

Application for Development Consent

Made under the Environmental Planning & Assessment Act.1979

LAST UPDATED 07 JUNE 2019

_{Date:} 09/04/21

DEVELOPMENT APPLICATION NUMBER

Development Application Number: 10.2021.0000035.001

 APPLICANT DETAILS

 Name(s):
 ITP Development

 Address:
 Level 1, 19-23 Moore Street

 Town/Suburb:
 Turner

 State:
 ACT

 Postcode:
 2612

LAND OWNER DETAILS

Name(s): Gregory John Foran & Belinda	Anne Foran	
Address: 781 Wandobah Road		
Town/Suburb: Gunnedah		Postcode: 2380
Telephone:		8155
, anar faran 12@hatmail aana		

Email: greg_foran13@hotmail.com

LAND TO BE DEVELOPED

Address: 781 Wand	obah Road	
Lot Number: 48		Parish: Black Jack
Site Area: 12.3 ha		
Latitude of Developmen	_{t:} -31.047137	
Longitude of Developme	nt: 150.217529	

TYPE OF DEVELOPMENT APPROVAL BEING SOUGHT

□ Erecting, altering or adding to a building

□ Subdivision of Land

□ Subdivision of a building into Strata Units

□ Change of use of land or building

Demolition

📕 Other work

Open New Horizons



FULL DESCRIPTION AND USE OF PROPOSED DEVELOPMENT

ITP Development is proposing to construct a solar farm with AC output of 5MW

on approximately 12.30 ha for the purposes of generating electricity.

PROPOSED DEVELOPMENT DETAILS

Local Development

☑ Integrated Development (requires approval under another Act)

Designated Development (requires an EIS to be submitted)

Total Project Value: \$.6,600,00 Existing Use of the Land: Grazing

Does the development involve the removal of trees? If yes, how many?:

INTEGRATED DEVELOPMENT – Requires approval under one or more of the following

Coal Mine Subsidence Compensation Act 2017 - s.22

Environmental Planning and Assessment Act, 1979 - s.91

Fisheries Management Act 1994 - S.144 S.201 S.205 S.219

Heritage Act 1977 - 🗆 s.58

Mining Act 1992 - Ss.63 & 64

National Parks and Wildlife Act 1974 - 🗖 s.90

Petroleum (onshore) Act 1991 - 🗆 s.16

Protection of the Environment Operations Act 1997 - Ss.43(a), 47 & 55 ss.43(b), 48 & 55

🗆 ss.43(d), 55 & 122

Roads Act 1993 - 🗹 s.138

Rural Fires Act 1997 - 🛛 s.100B

Water Management Act 2000 - Ss.89, 90 & 91

CERTIFYING AUTHORITY

Do you wish to appoint Gunnedah Shire Council as the Principal Certifying Authority for the purposes of undertaking the required inspections and issuing the Compliance and Occupation Certificate(s)?

Gunnedah

Shire Council

□ Yes

No No

Note: If 'Yes' is ticked, this application will be deemed to also be an application for Final Occupation Certificate. The date of the application will be taken to be the date that a final inspection is requested. If an Interim Occupation Certificate is required, a separate application must be lodged at that time.

ENVIRONMENTAL IMPACTS

A Statement of Environmental Effects is attached

The development will have a negligible effect on the Environment (eg. minor interior alterations)

Will the proposal impact the environment of Threatened Species?

□ Yes - Species Impact Statement to be attached

No No

Is the land subject to a private land conservation agreement under the Biodiversity Conservation Act 2016?

□ Yes – Provide details of the type of agreement

No No

For Designated Development Only

An Environmental Impact Statement is attached

BUILDER'S DETAILS

그 Owner Builder Permit Number:
Licensed Builder Number:
Builder's Name:
Builder's Address:
Felephone:Fax:

DETAILS OF PROPOSED STRUCTURE

□ New	□ Alterations	□ Additions	
Colour of	Walls:		
Colour of	Roof:		
Floor Area	a (Square Metres): .		
□ Separa	te House 🛛 🗆	Kit House	□ Transportable House
Number o	f Storeys:	Numb	er of new or additional dwellings/units:
🗆 Attach	ed Dwelling 🛛	Detached Dwelli	ng

Gunnedah Shire Council

Materials

Please indicate the materials to be used in the construction of the new building(s):

Walls	Code	Roof	Code	Floor	Code	Frame	C	ode
Brick (double)	□ 11	Tiles	□ 10	Concrete or slate	□ 20	Timber		40
Brick (veneer)	□ 12	Concrete or slate	□ 20	Timber	40	Steel		60
Concrete or stone	□ 20	Fibre Cement	□ 30	Other	□ 80	Aluminium		70
Fibre cement	□ 30	Steel	□ 60	Not Specified	D 90	Other	0	80
Timber	□ 40	Aluminium	0 70	S. Dilling	-	Not Specified		90
Curtain Glass	□ 50	Other	08 🖸		-	Section of the		
Steel	□ 60	Not Specified	D 90		A STATE	And the subscription of the	R. L.	100-10
Aluminium	□ 70	Mas Sugar	S.Ph.	The Heaters	-		1000	A PERSONAL PROPERTY AND
Other	08 []		1.1.1.1		No. Con		199	
Not Specified	00		a aller	See Hall		the internation	1.1125	

APPLICANT'S DECLARATION

I/We the undersigned hereby apply for development consent and a construction certificate in relation to the development proposal described hereon and in the plans, specifications and documents accompanying the application.

I/We undertake to develop in accordance with the development consent approval granted by Council and conform with the provisions of the relevant Acts, Regulations, Codes and Local Environmental Plan.

I/We further undertake to indemnify against all claims arising from negligence (or otherwise) resulting from work carried out in connection with the development within the road reserve.

