values has not been studied in-depth; however, numerous studies found the impact of wind energy generation on neighbouring properties to be negligible. As Solar Farms do not have the same impacts as wind farms (i.e. landscape views, shadowing, light flicker etc.), the impact on property values is anticipated to be less.

8.3.3 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise socio-economic and community risks are provided in Table 8-5.

Table 8-5 Safeguards and mitigation measures for socio-economic and community impacts

No.	Safeguards and mitigation measures	C	O	D
SE1	A Community Consultation Plan will be implemented during construction to manage impacts to community stakeholders, including but not limited to: <ul style="list-style-type: none"> • Protocols to keep the community updated about the progress of the Proposal and its benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). • Protocols to respond to any complaints. 	C	O	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C	O	
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	C		D

C: Construction; O: Operation; D: Decommissioning

8.4 HISTORIC HERITAGE

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Heritage –

Including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents;

DPIE REQUIREMENTS

Historic heritage –

The EIS must provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, 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 (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996),*
- *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),*
- *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.

8.4.1 Approach

A desktop study and site inspection were undertaken to identify any historic heritage (non-Aboriginal) items or places in proximity to the study area, with a focus on the Proposal site and surrounding landscape. The following resources were used as part of this assessment:

- Drayton Mine extension Environmental Assessment (Hansen Bailey, 2007).
- 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 Muswellbrook LEP, for locally listed heritage items, that are within or adjacent to the Proposal site.

8.4.2 Results

A summary of the results of the heritage searches are illustrated in Table 8-6 and discussed below.

Table 8-6 Summary of heritage listed items in Muswellbrook LGA

Name of register	Number of listings
World Heritage List	0
National Heritage List	0
NSW State Heritage Register	8
Muswellbrook LEP	205

Australian Heritage Database

The Australian Heritage Database search was undertaken on the 7 February 2019 using a search of Muswellbrook LGA (refer to APPENDIX D). The search resulted in one Commonwealth listed item; the Muswellbrook Post Office, located approximately 7km north of the Proposal site.

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

NSW State Heritage Inventory

The NSW State Heritage Inventory database search was undertaken on the 7 February 2019 for the Muswellbrook LGA (APPENDIX D); there were eight items listed under the NSW State Heritage Register. None of the items listed are within or adjacent to the Proposal site.

A total of 205 items were also listed by Local Government and State Agencies on the NSW State Heritage Inventory database. None of the items listed are within the Proposal site. The closest item, *Yammanie* (database ID: 2120116), is located approximately 3.7km from the northernmost extent of Proposal site.

Muswellbrook Local Environment Plan 2009

The Muswellbrook LEP database search was conducted on the 7 February 2019. No known items of local heritage were identified onsite or near the Proposal site.

8.4.3 Site inspection

A site inspection conducted on 12 February 2019 identified five potential heritage sites of local importance, none of which are statutorily listed. These include old mine workings and a house structure. These items were also identified in the Environmental Assessment for Drayton Mine (Hansen Bailey, 2007) and would not be impacted by the proposed Maxwell Solar Farm.

8.4.4 Potential impacts

A number of heritage items were identified from the desktop study, outlined above. Most of these items are found within Muswellbrook township, with none being adjacent or within the Proposal site.

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

8.4.5 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise historic heritage risks are provided in Table 8-7.

Table 8-7 Safeguards and mitigation measures for historic heritage

No.	Safeguards and mitigation measures	C	O	D
HH1	Should an item of historic heritage be identified, the Heritage Division (DPIE) would be contacted prior to further work being carried out in the vicinity.	C	O	D
HH2	Should any skeletal remains be found, works will cease immediately, the area cordoned off and the Police contacted.	C	O	D

C: Construction; O: Operation; D: Decommissioning

8.5 CLIMATE AND AIR QUALITY

8.5.1 Existing environment

Climate

The Muswellbrook LGA is part of the Sydney Basin Bioregion of NSW, which generally experiences a temperate climate characterised by warm summers with no dry season (OEH, 2016). The LGA experiences most of its rainfall during the summer months, with the highest falls occurring in February, with heavy isolated falls during winter. The average annual rainfall is 700mm (Muswellbrook Shire Council , 2015).

The closest Bureau of Meteorology Weather Station is Scone Airport, located approximately 24.3km north of the Proposal site. Mean annual maximum temperature is 24.5°C and mean annual minimum temperature is 9.9°C. A summary of the climate averages for Muswellbrook and the Upper Hunter as shown on the Council website is detailed in Figure 8-5.

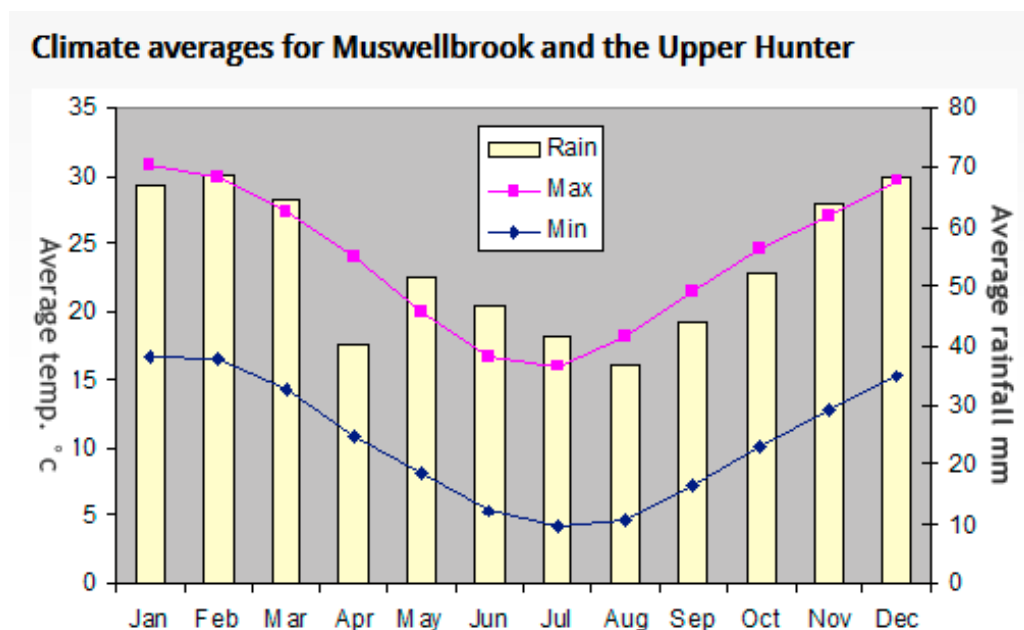


Figure 8-5 Climate averages for Muswellbrook and the Upper Hunter (Muswellbrook Shire Council , 2015)

Current drought conditions have shown an increase in temperature and a decrease in rainfall in the region. Drought has a compounding effect on environmental aspects, including biodiversity, soil and water.

Drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use. Current drought conditions display an increase in temperature and a decrease in rainfall in the region. Figure 8-6 shows the region has received “very much below average” and “below average” rainfall during 2018 (BOM, 2018). Drought has a compounding effect on environmental aspects, including biodiversity, soil and water.