Office (e.g. Director):	—		Date: 08	/04/21
Signature:				Manager and a second statement
OWNER'S DECLARATION				
I/We the undersigned are the owner(s) of the lodgement. I/We hereby permit and duly authorise officers of carry out inspections and surveys or take measure the Act(s), Regulations or Planning Instrument. Name(s) GREGORY JOHN FORAN	of the (uremen	Sunnedah Shire (its or photograph BELINDA	Council to ns as requi	enter the land or premises to ired for the administration of TORAN
Office (e.g. Director):	2		Date:	814/21
ignature:			Constantine of the	

T +61 2 6740 2100 E council@infogunnedah.com.au www.gunnedah.nsw.goviau

2380

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Page 4 of 7



2664 Quote Number:

Туре	Description	GST	Fee
81	Development Application Fees	No	\$9,815.00
82	Plan First Levee	No	\$ 3,840.00
83	Construction Certificate Fees	Yes	\$
84	Inspection Fees	Yes	\$
85	Long Service Levy Payment	No	\$
88	Sewerage Management System Fee	No	\$
89	Notification Fees	Yes	\$ 49.50
89	Local Advertisement Fee	Yes	\$245.00
106	Modification of Consent	No	\$
109	Complying Development Certificate	Yes	\$
111	Amend Construction Certificate	Yes	\$
115	Section 68 Approvals	Yes	\$
	Section 94A Contribution	No	\$
	Other:	Yes/No	\$
		Total	\$ 13,949,50

Parcel ID: Zone: Assessment Number: RU1 8936 1331726 Date: 5 2021 Documentation Approved for Receipting:

PO Box 63 (63 Elgin Street) Gunnedah NSW 2380 T+61 2 6740 2100 E council@infogunnedah.com.au www.gunnedah.nsw.gov.au

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DISCLOSURE OF POLITICAL DONATIONS AND GIFTS

Amendments made to the Local Government Act 1993 and Environmental Planning & Assessment Act 1979 in relation to political donations and gifts will become effective from 1 October 2008.

Gunnedah

Shire Council

These introduce obligations on applicants, those making submissions and decision makers in relation to the disclosure of information relating to political donations and gifts during the plan making or development assessment process.

When must an applicant/proponent make a disclosure?

A disclosure must be made by any person who has a financial interest in a planning application and who has made a reportable political donation in the 2 years before a planning application is made and/or determined.

When must a person making a submission make a disclosure?

Any submissions must include disclosure of any reportable political contribution or gift made in the previous two years, and up to the time the application is determined, by you or your associate to anyone including:

- (i) all reportable political donation made to any local councillor of the council
- (ii) all gifts made to any local councillor or employee of that council.

A reportable political donation made to a local councillor of any local council includes any donation made at the time the person was a candidate for election to the council.

You are advised that a person is guilty of an offence under s9.37 of the Environmental Planning & Assessment Act 1979 if the person fails to make a disclosure of a reportable political donation or gift if it is reasonable for that person to know such a reportable donation or gift should have been disclosed. It is also an offence to make a false statement. Currently, the maximum penalty is \$22,000 or imprisonment for 12 months, or both.

A blank disclosure statement which meets the requirements of the legislation is provided on the backside of this information. If you require any further information as to the definition of terms used, or clarification of your obligations, the Guideline produced by the Department of Planning may be obtained from their web-site – www.planning.nsw.gov.au, or a printed copy obtained from Council's Customer Services Centre.

PO Box 63 (63 Elgin Street) Gunnedah NSW 2380 T +61 2 6740 2100 E council@infogunnedah.com.au www.gunnedah.nsw.gov.au



Application No:

Date Disclosure Made:

DISCLOSURE STATEMENT OF POLITICAL DONATIONS AND GIFTS

A disclosure statement of a reportable political donation or gift must accompany a planning application or submission if the reportable donation or gift is made within 2 years before the application or submission is made. If the donation or gift is made after the lodgement of the application, a disclosure statement must be sent to the relevant consent or approval authority within 7 days after the donation or gift is made.

Name of the person making donation or gift:		
Residential address or Registered/official office:		
ABN if not an individual:		
Name/address of development application or plannir	ng matter:	
Date application lodged:		
Consent or approval authority: Gunnedah Shire Cour	ncil	
Person's interest in application:		
Applicant:		
Person with financial interest (explain):		
Person making submission in opposition:		
Person making submission in support:		
Name of the person to benefit from the donation	Date donation made	Amount of the donation*
Name of the person to whom gift is made	Date gift made	Amount or value of the gift*

*Note: A reportable political donation of:

- \$1,000 or more made to or for the benefit of the party, elected member, group or candidate; or
- \$1,000 or more made by a major political donor to or for the benefit of a party, elected member, group or candidate; or
- Less than \$1,000 if the aggregated total of the donation made by the entity or person to the same party, elected member, group, candidate or person within the same financial year (ending 30 June) is \$1,000 or more.

STATEMENT OF ENVIRONMENTAL EFFECTS

Gunnedah 2A Solar Farm

8 April 2021



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	Biodiversity Natural hazards Water resources Air quality

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Attachment A: AHIMS Search Results

Document Details & History

Project number	1920		
Project title	Gunnedah 2A Solar Farm		
Document title	Statement of Environmental Effects		
Client	ITP (Development) Pty Ltd		
Author	Allen Grimwood, Director		
	Zenith Town Planning Pty Ltd		
ABN	PO Box 591 Moruya NSW 2537		
	11 624 467 349		
	Bachelor of Arts (Honours), UNSW		
	Master of Urban & Regional Planning, USyd		
Qualifications	Planning Institute Australia		
	Draft 26 March 2021		
Version	Final 8 April 2021		

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EXECUTIVE SUMMARY

This Statement of Environmental Effects supports an application to Gunnedah Shire Council to develop a solar farm at Lot 48 DP 755474 No 781 Wandobah Road, Gunnedah, referred to as the Gunnedah Solar Farm. The proponent is ITP (Development) Pty Ltd. The site is located 7.4 kilometres south-west of Gunnedah town centre and occupies 12.3 hectares of the 49.6 hectare property. The application is for regionally significant development that needs consent and is to be determined by the Northern Regional Planning Panel.

The proposed development comprises the following:

- 12,000 solar modules ranging in height from 1.5 metres to 2.75 metres installed in 140 rows,
- Two 3.4MW inverter stations each mounted on a 12.2 metre long skid,
- A temporary car parking and materials laydown area,
- A security fence, and
- Perimeter landscaping on the outer side of the security fence on the northern, western and southern sides of the array.

The site selection process has involved liaison with Gunnedah Shire Council officers; identification of environmental and topographical constraints; existence of necessary infrastructure including accessways, power lines and sub-stations; proximity to the settlement of Gunnedah to enable supply of power direct to the township; sufficient cleared land area; willingness of the land owner to develop part of the property and enter lease arrangements to facilitate the solar farm; and the availability of solar resources.

Documentation is submitted in accordance with Schedule 1 Forms Part 1 Development Applications of the Environmental Planning and Assessment Regulation 2000. It is not integrated development as there are no separate approvals required to be issued under section 4.46 of the Environmental Planning and Assessment Act 1979.

The development is satisfactory to the objects of the *Environmental Planning & Assessment Act* 1979 and applicable environmental planning instruments. The land is zoned RU1 Primary Production under *Gunnedah LEP 2012*. The development is defined as *electricity generating works* which means a building or place used for the purpose of making or generating electricity. The proposed development of Gunnedah Solar Farm is permitted in zone RU1 and is also made permissible by provisions of *SEPP (Infrastructure) 2007*.

The proposed development is consistent with the strategic planning framework that applies to the local government area, the site itself and to the development of electricity generating works. Goals,

objectives and actions of the New England North West Regional Plan 2036, the Gunnedah Local Strategic Planning Statement Future 2040, the Gunnedah Shire Rural Strategy and the NSW Renewable Energy Action Plan are satisfied.

Key issues are potential impacts on biodiversity, access to the site and traffic impacts, the effects of flooding and noise emissions, and impacts on cultural heritage, the rural landscape and scenic amenity. The likely impacts of the development have been considered and measures recommended to avoid, minimise or mitigate these impacts.

The solar farm is designed to generate in excess of 12.71GWh of energy annually which will offset almost 8.5 thousand tonnes of CO² equivalent emissions (Sources: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)* and Department of the Environment and Energy) and providing enough energy to power about 2,150 NSW homes. Electricity generated by the system will be directed to the settlement via existing electrical infrastructure to contribute to the supply of electricity for use by households and businesses in Gunnedah town centre. The solar farm will generate community economic benefits through local employment opportunities during the planning and construction phases as well as maintenance and inspection jobs once operational. The land may continue to be used for agriculture and returned to its current condition once the facility is decommissioned.

The development of the solar farm will assist the transition of our economy from reliance on fossil fuels to renewable sources. It will assist Commonwealth and NSW Governments to achieve targets and objectives relating to emissions and addressing climate change.



1. INTRODUCTION

1.1 Overview

The purpose of this Statement of Environmental Effects is to support an application to Gunnedah Shire Council to develop a solar farm at Lot 48 DP 755474 No 781 Wandobah Road, Gunnedah, referred to as the Gunnedah Solar Farm. The application is for regionally significant development that needs consent and is to be determined by the Northern Regional Planning Panel.

The purpose of this report is to assist Council's assessment of the proposal against the matters for consideration listed in section 4.15 of the *Environmental Planning and Assessment Act 1979*. There are no separate approvals required to be obtained under section 4.46 of the *Environmental Planning and Assessment Act 1979* therefore the application is not integrated development.

This Statement has been prepared having regard to advice provided by Gunnedah Shire Council during a site visit in September 2020. Information has also been sourced from the Council's website, the NSW legislation website, SIX Maps, the website of the Department of Planning, Industry & Environment, the Planning Portal and SEED (Sharing and Enabling Environmental Data). All information referenced in this Statement has been sourced from publicly available documents or websites and from expert reports produced to support the application.

1.2 Scope of the report

The contents of this Statement have been prepared in accordance with *Schedule 1 Forms Part 1 Development Applications* of the *Environmental Planning and Assessment Regulation 2000 w*hich specifies that a statement of environmental effects must indicate:

- (a) the environmental impacts of the development,
- (b) how the environmental impacts of the development have been identified,
- (c) the steps to be taken to protect the environment or to lessen the expected harm to the environment,
- (d) any matters required to be indicated by any guidelines issued by the Planning Secretary for the purposes of this clause.

This statement is accompanied by the documents listed in Table 1 which support the development application and have been submitted under separate cover. This documentation is



submitted in accordance with Schedule 1 Forms Part 1 Development Applications of the Environmental Planning and Assessment Regulation 2000.

Note that the findings and recommendations of expert reports that accompany the application are summarised in this Statement. Further information about these matters should be sought from the original documents.