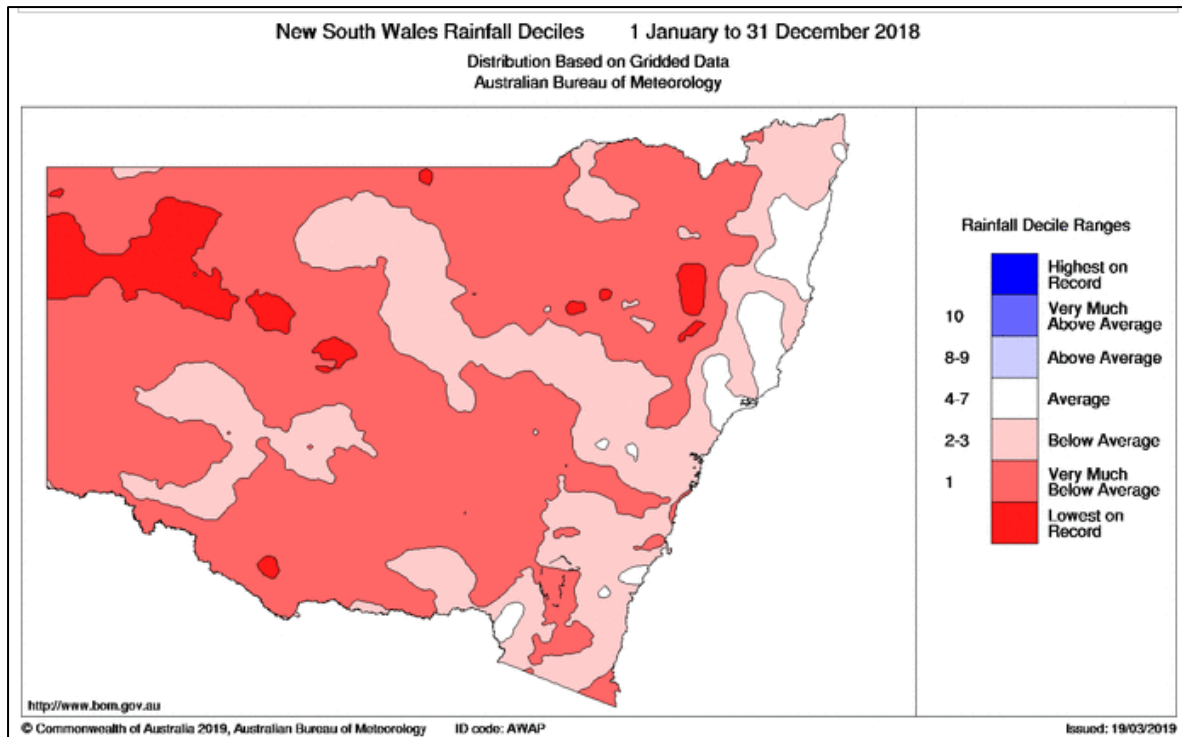


Figure 8-6 NSW Rainfall Deciles 1 January to 31 December 2018

Local air quality

The air quality around the Proposal site is generally expected to be good and typical of that found in a rural setting of NSW. Existing sources of air pollution include mining activities, dust, vehicle emissions, rail activities and agricultural activities, particularly stubble burning and harvest. Dust emissions at the Proposal site are from a variety of sources including material handling such as loading and dumping of overburden and topsoil during remediation activities, material transport, wind erosion from exposed areas and dust associated with dry periods.

The Proposal is not located within a 200km radius of the Siding Spring Observatory and therefore is not within the *Dark Sky Region*.

A search of the National Pollutant Inventory identified six substance emissions facilities located within 6km of the Proposal site, which include:

- Aurizon Operations Ltd.
- AGL Macquarie Pty Ltd (2 sites).
- Maxwell Ventures (Management) Pty Ltd.
- Hunter Valley Energy Coal Pty Ltd.
- Orica Australia Pty Ltd.

There are no inhabited residences or buildings within the Proposal site, with adjoining land uses including mining and power generation. There are 22 residences located within 3km of the Proposal site (refer to Figure 7-35). Topography of the Proposal site is relatively flat where the solar array is proposed with undulating hills surrounding the site.

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/m²/month are also specified by the EPA.

Climate change

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases (GHGs) in the atmosphere. GHG's include carbon dioxide, methane and water vapour. Climate change projections for Australia includes more frequent and hotter hot days and fewer frost days, rainfall reductions in southern Australia and more extreme weather events including intense rainfall, more severe drought and harsher fires (CSIRO, 2015). The region is currently in a drought.

8.5.2 Potential impacts

Construction and decommissioning

Climate can act to influence the impacts of construction and decommissioning on the environment. For example, hot, dry or windy conditions can exacerbate adverse air quality impacts; prolonged rainfall can increase soil compaction impacts. For these reasons, the specific climatic conditions of the site are considered in the assessment of impacts.

Dust generation would accompany excavation and other earthworks as well as the movement of trucks and work vehicles along any unsealed road during construction and decommissioning of the Proposal. Air emissions would also be produced from equipment and vehicle exhaust fumes. Dust and emissions can be a nuisance, interfere with visibility when driving and lead to adverse health impacts when severe or prolonged. Emission of GHGs are likely to contribute to climate change.

The construction phase is expected to last approximately 12 to 18 months with a peak period lasting approximately 6 months. During this time, emissions would be generated from earth-moving equipment, diesel generators, trucks, cranes and pile driving equipment. Vehicles accessing the site would include the construction labour force (up to 100 construction personnel during the peak period) and haulage traffic delivering construction components (as detailed in Section 7.7).

Earthworks associated with construction and decommissioning are relatively minor and not likely to cause significant dust or emissions. In addition, the proponent has access to sufficient quantities of stored water in existing voids to mitigate dust using water carts. The construction of the solar arrays may use a piling machine which is designed to reduce soil disturbance and corresponding dust pollution. The impact area for the piles would be less than 0.1% of the development site based on a pile area of 20cm x 20cm and the NexTracker system.

Additional disturbance and earthworks would be associated with trenching for cables, the construction of concrete footings for infrastructure and internal access tracks.

There are 22 residences located within 3km of the Proposal site and are the key receivers for adverse air quality impacts. Existing mature vegetation and earthen banks occurs between most receivers and the Proposal site.

In accordance with good international practice, the assessment of sensitive receivers should consider up to 500m from the site boundary for both human and ecological receptors (Holman et al, 2014), due to the typical distance of dust dispersion. The assessment of other pollutants (e.g. gaseous exhaust fumes) would

require a smaller area of assessment, (~ 200m) as suggested by Bignal, K. *et al.* (Bignal, Ashmore, & Power, 2004), before emissions are indistinguishable from background concentrations. Dust impacts would be mitigated using dust suppression methods; refer to Section 7.4.

The construction and decommissioning of the Proposal are not expected to noticeably increase air pollution or add to the cumulative impacts of other industries.

No climatic impacts are anticipated as a consequence of the construction and decommissioning activities for the Proposal. Nonetheless, construction and decommissioning would be responsive to local conditions to ensure impacts are managed.