Plan/Doc No.	Plan/Doc Title	Prepared by	Issue	Date
GND2A-G-0100	Gunnedah 2A 5MW Solar	ITP Renewables	-	-
	Farm Development			
	Application			
GND2A-G-0400	Location Plan, Site Plan	ITP Renewables	1	23 /02/21
GND2A-G-2100	General Arrangement Plan	ITP Renewables	2	01/03/21
GND2A-G-2200	Site Elevations	ITP Renewables	1	01/03/21
GND2A-C-4300	Inverter Footing Details	ITP Renewables	1	09/02/21
GND2A-C-5300	Fencing Details	ITP Renewables	1	22/01/21
GND2A-C-5301	Gate Details	ITP Renewables	1	22/01/21
GND2A-C-6300	Access Path Details	ITP Renewables	1	04/02/21
GND2A-E-3400	Nextracker Array Detail	ITP Renewables	1	18/02/21
GND2A-E-4300	Inverter Station Detail	ITP Renewables	1	09/02/21
MAC180781-	Noise Assessment	Muller Acoustic	-	08/09/20
12RP1V1		Consulting Pty Ltd		
TX15008.00- 01 RPT RA S-	Traffic Assessment Report	Triaxial Consulting	2	06/04/21
REV2				
-	Water Assessment	ITP Renewables	1	08/10/20
-	Glare and Glint	ITP Renewables	2	14/09/20
	Assessment			
-	Waste Assessment	ITP Renewables	1	16/09/20
-	Decommissioning	ITP Renewables	1	11/03/21
	Assessment			
-	Biodiversity Inspection	Red-Gum	-	15/03/21
	Report	Environmental		
		Consulting Pty Ltd		
2220	Landscape Character and	Zenith Town	-	08/04/21
	Visual Impact Assessment	Planning Pty Ltd		

Table 1: Development application documents



1.3 The proponent

The proponent for the proposed solar farm is ITP (Development) Pty Ltd. ITP (Development) is a private sector organization based in Canberra and Sydney, which was established in 2003. It is part of the IT Power Group which was formed in 1981 in the UK to bring together specialists in renewable energy, energy efficiency and carbon markets. IT Power offers expertise in renewable energy and energy efficiency, including research, development and implementation, managing and reviewing government incentive programs, high level policy analysis (including carbon markets), engineering design and project management.

1.4 Justification

Solar energy is energy created by the heat and light of the sun. Solar power is produced when this energy is converted into electricity or used to heat air, water, or other substances. Australia has the highest average solar radiation per square metre of any continent in the world. Despite uncertainty regarding energy policy, the Commonwealth and NSW Governments have recognized the need to supplement energy derived from fossil fuels with energy generated from renewable sources. Alternative energy supply may be sourced from solar photovoltaic, geo-thermal, solar thermal, wave and tidal action, and wind.

The development of solar photovoltaic power is well underway in NSW and across Australia. This growth in the local solar PV sector continues to provide a significant boost for Australia's regional economy with renewable infrastructure development estimated to create upwards of 2,300 direct jobs plus indirect employment.

According to the Australian Renewable Energy Agency (ARENA), the deployment of household solar PV that generates about 5 kW is expected to continue and at the same time an increase in rooftop solar PV installations on commercial premises generating around (10-100 kW) is expected. Large scale solar PV is also rapidly expanding in Australia with several solar farms being constructed that will have the capacity to generate over 50MW. The proposed solar farm aims to fill the gap in the mid-sized plants. It will generate 5MW of AC power and contribute to renewable energy supply to supplement electricity generation from coal, oil and gas.

The proposed development is in accordance with relevant objects of the *Environmental Planning and Assessment Act 1979* in that it will assist to generate power to be distributed to the residents of NSW thereby promoting the social and economic welfare of the community in a manner that manages and conserves natural resources. The Gunnedah Solar Farm will further the goals of sustainability, and the orderly and economic use of land.



1.5 Electromagnetic radiation

The information presented in this section has been sourced from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). It includes a description of the type of electromagnetic radiation that may be produced by the generation and distribution of electricity.

The generation, distribution and use of electricity can produce extremely low frequency (ELF) electromagnetic fields (EMF) from electrically charged particles. The electric field is produced by the voltage whereas the magnetic field is produced by the current. The strength of the electric field is measured in units of volts per metre whilst the strength of the magnetic field is expressed in units of tesla (T), microtesla (μ T), gauss (G) or milligauss (mG).

ELF EMF is produced by both natural and artificial sources. Naturally occurring ELF EMF is associated with atmospheric processes such as ionospheric currents, thunderstorms and lightning. Artificial sources are the dominant sources of ELF EMF and are usually associated with the generation, distribution and use of electricity at the frequency of 50 or 60 Hz. The widespread use of electricity means that people are exposed to ELF electric and magnetic fields in the home, in the environment and in the workplace.

According to the Australian Radiation Protection and Nuclear Safety Agency, which maintains continual oversight of emerging research into the potential health effects of the EMF exposure, there is no established evidence of health effects from exposure to electric and magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of proximity.



2. SITE DESCRIPTION AND CONTEXT

2.1 Description

The site of the proposed Gunnedah Solar Farm is described as Lot 48 DP 755474 No. 781 Wandobah Road, Gunnedah, NSW. The property, named Yarra Park, is located approximately 7.4 kilometres south-west of Gunnedah centre and about 6.6 kilometres from the edge of the urban area. It is an irregular shape with a total area of 49.6 hectares.

The location of the site is shown in Figure 1 below.



Figure 1: Locality map. Source: SIX Maps, 2020

The site is occupied by a dwelling and a number of farm sheds that are sited at the centre of the property and enclosed within a wire stock fence. The topography of the site is flat with a very gentle crossfall to the east. A watercourse crosses the property close to the southern boundary running in a west to east direction to enter Peach Tree Gully some 2.6 kilometres to the east.

The property is farmland and has previously been used for livestock grazing and/or cropping. It has not been actively used for agriculture for over 10 years. Existing ground vegetation comprises mostly exotic grasses and weeds such as turnip weed with some scattered shrubs and trees.



Current access to the site is by way of an entrance off Wandobah Road which is located approximately half way along the western boundary. The road reserve is partly vegetated with scattered native trees and exotic grasses between the boundary fence and the pavement.