Operation

The operation of the Proposal would generate negligible air quality impacts and emissions. The Solar Farm would produce minimal CO₂ emissions when compared to conventional coal and gas fired powered stations (Table 8-8). As discussed in Section 2.2, the operation of the Proposal would help reduce GHG emissions and move towards cleaner electricity generation. Based on 60GWh per annum, the Proposal would power the equivalent of about 10,000 NSW homes.

Table 8-8 Comparison of CO₂ equivalent emissions produced per kilowatt hour for the lifecycle of the asset

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)

During regular operation, no vehicles would be present on site on a permanent basis, with only occasional visits by light vehicles. The impacts on local and regional air quality are expected to be negligible during operation in comparison to the regular agricultural activities currently undertaken on the subject land (i.e. herbicide in application, harvesting, ripping of soils etc.).

Maintenance activities would result in some minor vehicle emissions and potentially some generation of dust from vehicles travelling on the unsealed access roads. During major maintenance activities the number of vehicles could increase to 20-30 mostly light vehicles for short periods of time.

There is a risk that unsealed access roads may create dust during windy conditions. However, the access tracks would be regularly maintained as per the Maxwell Infrastructure site requirements. Dust creation is expected to be no more than the existing unsealed access roads that surround the site. As such, there is unlikely to be any noticeable increase in dust creation.

Limited amounts of fuel would be required for maintenance vehicles during operation of the Proposal and for temporary power generation in the event of an unplanned outage. During operation, the Proposal would have a significantly positive impact on global climate by assisting to reduce Australia's reliance on fossil fuels for electricity generation (discussed in Section 2.2).

Due to the existing activities surrounding the site and the minimal impacts on air quality during operation resulting from the Proposal, the cumulative impact is not expected to be significant. Cumulative impacts are discussed further in Section 8.7.

8.5.3 Safeguards and mitigation measures

Safeguards and mitigation measures to be implemented to minimise climate and air quality risk are provided in Table 8-9

Table 8-9 Safeguards and mitigation measures for climate and air quality impacts

No.	Safeguards and mitigation measures	C	O	D
AQ1	Development of a complaints procedure to promptly respond to issues.	C	O	D
AQ2	Protocols to guide vehicle and construction equipment use to minimise emissions will be included in construction and operational environmental management plans. This will include but not be limited to Australian standards and POEO Act requirements.	C	O	D
AQ3	Dust will be monitored and managed to prevent dust leaving the Proposal site. This includes covering loads and watering of unsealed roads and stockpiles.	C	O	D
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	C		D
AQ5	Fires and material burning are prohibited on the Proposal site.	C	O	D

C: Construction; O: Operation; D: Decommissioning

8.6 RESOURCE USE AND WASTE GENERATION

SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The EIS must also address the following specific issues:

Waste –

Identify, quantify and classify the likely waste stream to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

8.6.1 Policy Position

Resource use

Key resources and estimated quantities (pending the completion of the detailed project design) required to construct the Proposal include those listed in Section 4.5.3.

Waste generation

Policy position

Legal requirements for the management of waste are established under the POEO Act and the Protection of the Environment Operations (Waste) Regulation 2005. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The *Waste Avoidance and Resource Recovery Act 2001* includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. The Proposal's resource management options would be considered against a hierarchy of the following order:

- Avoidance of unnecessary resource consumption.
- Resource recovery (including reuse, reprocessing, recycling and energy recovery).
- Disposal.

Adopting the above principles would encourage the most efficient use of resources and reduce costs and environmental harm in accordance with the principles of ecologically sustainable development.

8.6.2 Potential impacts

Construction and decommissioning

Resource Use

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Potable water requirements during operation are estimated to be 15kL/year. Non-potable water requirements for panel cleaning is weather dependent and expected to be 10L/year.

Construction

Solid waste is one of the major pollutants caused by construction. Several construction activities would produce solid wastes, such as:

- Packaging materials.
- Excess building materials.
- Scrap metal and cabling materials.
- Plastic and masonry products, including concrete wash.
- Excavation of topsoils and vegetation clearing (expected to be minimal).
- Bio wastes from onsite septic systems.

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction phase would be classified as building and demolition waste within the class general solid waste (non-putrescible). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescible) in accordance with the POEO Act.

Muswellbrook Waste Management Facility accepts mixed commercial and industrial waste, including recyclables, mixed waste, scrap metal, green waste and batteries etc. and would a suitable waste management facility for the disposal of waste generated by construction.

Tree removal waste

The waste from previous site rehabilitation any other vegetation would be mulched for composting or reused on site.

Decommissioning

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

- Solar panels and mounting system.
- Metals from posts, cabling, fencing.

- Buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. All above ground infrastructure would be removed from the site during decommissioning.

Impacts

While increasing scarcity of resources and environmental impacts are emerging from the use of non-renewable resources, the supply of the materials required for the Proposal are not currently limited or restricted. In the volumes required, the Proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of the required resources is considered reasonable given the benefits of offsetting fossil fuel electricity generation.

Water would be required during construction for activities including watering of roads and in the site office and amenities. Water use is considered in Section 8.1.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved local facilities. The Proposal is considered highly reversible in its ability to return to the pre-existing land use or alternative land use. Most of the project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

Operation

During operation the solid waste streams would be associated with maintenance activities and presence of employees. Some materials, such as fuels, lubricants and metals may require replacement over the operational life of the Proposal.

Life Cycle Analysis

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery. LCA estimates energy and emissions based on the total life cycle of materials used for a project, being the total amount of energy consumed in procuring, processing, working up, transporting and disposing of the respective materials (Schleisner, 2000).

A life cycle inventory of multicrystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 25 to 30-year lifetime of the panels, it is expected that 28 g of GHG would be produced per kWh of energy generated (Fthenakis, et al., 2011). The 'energy payback time' for multicrystalline PV panels is dependent on the geographical location, however, on average it is estimated to be 1.5 years. A solar installation in Southern Europe would be less than 1.5 years, which is considered comparable to the Proposal site.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce the panel. This stage also produces the largest amount of pollutants with the use of electricity and natural gas for heating (Fthenakis, et al., 2011). The waste produced during production of the panels which can be recycled includes graphite crucibles, steel wire and waste slurry (silicon and polyethylene glycol). However, silicon crystals cannot be recycled during this stage (Fthenakis, et al., 2011). The production of the frames and other system components, including cabling, would also produce emissions and waste, but less than the production of panels.

The energy yield ratio of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it. PV system energy yield ratio in Northern Europe was estimated to be more than ten, indicating the system would produce more than ten times the amount of energy required to make it. This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the system's life.

When compared to the major electricity generating methods employed in Australia, Solar Farms are favourable for the following reasons:

- CO₂ emissions generated per kilowatt hour of energy produced.
- Short energy payback time in comparison to the life span of the Proposal.
- Potential to reuse and recycle component parts.

Resources and waste streams

Electricity production using photovoltaics emits no pollution, produces no GHGs, and uses no finite fossil-fuel resources (U.S. Department of Energy, 2004). Only limited amounts of fuels would be required for maintenance vehicles during operation of the Solar Farm.

Operational waste streams would be very low given the low maintenance requirements of the Solar Farm.

It is likely that some electrical components, such as inverters, transformers and electrical cabling, would need replacement over the proposed life of the Solar Farm. This would require further use of metal and plastic based products. Repair or replacement of infrastructure components would result in some waste generation. However, these activities would occur very infrequently and there would be a high potential for recycling or reuse of any waste.