2.2 Context

Gunnedah local government area is located in the New England and North West region of NSW. It's traditional custodians are the Gamilaraay people and the LGA includes the administrative centre of Gunnedah and the villages of Breeza, Carroll, Curlewis, Emerald Hill, Kelvin, Mullaley and Tambar Springs. Gunnedah township is located approximately at the intersection of the Oxley Highway and the Kamilaroi Highway 440 kilometres north-west of Sydney GPO. The town is located on the floodplain of the Namoi River. The area has rich agricultural lands which support a thriving beef cattle industry as well as coal mining and gas extraction.

Land surrounding the development site is predominantly large farm holdings and environmental lands that are steep and vegetated. Large areas zoned and developed for rural living and rural small holdings separate the township from the development site. There is scattered remnant and regrowth native vegetation along road reserves, property boundaries and on distant hillsides. An aerial image of the site and surrounding land is shown in Figure 2 below which is dated 28 July 2011.



Figure 2: Aerial image. Source: SIX Maps, 28 July 2011

Below is an extract from the topographic map for land in the vicinity of Gunnedah that shows the location of the settlement, transport infrastructure, dams, cadastre and waterways.



Gunnedah Airport is located more than 9 kilometres north of the site and 1.8 kilometres from the town centre.



Figure 3: Extract from the topographic map. Source: Land & Property Information 2015

2.3 Climate

Global solar exposure is described by the Australian Bureau of Meteorology as being the total amount of solar energy falling on a horizontal surface. The daily global solar exposure is the total solar energy for a day. Typical values for daily global solar exposure range from 1 to 35 MJ/m^2 (megajoules per square metre). The values are usually highest in clear sun conditions during the summer, and lowest during winter or very cloudy days.

Global solar exposure coincides with seasons – the longer the daylight hours the greater the solar radiation due to the tilt of the earth during summer months. Rainfall is spread relatively evenly across the year and so does not appear to impact on the level of solar radiation.

Solar exposure estimates are important for a wide range of applications, including for agriculture, power generation and solar heating system design and use. This climatic information sourced from the Australian Bureau of Meteorology indicates that the global solar exposure, or solar radiation, is sufficient to support power generation in the proposed location which benefits from the presence of electricity power lines in the vicinity of the development site.



The map below (Figure 4) shows the average daily hours of sunshine across Australia. Gunnedah LGA receives an average of between 7 and 8 hours of sunshine each day.



Figure 4: Average daily sunshine hours. Source: Australian Bureau of Meteorology

The mean monthly global solar exposure measured at Gunnedah Airport (station number 055202), the closest measuring station to the solar farm, site, is given in Table 2 below. The annual mean daily global exposure for 2020 was $18.2 MJ/m^2$.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly	05.0	20.1	10.0	14.0	10.1	10.0	11.2	14.2	10 7	01.1	07.0	02.1
mean	25.9	20.1	19.0	14.9	12.1	10.9	11.3	14.3	10.7	41.1	21.2	23.1

This data demonstrates that Gunnedah LGA receives adequate solar energy to harness and convert to clean electricity and is eminently suitable for the development of a solar photovoltaic farm.



3. DETAILS OF THE PROPOSED DEVELOPMENT

3.1 Overview

The proposed development comprises a solar farm and ancillary facilities with an AC capacity of 5.0MW on approximately 12.3 hectares, giving a coverage of 25% of the total site.

The capital investment value of the solar farm is estimated to be \$6.6 million.

3.2 The array

There are proposed to be 12,000 solar modules installed in 140 rows that are 103.5 metres long and 2 metres wide running east to west. There is approximately 6.25 metres spacing between each row.

The array is proposed to be placed in the upper half of the property adjacent the northern boundary. The array is to be contained within an area with perimeter dimensions of 334.3 metres across the northern side, 356.2 metres along the southern side and 357 metres along the eastern and western sides.

Each row of PV modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker is 1.5 metres with the peak of the modules reaching an approximate height of 2.75 metres when the array is fully tilted to 60 degrees from horizontal, i.e. in the early morning and late evening.

The layout and exact placement of the array is shown on General Arrangement Plan (Drawing No GND2A-G-2100).

3.3 Inverters and ancillary items

Two 3.4MW AC inverter stations and a transformer will be installed at the solar farm. These inverters are to be located within the centre of the array and are each mounted on a 12.2 metre long skid. Each of these inverter stations incorporate high and medium voltage switchgear.

Each inverter will be connected by way of underground cables to a power line running parallel to the eastern boundary within a 20 metre wide easement to inject power to the electricity grid at the Essential Energy Gunnedah Zone Substation. Dial-before-you-dig investigations would be carried out prior to commencing all subsurface work.



3.4 Construction

The mounting system for the PV panels is constructed on piles that are driven into the ground using a vibrating pile driver. The piles will be driven approximately 1.5 to 3.5 metres into the ground, as to be confirmed by a geotechnical and structural engineer.

During construction there is expected to be 50 personnel on site working from 7.00am – 4.00pm Monday to Friday. The construction is expected to take approximately three months. Should it be necessary to carry out work outside these hours then activities would be limited to those generating low noise emissions. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 to 3 people.

3.5 Services

Reticulated water and sewer services are not required to be provided to the solar farm as there are no permanent offices or amenities proposed on site. Portaloos for wastewater disposal (see https://www.kennards.com.au/site-equipment/showers-toilets.html) and water supply by way of a portable tank or cart (see https://www.kennards.com.au/site-equipment/showers-toilets.html) and water supply by way of a portable tank or cart (see https://www.kennards.com.au/site-equipment/water-tank.html) are proposed to be installed during the construction phase. Maintenance workers would not be required to remain on site. Cleaning of the PV panels would be carried out on an annual basis to maximise the performance of the system. This is done using water brought into the site and a sponge mop.

3.6 Access and car parking

It is proposed to construct a new access entry into the development site off Wandobah Road at the north-western corner of the property. A 4 metre wide internal road will connect to the centre of the array where the inverter stations will be located. A temporary materials laydown and car parking area are to be located at the northern end of the array between the internal access road and the northern boundary fenceline. It is expected that car parking for up to 40 small vehicles will be needed to cater for 50 construction workers at the rate of 0.8 spaces per worker. Traffic generation is given in Table 3 below. It is proposed that heavy vehicles only access the site between 10.00am and 2.00pm.

Table 3: Expected traffic generation

Phase	Description of vehicles	Expected vehicle movements
Construction	45 articulated trucks (maximum 19m	4 vehicle trips per day non-peak
	length) to deliver equipment	



Phase	Description of vehicles	Expected vehicle movements
	40 light vehicle one-way trips for 50 construction workers (worst case without shuttle bus)	40 vehicle trips per day
	Potential shuttle bus service to and from the site	10 vehicle trips per hour
Operational	1 light vehicle for maintenance contractor	1 vehicle trip every 2 to 3 months

3.7 Landscaping

It is proposed to plant a vegetated screen around the northern, western and southern sides of the array on the outer side of the security fence. A mix of native shrubs and ground covers that grow to a maximum height of 3 metres have been selected to ensure that overshadowing of panels does not occur. The plants would be spaced 3 metres apart to provide a continuous screen upon maturity.

Land that is disturbed during construction of the solar farm and not to be used for access or other maintenance purposes will be sown with grasses following completion of construction. Planting will also assist to minimise site disturbance and contribute to the rural landscape and character of the immediate area.

Plantings will be maintained and watered by maintenance crew on a regular basis. The planting will be carried out whilst construction takes place to enable use of the hired portable tank or cart that will provide water supply to the site. Construction will take approximately 3 months so regular watering during that period would ensure the establishment of plants. The use of native plants means that watering requirements once established would be minimal and would be done once every 2 or 3 months by the landowner. There would be nil impact on Council's infrastructure and no augmentation of services would be required. Bore water would be sourced to maintain the plants if available, otherwise water may be brought onto the site in tanks fixed to utility trays.

Regular inspections of the site will be carried out to ensure that grassland is managed to reduce the risk of bushfire to surrounding land and to control weeds. Mowing or slashing between rows of PV panels and in the area immediately surrounding the arrays would be carried out as required. Livestock grazing is being trialled elsewhere and may be carried out around and beneath panels in the future.



3.8 Security

The solar farm is to be enclosed within a 1.8 metre high security fence setback 5 metres from the northern boundary, 7.6 metres from the eastern boundary, 46.3 metres from the centre of Wandobah Road to the stock fence and 735 metres from the southern boundary. Solar arrays are to be setback 8 metres from the security fence. The proposed fence is to be chain mesh steel topped with three rows of barbed wire giving a total height of 2.3 metres similar to that shown in Plate 1 below.

Security lighting is not proposed to be installed.



Plate 1: Example of security fencing

3.9 Waste management

A *Waste Assessment* of the waste generated during construction and operation of the proposed solar farm has been carried out by ITP Renewables to determine the appropriate means of waste disposal and recycling. The findings of the assessment are summarized below. Reference should



be made to the *Waste Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The largest amount of waste will be generated during the construction phase and be classified as general solid waste (non-putrescible). Wastes would include wooden pallets, cardboard, plastics, green waste and domestic waste. Construction of a solar farm would not generate any putrescible waste products. Minimal waste would be generated when the farm is operational other than small amounts of replacement parts and packaging required for maintenance and repair works.

Local waste management facilities and capacities are identified in the assessment. Technology for recycling of PV panels is advancing rapidly worldwide and while recycling options currently exist, they are likely to be more advanced and readily available at the time of decommissioning. Options for recycling of PV panels should be reviewed as the project progresses.

Estimates of waste materials and proposed management arrangements for each phase of the development project are provided in Table 4 below.

Phase	Waste material	Proposed management
Construction	Packaging waste such as	Waste products will be sorted and stored
	cardboard, wood pallets, plastic	separately in skip bins located in the
	wrap, scrap metal, general waste	materials laydown area in accordance with
	including approximately 810	EPA Waste Classification Guidelines. This
	wooden pallets and carboard	will facilitate disposal through appropriate
	packing boxes	waste streams as follows:
	• Concrete waste during setting of	
	footings and mounts	Recycling:
	• Electric cable waste and cable	• Steel and scrap metal (recycled)
	reels	• Timber/cardboard (recycled)
	Plastic pipe offcuts/scrap	Recyclable plastics
	• Empty drums and containers	
	(minimal quantities)	Landfill:
	• Minimal used lubricating oil	• General wastes and plastic (other than
	and filters	where recyclable)
	• Unused or spent chemicals	
		All recycling and general waste would be
		collected and taken to off-site waste
		management facilities for disposal

Table 4: Estimated waste materials and waste management arrangements



Operational • Minimal volumes of domestic waste materials would be recycled where possible or taken to off-site waste management facilities for disposal Operational • Minimal volumes of domestic wastes such as office consumables, paper, plastics and glass All waste materials would be taken to off-site waste management facilities for recycling or disposal Waste resulting from maintenance or replacement of equipment • Waste resulting from mounts The solar farm infrastructure would be dismantled into separate waste products such as metals, glass, plastics and concrete. Decommissioning • PV modules (12,000 panels) and supporting poles and mounts The solar farm infrastructure would be dismantled into separate waste products such as metals, glass, plastics and concrete. Silicon for wafers (40 tonnes) Inverters / transformers / batteries All products would be sorted on site into recyclable and general waste streams in acordance with the EPA Waste Classification Fencing and storage containers would be removed from the site and reused	Phase	Waste material	Proposed management
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		• Fencing	and reused
Storage containers (two 20-foot		• Storage containers (two 20-foot	
containers)		containers)	

Waste management should be predicated on the international hierarchy of waste management to avoid/reduce, reuse, recycle, recover, treat and dispose of waste products to avoid or reduce waste materials where possible, and to re-use, recycle and recover the majority of waste materials generated during each of the construction, operational and decommissioning phases.