8.6.3 Safeguards and mitigation measures

Resource and waste generation risks are proposed to be addressed via the mitigation measures in Table 8-10.

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

No.	Safeguards and mitigation measures	C	O	D
WM1	<p>A Waste Management Plan (WMP) will be developed and implemented during construction, operation and decommissioning to minimise wastes. It will include but not be limited to:</p> <ul style="list-style-type: none"> • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage will be disposed of (i.e., pump out to local sewage treatment plant). • Tracking of all waste leaving the site. • Disposal of waste at facilities permitted to accept the waste. • Requirements for hauling waste (such as covered loads). 	C	O	D

C: Construction; O: Operation; D: Decommissioning

8.7 CUMULATIVE IMPACTS

8.7.1 Existing environment

Cumulative impacts relate to the combined effect of similar or different impacts on a particular value or receiver and may occur concurrently or sequentially. For these purposes, cumulative impacts are associated with other known or foreseeable developments occurring in proximity to the Proposal. The incremental effects of the Proposal on existing background conditions in the study area have been considered in the preceding assessment sections.

Proposed developments within the locality or region which may contribute to the cumulative impacts of the Proposal are detailed in Table 8-11.

Table 8-11 Nearby proposed developments

Project	Proponent	Location/ distance from Proposal	Current status (taken from Major Projects website)
Maxwell Underground	Malabar Coal Ltd	Surrounding Proposal	Submitted
Spur Hill Underground Coking Coal Project	Spur Hill Management Pty Ltd	16km south-west	N/A
Bayswater Power Station Upgrade	AGL Macquarie Pty Ltd	5km south-east	Prepare EIS
Thomas Mitchell Drive Upgrade	NSW Government (Roads and Maritime Services)	Directly north	N/A

It is likely that the Bayswater Power Station upgrade and Thomas Mitchell Drive Upgrades would be completed before construction of Maxwell Solar Farm commences. Due to the location and timing of Spur Hill Underground Coking Coal Project, it is not required to be considered in the cumulative impacts for this Proposal.

Construction and operation of Maxwell Underground is the most relevant proposed development due to the proximity of the two projects.

8.7.2 Potential impacts

As mining activity ceased at the Proposal site in October 2016, maintenance and rehabilitation activities have been the main activities undertaken on the Maxwell Infrastructure site. The Drayton Mine (now referred to as the Maxwell Infrastructure site) was assessed and approved as a mining operation project.

Construction, operation and decommissioning of the Solar Farm, along with concurrent maintenance and rehabilitation activities would be smaller in scale than the original approved Drayton Mine. Due to the minor scale of the proposed Maxwell Solar Farm, cumulative impacts are anticipated to be negligible.

Potential minor cumulative impacts are primarily associated with the following:

- Noise impacts.
- Visual and landscape character impacts.

- Traffic impacts.
- Pressure on local facilities, goods and services.

These issues, and their potential interaction with the Proposal, have been assessed separately in relevant sections of this EIS. Mitigation measures have been developed for these issues. The potential minor cumulative impacts are summarised below:

Noise impacts

Noise impacts from plant, machinery and vehicles would be heightened if the construction and operation of other proposed nearby developments is undertaken concurrently. Mitigation measures to address and reduce any impact have been proposed as part of this report (refer to Section 7.6). The cumulative impact of noise in the vicinity of the Proposal is not expected to result in any significant impacts due to the relatively small scale of Maxwell Solar Farm.

Visual and landscape character impacts

The visibility of the Proposal (the view when the Proposal is in operation) may generate a cumulative impact with Maxwell Infrastructure and existing transmission lines. The mitigation measures recommended in this report and the VIA (APPENDIX H) would act to reduce the cumulative impacts. Screen planting would be undertaken in key locations on-site, outside the perimeter fence, to minimise views of the Proposal's solar array and infrastructure.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen the Proposal's infrastructure due to the topographic landform, including the 'lip' of the rehabilitation mound and nearby hilltops and rolling fields.

Traffic impacts

Cumulative traffic impacts may occur on common construction access and freight transport routes. Thomas Mitchell Drive and the New England Highway are high capacity roads designed for heavy vehicle traffic and are likely to absorb any cumulative impacts. Any increase to traffic would be predominately limited to the Proposal's 12 to 18-month construction period. In all stages of the Proposal, the impacts to the local road network are expected to be marginal. It is also important to note that traffic would decrease during the operational stage of the Proposal due to cessation of rehabilitation activities at the Maxwell Infrastructure site. As discussed in the Traffic Impact Assessment (Appendix K) and summarised in Section 7.7 of this EIS the roads system in the vicinity of the Proposal is below capacity and cumulative impacts are anticipated to be negligible.

Pressures on local facilities, goods and services

There is potential that the possible concurrent construction of the Proposal with Maxwell Solar Farm and other projects in the region would increase pressures on local community services, including accommodation. However, there is also potential for positive cumulative economic effects from the construction of multiple developments in the area. The increased creation of jobs and economic input into local businesses would benefit local communities.

Assessments concluded that the Proposal would not result in significant negative impacts to local businesses, residents and road users, subject to the range of identified mitigation measures. Due to the number of local communities in the area, any cumulative impacts on local services are likely to be spread between communities. There is sufficient residual capacity within the existing communities. It is unlikely that there would be negative cumulative impacts to local facilities' goods and services.

8.7.3 *Safeguards and mitigation measures*

The cumulative impacts identified for the Proposal are best managed by dealing with each component individually. No additional safeguards are proposed.

9 ENVIRONMENTAL MANAGEMENT

9.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The environmental risks associated with the proposed Maxwell Solar Farm would be managed by implementing a Proposal-specific suite of mitigation measures detailed in Sections 7 and 8 and summarised below.

All commitments and mitigation measures would be managed through the implementation of a Project Environmental Management Strategy (EMS). The EMS would comprise a Construction Environmental Management Plan (CEMP), an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). These plans would be prepared sequentially, prior to each stage of works by the contractor (CEMP, DEMP) and proponent (OEMP).

The EMS would include performance indicators, timeframes, implementation and reporting responsibilities, communications protocols, a monitoring program, auditing and review arrangements, emergency responses, induction and training and complaint/dispute resolution procedures. The monitoring and auditing program would clearly identify any residual impacts after mitigation. Adaptive management would be used to ensure that improvements are consolidated in updated EMPs.

9.2 CONSOLIDATED MITIGATION MEASURES

The mitigation measures contained in this report comprise Proposal-specific safeguards, recommendations from specialist assessment reports and reference to a range of best practice guidelines and regulatory requirements. The measures are to be incorporated in Proposal plans and designs, contract specifications and the Construction Environmental Management Plan, Operation Environmental Management Plan and Decommissioning Environmental Management Plan as appropriate. The mitigation measures are consolidated below. Where measures are relevant to more than one environmental aspect, they are cited only once under the most relevant aspect, to avoid duplication.

Table 9-1 Consolidated list of mitigation measures

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
BD1	<p>The following plans are to be prepared and approved by the relevant authorities:</p> <ul style="list-style-type: none"> • Construction Environmental Management Plan. • Weed Management Plan. • Erosion and Sediment Control Plan. <p>The plans should include but not be limited to the relevant commitments below.</p>	Pre-construction		
BD2	<p>Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas. This will be incorporated into the Weed Management Plan.</p>	C	O	
BD3	<p>Priority weeds shall be managed according to the requirements of the <i>Biosecurity Act 2015</i>, in that they are to be disposed of at a licenced waste management facility or similar. Priority weeds are not to be mulched and repurposed for any landscaping use</p>	C	O	
BD4	<p>Construction areas would be stabilised as soon as practicable (progressively where possible).</p>	C		
AH1	<p>Further archaeological assessment would be required if the Proposal activity extends beyond the area assessed as detailed in this report. This would include consultation with the registered Aboriginal parties and may include further field survey.</p>	C		
AH2	<p>In the event that previously unrecorded Aboriginal objects are found the following process should be followed:</p> <ol style="list-style-type: none"> 1. All works must cease immediately in the area to prevent any further impacts to the site; 2. Notify the Manager Environment and Community; 3. Engage a suitably qualified archaeologist and RAP representative to determine the nature, extent and significance of the site and provide appropriate management advice. Management action(s) will vary according to the type of evidence identified, its significance (both scientific and cultural) and the nature of potential impacts; and 4. Prepare and submit an AHIMS site card for the site. 	C		

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
AH3	<p>In the event that potential human skeletal remains are identified at any point throughout the life of the proposed activity, the following standard procedure should be followed:</p> <ol style="list-style-type: none"> 1. All work in the vicinity of the remains should cease immediately; 2. The location should be cordoned off - work can continue outside of this area as long as there is no risk of interference to the remains or the assessment of the remains; 3. Where it is instantly obvious from the remains that they are human, the Manager Environment and Community (or a delegate) should inform the NSW Police by telephone (prior to seeking specialist advice); 4. Where uncertainty over the origin (i.e., human or non-human) of the remains exists, a physical or forensic anthropologist should be commissioned to inspect the exposed remains in situ and to make a determination of origin, ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or modern): <ol style="list-style-type: none"> a) If the remains are identified as modern and human, notify NSW Police; b) If the remains are identified as pre-contact or historic Aboriginal, notify DPIE using their Environment Line (131 555); c) If the remains are identified as historic (non-Aboriginal), notify the NSW Heritage Division; d) If the remains are as identified as non-human but archaeological in nature, engage a suitably qualified heritage specialist to determine the nature, extent and significance of the remains and to provide appropriate management advice; and e) If the remains are as identified as non-human and non-archaeological, resume works. 	C		
AH4	An Aboriginal community representative must be present where it is reasonably suspected burials or human remains may be encountered. If human remains are unexpectedly encountered and they are thought to be Aboriginal, the Aboriginal community must be notified immediately.	C		
AH5	Recording of Aboriginal ancestral remains must be undertaken by or be conducted under the direct supervision of a specialist physical anthropologist or other suitably qualified person.	C		
AH6	Archaeological reporting of Aboriginal ancestral remains must be undertaken by, or reviewed by, a specialist physical anthropologist or other suitably qualified person, with the intent of using respectful and appropriate language and treating the ancestral remains as the remains of Aboriginal people rather than as scientific specimens.	C		
LU1	Consultation with adjacent landholders will be ongoing to manage interactions between the Solar Farm and other properties.	C	O	D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
LU2	Consultation will be undertaken with AGL and Ausgrid regarding offsite energy transmission infrastructure.	C	O	D
LU3	<p>A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to decommissioning. The Rehabilitation and Decommissioning Management Plan is to include:</p> <ul style="list-style-type: none"> • Removal of all above ground infrastructure. • Removal of gravel from internal access tracks where required, in consultation with landowner. • Reverse any compaction by mechanical ripping. <p>Indicators and standards to indicate successful rehabilitation of disturbed areas. These indicators and standards should be applied to rehabilitation activities once the Solar Farm is decommissioned.</p>			D
LU4	A Pest and Weed Management Plan will be prepared to manage the occurrence of priority weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Muswellbrook Shire Council and NSW DPI requirements. Where possible integrate weed and pest management with adjoining landowners.	C	O	
LU5	Construction and operations personnel will drive carefully and below the designated speed limit according to the Traffic Management Plan to minimise dust generation and ground disturbance.	C	O	D
SO1	A construction Erosion and Sediment Control Plan (ESCP) should be prepared for a high-risk erosion hazard site in accordance with <i>Landcom Soils and Construction: Managing Urban Stormwater</i> (2004).	C		
SO2	The design and construction of the Proposal should minimise ground disturbance and avoid disturbing steep slopes.	Design		
SO3	Where ground disturbance is required the vegetation (organic matter) should be retained and reused during rehabilitation.	C		
SO4	Topsoil should be stockpiled separately and treated with ameliorants as soon as practicable to encourage topsoil quality for reuse during rehabilitation.	C		
SO5	A rehabilitation and revegetation plan should be prepared and include stabilisation and topsoil amelioration.	C		D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
SO6	Soils disturbed during construction and with an exchangeable sodium percentage above 6% should be treated with gypsum to increase the levels of calcium and magnesium, and thus lowering the exchangeable sodium percentage.	C		
SO7	Unrehabilitated areas on the powerline easement and access road should be rehabilitated in accordance with the conditions of the current mining approval.	C		D
NS1	Works should be undertaken during hours: <ul style="list-style-type: none"> Monday – Friday 6am to 6pm. Saturday 6am to 1pm. No work on Sundays or public holidays. 	C		D
NS2	All staff on-site should be informed of procedures to operate plant and equipment in a quiet and efficient manner.	C	O	D
NS3	A letter box drop would be prepared and provided to residences within 3km of the works. The letter would contain details of the proposed works including timing and duration and a contact person for any enquiries or complaints.	C	O	D
NS4	Implement noise control measures that are suggested in Australian Standard 2436-2010 “ <i>Guide to Noise Control on Construction, Demolition and Maintenance Sites</i> ”, to reduce predicted construction noise levels.	C		D
NS5	In addition to physical noise controls, the following general noise management measures should be followed: <ul style="list-style-type: none"> 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. 	C		D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
NS6	Establish a noise management procedure 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.	C	O	D
NS7	Where noise level exceedances cannot be avoided, then time restrictions and/or providing periods of repose for residents must be considered where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during construction hours.	C		D
NS8	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. Allowing the construction activities to proceed, despite the noise exceedance may be the preferred method in order to complete the works expeditiously.	C		D
TT1	<p>A Traffic Management Plan will be developed and implemented during construction and decommissioning. The plan will be prepared in consultation with the relevant road authority and the appointed transport contractor. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • The designated routes and vehicular access of construction traffic (both light and heavy) to the site. This will include the management and coordination of movement of vehicles for construction and worker related access to limit disruptions to other motorists, emergency vehicles, school buses and other public transport. • Procedure for informing the public where any road access will be restricted as a result of the project. • The designated routes of construction traffic to the site. • Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction. • Scheduling of deliveries. • Community consultation regarding traffic impacts for nearby residents. • Consideration of cumulative impacts. • Traffic controls (speed limits, signage, etc.), and any proposed precautionary measures to warn road users such as motorists about the construction activities for the project. • Procedure to monitor traffic impacts and adapt controls (where required) to reduce the impacts. • Details of measures to be employed to ensure safety of road users and minimise potential conflict. 	C		D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
	<ul style="list-style-type: none"> A driver Code of Conduct to address such items as appropriate driver behaviour including adherence to all traffic regulations and speed limits, driver fatigue, safe overtaking and maintaining appropriate distances between vehicles, etc. and appropriate penalties for infringements of the Code. Details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site. Providing a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures. <p>Water to be used on unsealed roads to minimise dust generation through increased traffic use.</p>			
WA1	All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA2	All fuels, chemicals, and liquids will be stored at least 50m away from any waterways or drainage lines and will be stored in an impervious bunded area.	C	O	D
WA3	Adequate incident management procedures will be incorporated into the Construction and Operation Environmental Management Plans, including requirement to notify EPA for incidents that cause material harm to the environment (refer s147-153 <i>Protection of the Environment Operations Act 1997</i>).	C	O	D
WA4	The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas.	C	O	D
WA5	Machinery will be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	C	O	D
WA6	Erosion and sediment control measures that will be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom, 2004).	C	O	D
WA7	Ensure appropriate drainage controls are incorporated into the design.	Design		
WA8	<p>An Emergency Response Plan incorporating a Flood Response Plan will be prepared prior to construction covering all phases of the Proposal. The plan will:</p> <ul style="list-style-type: none"> Detail who will be responsible for monitoring the flood threat and how this is to be done. Detail specific response measures to ensure site safety and environmental protection. Outline a process for removing any necessary equipment and materials offsite and out of flood risk areas (i.e. rotate array modules to provide maximum clearance of the predicted flood level). 	C	O	D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
	<ul style="list-style-type: none"> Consider site access in the event that some tracks become flooded. Establish an evacuation point. Define communication protocols with emergency services agencies. 			
WA9	<p>The design of buildings, equipment foundations and footings for electrical componentry and panel mounts will be designed to avoid the 1% AEP flood level to minimise impacts from potential flooding including:</p> <ul style="list-style-type: none"> The solar array mounting piers are designed to withstand the forces of floodwater (including any potential debris loading) up to the 1% AEP flood event, giving regard to the depth and velocity of floodwaters. The mounting height of the solar module frames will be designed such that the lower edge of the module is clear of the predicted 1% AEP flood level. All electrical infrastructure, including inverters, will be located above the 1% AEP flood level. Where electrical cabling is required to be constructed below the 1% AEP flood level it will be capable of continuous submergence in water. The proposed perimeter security fencing will be constructed in a manner which does not adversely affect the flow of floodwater and should be designed to withstand the forces of floodwater or collapse in a controlled manner to prevent impediment to floodwater. 	Design		
HA1	An Emergency Response Plan, incorporating an Evacuation Plan and Emergency Fire Response Plan will be developed prior to commissioning the Solar Farm. Two copies of the plan will be kept on site in an 'Emergency Information Cabinet' in a prominent position adjacent to the site entry point at all times.	C	O	D
HA2	Dangerous or hazardous materials will be transported, stored and handled in accordance with AS1940-2004: <i>The storage and handling of flammable and combustible liquids</i> , and the ADG Code where relevant. All potential pollutants kept on-site will be stored in accordance with relevant HAZMAT requirements and banded.	C	O	D
HA3	All design and engineering will be undertaken by qualified competent persons with the support of specialists as required.	C		