It is recommended that a waste management plan be developed to provide detailed procedures to manage the waste stream. The plan should contain:

- Strategies to reduce waste during all project phases,
- Recycling, re-use and recovery strategies and opportunities,
- Classification of all waste streams with a tracking register and details,
- On site recycling management,
- Allocation of responsibilities for recycling, re-use and disposal, and
- Reporting and notification procedures if a waste incident occurs and there is a threat to the environment.

3.10 Decommisioning

The expected life of the Gunnedah Solar Farm is projected to be 35 years. Upon decommissioning all infrastructure, including cabling and panels and mounting frames including footings and inverters would be disassembled and removed from the site. The bulk of materials that are used in solar panel manufacturing include glass (75%), aluminum (8%), silicon (5%) and copper (1%). There are also small amounts of silver, tin and lead. These materials are recoverable.

Decommissioning will involve:

- Notification of stakeholders (e.g. Essential Energy, Gunnedah Shire Council) of proposed de-energisation,
- De-energisation of the solar farm and disconnection of assets,
- Removal of PV modules and associated infrastructure,
- Removal of electrical wiring,
- Remediation of land.

Relevant equipment will be brought to site to facilitate decommissioning, including amenities for site crew for the duration of the works. This equipment may include mobile cranes, excavators, skid steers, loaders, rollers/compactors, pile drivers, telehandlers, skip bins, water carts, temporary shipping containers for storage, site office and site ablution blocks.

Full details of the process are provided in the *Decommissioning Plan* prepared by ITP Renewables. Reference should be made to that report for an explanation of each step in the decommissioning process.



4. STATUTORY FRAMEWORK

4.1 Legislation

4.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment (EPA) Act 1979* is the principal piece of legislation governing the use and development of land in NSW. The objects of the Act are:

- (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,
- (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,
- (c) to promote the orderly and economic use and development of land,
- (d) to promote the delivery and maintenance of affordable housing,
- (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,
- (f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),
- (g) to promote good design and amenity of the built environment,
- *(h)* to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,
- *(i)* to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,
- *(j)* to provide increased opportunity for community participation in environmental planning and assessment.

The objects of the EPA Act are intended to guide land planning and management. Section 4.15 of the Act lists matters for consideration when assessing and determining an application for development.

4.1.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* introduced the *Biodiversity Offsets Scheme* which is used to determine whether the *Biodiversity Assessment Method* is necessary to assess the impacts of a development proposal on threatened species, endangered ecological communities and habitats. Determining whether a *Biodiversity Development Assessment Report* is required under the



Biodiversity Conservation Act 2016 and subsequently whether the *Biodiversity Offsets Scheme* would apply to the proposed works is subject to three steps.

- The first step is to identify whether the site is mapped on the *Biodiversity Values Map*.
- The second step is to estimate whether the extent of native vegetation to be cleared for the proposed development is above the threshold which in this case is 1 hectare.
- The third step is to carry out a test of significance to predict whether impacts on biodiversity are likely to be significant.

Under the *Biodiversity Offsets Scheme* offset obligations may apply whereby the biodiversity assessment finds that the removal of vegetation to facilitate the development will have significant impacts on flora. These offsets are in the form of credit obligations whereby payment is made to a biodiversity conservation fund which enable vegetation removal and provides funds to assists to preserve the same vegetation community elsewhere. Credit obligations also apply to fauna species where particular species are likely to be living in or frequenting the property. These matters are addressed in section *5.1 Biodiversity* of this Statement.

4.1.3 Water Management Act 2000

The *Water Management Act 2000* includes provisions to control or permit works near a watercourse or stream. Works within specified distances of the top of the bank of a watercourse may necessitate issue of a *controlled activity approval* by the Natural Resources Assessment Regulator. Impacts on surface and groundwaters are addressed in *5.3 Water resources* of this Statement.

4.1.4 Local Land Services Act 2013

The *Local Land Services Act 2013* regulates the clearing of native vegetation on rural land and where an activity is permitted without Council consent. There are two broad categories of land under the LLS Act - Category 1 (Exempt) land and Category 2 (Regulated, Vulnerable or Sensitive) land which are shown on the Native Vegetation Regulatory Map .

Clearing may be authorised on Category 1 (Exempt) Land but only where the activity is permitted without consent and when no other permit is required under other legislation. The onus is on the applicant to ensure they are not committing an offense under other legislation. If located on Category 2 (Regulated, Sensitive or Vulnerable) Land, the clearing may be authorised as an Allowable Activity or under the Land Management (native vegetation) Code within the *LLS Act*. If the clearing on Category 2 Land is not an Allowable Activity or is not authorised under the Land Management (native vegetation) Code, the clearing will need to be offset under the Biodiversity Offset Scheme. This means a Biodiversity Development Assessment Report is needed and the



clearing will need to be approved by the Native Vegetation Panel. The LLS Act does not apply to the proposed solar farm as development consent is required to be obtained to enable the works to proceed.

4.1.5 National Parks and Wildlife Act 1994

The objectives of the *National Parks and Wildlife Act 1974* are to conserve and protect habitat, ecosystems, biodiversity, landforms, landscapes and objects, places or features of cultural value in NSW. Under the NPW Act, it is an offence to knowingly harm or desecrate an Aboriginal object. Harm includes destroy, deface or damage an Aboriginal object or Aboriginal Place, and in relation to an object, move the object from the land on which it has been situated. Aboriginal objects include sites, relics or cultural material such as scar trees, middens and ancestral remains.