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
HA4	All electrical equipment will be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
HA5	Design of electrical infrastructure to minimise EMFs through the solar array.	C		
HA6	<p>A Bush Fire Management Plan will be developed and implemented during construction, operation and decommissioning, with input from the RFS, and include but not be limited to:</p> <ul style="list-style-type: none"> • Management of activities with a risk of fire ignition. • Management of fuel loads onsite. • Storage and maintenance of firefighting equipment, including siting and provision of adequate water supplies for bush fire suppression. • The below requirements of <i>Planning for Bush Fire Protection 2006</i>: <ul style="list-style-type: none"> ○ Identifying asset protection zones. ○ Providing adequate egress/access to the site. ○ Emergency evacuation measures. <p>Operational procedures relating to mitigation and suppression of bush fire relevant to the Solar Farm.</p>	C	O	D
HA7	<p>A comprehensive Emergency Fire Response Plan will be developed and implemented during construction, operation and decommissioning, and include but not be limited to:</p> <ul style="list-style-type: none"> • Address foreseeable on-site and off-site fire events. • Detail appropriate risk control measures that will need to be implemented to safely mitigate potential risk to the health and safety of firefighters and other first responders. <p>Other risk control measures that may need to be implemented in a fire emergency due to any unique hazards specific to the site.</p>	C	O	D
HA8	Once constructed and prior to operation, that the operator of the facility contacts the relevant local emergency management committee (LEMC), which contact can be obtained from the relevant council.	C	O	

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
SE1	A Community Consultation Plan will be implemented during construction to manage impacts to community stakeholders, including but not limited to: <ul style="list-style-type: none"> • Protocols to keep the community updated about the progress of the Proposal and Proposal benefits. • Protocols to inform relevant stakeholders of potential impacts (haulage, noise etc.). Protocols to respond to any complaints received.	C	O	
SE2	Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials.	C	O	
SE3	Liaison with local representatives regarding accommodation options for staff, to minimise adverse impacts on local services.	C		D
SE4	Liaison with local tourism industry and council representatives to manage potential timing conflicts or cooperation opportunities with local events.	C		D
HH1	Should an item of historic heritage be identified, the Heritage Division (DPIE) would be contacted prior to further work being carried out in the vicinity.	C	O	D
HH2	Should any skeletal remains be found, works will cease immediately, the area cordoned off and the Police contacted.	C	O	D
AQ1	Development of a complaints procedure to promptly identify and respond to issues generating complaints.	C	O	D
AQ2	Protocols to guide vehicle and construction equipment use to minimise emissions will be included in construction and operational environmental management plans. This will include but not be limited to Australian standards and POEO Act requirements.	C	O	D
AQ3	Dust will be monitored and managed to prevent dust leaving the development site. This includes covering loads and watering of unsealed roads and stockpiles.	C	O	D
AQ4	Monitor local weather conditions and manage the site if any conditions will exacerbate air quality (e.g. wind).	C		D
AQ5	Fires and material burning are prohibited on the Proposal site.	C	O	D

No.	Safeguards and mitigation measures	Construction	Operation	Decommissioning
WM1	<p>A Waste Management Plan (WMP) will be developed and implemented during construction, operation and decommissioning to minimise wastes. It will include but not be limited to:</p> <ul style="list-style-type: none"> • Identification of opportunities to avoid, reuse and recycle, in accordance with the waste hierarchy. • Quantification and classification of all waste streams. • Provision for recycling management onsite. • Provision of toilet facilities for onsite workers and how sullage will 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. <p>Requirements for hauling waste (such as covered loads).</p>	C	O	D

10 CONCLUSION

10.1 PROPOSAL OVERVIEW

The proposed Maxwell Solar Farm would be located on rehabilitated open cut mine land within the Maxwell Infrastructure site, ten kilometres south-east of Muswellbrook, NSW. The site would be accessed from Thomas Mitchell Drive, which is located directly to the north of Maxwell Infrastructure. The proposed Solar Farm would connect to one of two alternative proposed connections options to connect to the Ausgrid network:

- Option A is to construct a new 33kV transmission line connecting to the existing 33kV transmission line and substation of Maxwell Infrastructure. This new section of transmission line would be within a proposed powerline corridor.
- Option B is to construct a new 66kV transmission line on the Maxwell Infrastructure site, connecting to a proposed new switch station that connects to the Ausgrid network via the Mt Arthur Feeder. The Mt Arthur Feeder is currently under construction. This installation also appears in the proposed Maxwell Underground Development Application as the power supply to the Maxwell Underground Project.

The Maxwell Solar Farm Proposal involves the construction, operation and decommissioning of a ground-mounted PV solar array which would have an installed capacity of approximately 25MW (AC) that would supply electricity to the Maxwell Infrastructure site and/or the Maxwell Underground site and/or the National Energy Market (NEM). Development of the Solar Farm would make use of existing electricity infrastructure and would contribute to Australia's transition to a low emission energy generation economy. The Proposal is considered compatible with existing land uses and highly reversible upon decommissioning, returning the site to its previous land capability for agricultural or other land uses.

10.2 BENEFITS OF AND NEED FOR THE PROPOSAL

The Proposal would result in a number of benefits including:

- Support Commonwealth and NSW climate change commitments.
- Generation of enough clean, renewable energy for about 10,000 average NSW homes.
- Enhance electricity reliability and security.
- Creation of local job opportunities.
- Injection of expenditure in the local area.
- Exploitation of a new land use thereby diversifying the regional economy.

In summary, the Proposal would support Australia's greenhouse gas reduction, renewable energy and electricity needs. It would additionally bring local benefits such as job opportunities and local expenditure.

10.3 ENVIRONMENTAL IMPACTS AND MANAGEMENT

The key environmental risks have been investigated through specialist investigations, and include:

- Biodiversity impacts.
- Aboriginal heritage impacts.
- Compatibility with existing land uses.
- Soils and erosion.

- Visual impact.
- Noise and vibration.
- Traffic transport and safety.

All these matters have been discussed directly with the local community and included in this environmental assessment.

A key concern raised via community engagement was visual impacts to the landscape. This has been addressed in the EIS (see Section 7.5) and Proposal design.

Overall there has been considerable support for the Proposal within the community.

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

10.4 ABILITY TO BE APPROVED

This EIS indicates that the Proposal can be approved, subject to the identified mitigation measures. In summary, this is because:

- The Proposal meets relevant planning requirements, as set out in Section 5.
- The environmental risks associated with the Proposal are well understood and manageable, as set out in Sections 7 and 8. Specifically, the Proposal has demonstrated consideration of avoidance and minimisation of negative impacts as part of the layout and mitigation strategy development. The impacts are largely reversible.

Consideration has been given to the compatibility of the Proposal with the existing electricity network and the compatibility of the site for the generation of solar energy. This ensures construction and operating costs are reduced, maximising the viability of the Proposal and its contribution to meeting energy needs into the future. Considerations during initial site investigations included:

- Access to and capacity of the electrical transmission network.
- Availability of an abundant solar resource.
- Availability of appropriate land (i.e. topography, aspect, vegetation).
- Suitability in terms of the interests of other stakeholders and the environment.

The consequences of not proceeding with the proposed Maxwell Solar Farm 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 Proposal.

The preferred option assessed in this EIS provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage of the Proposal. It would not result in significant impacts to environmental, cultural, social and economic values. Furthermore, the Proposal is consistent with the principles of ESD and forms an important part of Australia's transition to renewable energy generation.

11 REFERENCES

- ABS. (2016). *Quick Stats*. Australian Bureau of Statistics.
- AEMO. (2016). *National Electricity Forecasting Report: For the National Electricity Market*. Accessed from: <http://www.aemo.com.au/>.
- AER. (2015). *Annual Report 2015-2016*. report prepared for Commonwealth of Australia.
- Alsema, E. A., Wild-Scholten, M. J., & Fthenakis, V. M. (2006). *Environmental Impacts of PV Electricity Generation - A Critical Comparison of Energy Supply Options*. Dresden, Germany, 4-8 September: 21st European Photovoltaic Solar Energy Conference.
- Anglo American. (2013). *Drayton Mine Rehabilitation and Offset Management Plan*.
- ARENA. (2015). *Establishing the social licence to operate large solar facilities in Australia": insights from social research for industry*. Australian Renewable Energy Agency.
- ARENA. (n.d.). *Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry*. Australian Renewable Energy Agency.
- ARPANSA. (2015). *Fact Sheet 19: Electricity and Health*. Retrieved from Australian Radiation Protection and Nuclear Safety Agency: http://www.arpansa.gov.au/pubs/factsheets/019is_electricity.pdf
- Australia International Council on Monuments and Sites [ICOMOS]. (2013). *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*.
- Australian Heritage Commission. (2002). *Ask First: A Guide to Respecting Indigenous Heritage Places and Values*.
- Bignal, K., Ashmore, M., & Power, S. (2004). The ecological effects of diffuse air pollution from road transport. *English Nature Research Report 580*.
- Blum and Long. (2016, March 2). *Lithium Ion Battery Energy Storage System Fires*. Retrieved from Exponent Inc.: <http://www.nfpa.org/news-and-research>
- BOM. (2018). *Archive - Twelve-monthly rainfall deciles for New South Wales/ACT*. Retrieved from Bureau of Meteorology: <http://www.bom.gov.au/jsp/awap/rain/archive.jsp?colour=colour&map=decile&year=2018&month=12&period=12month&area=ns>
- BOM. (2019, March 26). *Groundwater Dependent Ecosystems Atlas*. Retrieved from Bureau of Meteorology : <http://www.bom.gov.au/water/groundwater/gde/map.shtml>
- Butler, R. (2013, July 23). *Managing the lithium (ion) battery fire risk*. Retrieved from http://www.hemmingfire.com/news/fullstory.php/aid/1790/Managing_the_lithium__ion__battery_fire_risk.html
- Chang, G. J., & Jennings, C. (1994). *Magnetic Field Survey at PG&E Photovoltaic Sites*. Accessed 2nd April 2019.
- CSIRO. (2008). *Guideline for Surveying Soil and Land Resources*. CSIRO.
- CSIRO. (2009). *Australian Soil and Land Survey Handbook*. CSIRO.
- CSIRO. (2015). *Climate Change in Australia*. Retrieved from <https://www.climatechangeinaustralia.gov.au/en/>

- DEC. (2006). *Assessing Vibration: A Technical Guideline*. Department of Environment and Conservation .
- DECCW. (2009). *NSW Interim Construction Noise Guideline*. Department of Environment Climate Change and Water.
- DECCW. (2010). *Aboriginal Cultural Heritage Consultation Requirements for Proponents*. Department of Environment, Climate Change and Water NSW.
- DECCW. (2011). *Road Noise Policy*. Department of Environment, Climate Change and Water NSW.
- DECCW. (2011a). *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. Department of Climate Change and Water.
- Department of Commerce (WA). (2017). *Battery Energy Storage Systems*. Retrieved from A guide for Electrical Contractors : https://www.commerce.wa.gov.au/sites/default/files/atoms/files/bess_guideline.pdf
- Department of the Environment. (2016). *Engage Early*. Commonwealth of Australia.
- DIS. (2015). *Energy White Paper*. Department of Industry and Science.
- DOI. (2019, March 26). *Hunter catchment snapshot*. Retrieved from NSW Department of Industry - Water in NSW: <https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/hunter>
- DoP. (2009). *Consolidated Project Approval - Drayton Mine Extension (06_0202)*. Department of Planning.
- DPE. (2017). *Community and Stakeholder Engagement - Draft Environmental Impact Assessment Guideline Series*.
- DPE. (2018). *MinView Web Map*. NSW Department of Planning and Environment.
- DPE. (2018b). *Biodiversity development assessment report waiver determinations for SSD and SSI applications*. NSW Department of Planning and Environment.
- DPE. (2019, February 22). *Safeguarding our Agricultural Land*. Retrieved from NSW Department of Planning & Environment: <http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/Safeguarding-our-Agricultural-Land>
- DPI. (2011). *Land Use Conflict Risk Assessment Guide*. Department of Primary Industries .
- DPI. (2013). *Primefact 1063: Infrastructure proposals on rural land*. NSW Department of Primary Industries .
- EDAW. (2000). *Section 12 – Visual Assessment’, The Mount Arthur North Coal Project: Environmental Impact Statement*. EDAW (Australia) Pty Ltd.
- Emergent Ecology. (2019). *Maxwell Solar Fram: BDAR Waiver Application*.
- EPA. (2017). *Noise Policy for Industry*. NSW ENvironment Protection Authority.
- FAA. (2010). *Technical Guidance for Evaluating Selected Solar technologies on Airports, FAA-ARP-TR-10-1*. FAA.
- Finkel, A. (2017). *Independent Review into the Future Security of the National Electricity Market*. Accessed at: <https://www.energy.gov.au/sites/g/files/net3411/f/independent%20review%20future%20nem%20blueprint%20for%20the%20future%202017.pdf>.

- Fthenakis, V., Frischknecht, R., Rauge, M., Kim, H. C., Alsema, E., Held, M., & de Wild-Scholten, M. (2011). Methodology Guidelines on Life Cycle Assessment of Photovoltaic Electricity. *International Energy Agency Photovoltaic Power systems Programme*.
- Hansen Bailey. (2007). *Drayton Mine Extension - Environmental Assessment*.
- Holman et al. (2014). *Guidance on the assessment of dust from demolition and construction*. Retrieved from Institute of Air Quality Management: www.iaqm/wp-content/uploads/guidance/dust_assessment.pdf
- Industry Safety Steering Committee. (2005). *ISSC 3 Guideline for Managing Vegetation near Power Lines*.
- Landcom. (2004). *Managing Urban Stormwater, Soils and Construction*. (Volume 1) NSW Government.
- Maxwell Infrastructure (Malabar Coal). (2018). *Noise Management Plan*. Version: 3.0.
- McCarthy, F. D., & Davidson, F. (1943). The Elouera Industry of Singleton, Hunter River, New South Wales. In R. o. Museum.
- Moore, D. R. (1970). Results of an Archaeological Survey of the Hunter River Valley, New South Wales, Australia. <http://doi.org/10.3853/j.0067-1975.28.1970.421>.
- Muswellbrook Bush Fire Management Committee. (2011). *Bush Fire Risk Management Plan*.
- Muswellbrook Shire Council . (2015). *About our region - Climate*. Retrieved from Muswellbrook Shire Council : <https://www.muswellbrook.nsw.gov.au/index.php/climate>
- Muswellbrook Shire Council. (2016). *Community Strategic Plan*.
- NGH Pty Ltd. (2017). *Environmental Impact Statement Currawarra Solar Farm (prepared for RES)*. NGH Pty Ltd.
- NGH Pty Ltd. (2017a). *Environmental Impact Statement Beryl Solar Farm*. Prepared for First Solar.
- NOVA. (2017). *Annual Report 2016*. Australian Academy of Science.
- NREL. (2018, April 4). *Top 5 Large-scale Solar Myths*. Retrieved from National Renewable Energy Laboratory: <https://www.nrel.gov/state-local-tribal/blog/posts/top-five-large-scale-solar-myths.html>
- OEH. (2011). *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*. Office of Environment and Heritage.
- OEH. (2012). *The land and soil capability assessment scheme (Second approximation)*. Office of Environment and Heritage.
- OEH. (2016, April 18). *Sydney Basin Bioregion*. Retrieved from NSW Office of Environment & Heritage: <https://www.environment.nsw.gov.au/bioregions/SydneyBasinBioregion.htm>
- Parliament of Australia. (2016). *Interim Report - Retirement of coal fired power stations*. Commonwealth of Australia.
- Randell. (2016). *Australian National Waste Report*. Department of the Environment and Energy, Randell Environmental Consulting.
- Randell Environmental Consulting. (2016). *Waste lithium-ion battery projections*. Prepared for Department of Environment.

- Recharge. (2013). *Safety of Lithium-ion batteries*. Retrieved from Advanced Rechargeable and Lithium Batteries Association: <https://www.rechargebatteries.org/lithium-ion-battery-safety/>
- RFS. (2006). *Planning for Bush Fire Protection Guidelines*. NSW Rural Fire Service.
- RFS. (2018). *Draft Planning For Bush Fire Protection*. NSW Rural Fire Service.
- RFS. (2018b). *Planning for bush fire protection*. NSW Rural Fire Service.
- RMS. (2016). *Construction Noise and Vibration Guideline*. Roads and Maritime Services.
- RPS. (2017). *Finley Solar Project Environmental Impact Statement (Prepared for ESCO Pacific Pty Ltd)*. RPS Group.
- Schleisner, L. (2000). Life cycle assessment of a wind farm and related externalities. *Renewable Energy*.
- Spaven Consulting. (2011). *Solar Photovoltaic Energy Facilities: Assessment of potential for impact on aviation*.
- U.S. Department of Energy. (2004). *PV FAQs*. Retrieved from <http://www.nrel.gov/docs/fy04osti/35489.pdf>
- Water NSW. (2019, March 26). *Groundwater Site Details - Hunter River Basin*. Retrieved from <https://realtimedata.waternsw.com.au/water.stm>
- WHO. (2007). *Electromagnetic fields and public health: Exposure to extremely low frequency fields (Fact sheet No. 322)*. Retrieved from World Health Organisation: <http://www.who.int/mediacentre/factsheets/fs322/en/index.html>
- WHO. (2019). *What are electromagnetic fields?* Retrieved from World Health Organisation: <https://www.who.int/peh-emf/about/WhatisEMF/en/>
- Worley Parsons. (2015). *Hunter River Flood Study (Muswellbrook to Denman)*.
- Wright, M., & Hearps, P. (2010). *Australian Sustainable Energy Zero Carbon Australia Stationary Energy Plan*. University of Melbourne Energy Research Institute - Beyond Zero Emissions.