The NPW Act can also protect areas of land that have no Aboriginal objects, that is, they may have no physical evidence of Aboriginal occupation or use. These areas can be declared 'Aboriginal places' if they have spiritual, natural resource usage, historical, social, educational or other type of significance.

Anyone who exercises due diligence in determining that their actions will not harm Aboriginal objects has a defence against prosecution for the strict liability offence if they later harm an object. The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* provides a process whereby a reasonable determination can be made as to whether or not Aboriginal objects will be harmed by an activity, whether further investigation is warranted and whether the activity requires an application for an Aboriginal Heritage Impact Permit.

4.1.6 Heritage Act 1977

The aims of the *Heritage Act 1977* are to identify, protect and conserve items of State heritage significance. Provisions of the Heritage Act facilitate the establishment of a State Heritage Register for the listing of items of State significance and the preparation of conservation management plans for these items. The Heritage Act also sets out the procedures for the approval of works relating to items listed on the State Heritage Register. Impacts on listed heritage items are addressed in section *5.9 Heritage* of this Statement.

4.1.7 Noxious Weeds Act 1993

The aims of the *Noxious Weeds Act 1993* are to prevent the establishment, reduce the risk of spread and minimise the extent of noxious within NSW. The extent of noxious weeds and



procedures to eradicate weed infestation from the development site are addressed in section 3. *Details of the proposed development* in this Statement.

4.1.8 Roads Act 1993

Under section 138 of the Roads Act 1993, consent is required to carry out works in, on or over a public road, remove or interfere with a structure, work or tree on a public road or connect a road to a classified road. The consent of Transport for NSW is required in the case of works relating to a classified road. Traffic impacts are addressed in section *5.6 Traffic* and access of this Statement.

4.1.9 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* aims to protect nationally and internationally important flora, fauna, ecological communities and heritage places. The approval of the Commonwealth Minister for the Environment is required for actions that may have a significant impact on matters of national environmental significance. The *EPBC Act* also requires Commonwealth approval for certain actions on Commonwealth land.

An assessment of the potential impact of the proposed works on any matters of national environmental significance under the *EPBC Act* and the need for referral to the Commonwealth is provided in section *5.1 Biodiversity* of this Statement.

4.2 State Environmental Planning Policies

4.2.1 State Environmental Planning Policy No 55 – Remediation of Land

SEPP 55 requires Council to consider whether land is contaminated and to determine whether the proposed use is suitable with or without contamination. Council can require an applicant for development to conduct a preliminary investigation and a subsequent more detailed investigation if warranted. Where contamination exists and remediation is necessary, Council must be satisfied that the remediation will take place before the land is used for the proposed purpose. It is noted that should the preliminary investigation identify contamination on the site then the NSW Contaminated Land Planning Guidelines apply to subsequent investigations.

4.2.2 State Environmental Planning Policy (Infrastructure) 2007

The aims of *SEPP (Infrastructure) 2007* are to ensure a consistent and flexible planning system to facilitate the delivery of services. The policy identifies environmental assessment categories for types of infrastructure, matters to consider when assessing development adjacent to



infrastructure and provides for consultation with relevant public authorities. The policy applies to the whole of NSW.

SEPP (Infrastructure) contains provisions relating to approval processes and assessment requirements for infrastructure proposals according to the type or sector of infrastructure. It outlines land use zones where types of infrastructure are permissible with or without consent and identifies certain works as exempt and complying development.

Part 3 Division 4 of the policy relates to electricity generating works or solar energy systems. Section 34(7) enables development for the purpose of a solar energy system to be carried out by any person with consent on any land. The proposed development is permitted with consent by *SEPP (Infrastructure) 2007.*

Clause 45 of *SEPP (Infrastructure) 2007* requires the consent authority to consult with the electricity supply authority where development occurs near electricity infrastructure. If an electricity line runs within an easement on or near the development site, Council is to consult Essential Energy prior to determination of the application.

Clause 104 - Traffic-generating development also applies. Schedule 3 triggers a referral to Transport for NSW if the proposed development generates vehicle movements within a specified threshold.

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

The aims of SEPP (Primary Production and Rural Development) 2019 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 policy applies to *State significant agricultural land*, farm dams and other artificial waterbodies, livestock industries and aquaculture. There is no *State significant agricultural land* listed in the schedule to the policy. It is noted that, separately, the Department of Primary Industries are in the process of preparing mapping of *Important Agricultural Land* in NSW to assist decision-making regarding development on rural land.

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

Development that is state and regionally significant is identified in *SEPP (State and Regional Development) 2011*. Electricity generating works including solar farms which have a capital investment value of more than \$30 million, or a capital investment value of more than \$10 million and are located in an environmentally sensitive area of State significance, are declared state significant development. Private infrastructure, including electricity generating stations, that have a capital investment value of over \$5 million are declared regionally significant and are to be determined by a Regional Planning Panel.

4.2.5 State Environmental Planning Policy (Koala Habitat Protection) 2021

SEPP (Koala Habitat Protection) 2019 commenced on 1 March 2020. This policy aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline. The new policy is implemented through the *Koala Habitat Protection Guideline*. Schedule 1 lists local government areas to which the policy applies. A koala assessment report is required for development on rural properties greater than 1 hectare in area and for where a koala plan of management has not been prepared. Consent may be granted where there are no feed trees and the land is not koala habitat. This matter is addressed in section 5.1 Biodiversity of this Statement.

4.3 Local Environmental Plans

4.3.1 Gunnedah Local Environmental Plan 2012

The property is zoned RU1 Primary Production under *Gunnedah LEP 2012*. The objectives of zone RU1 are:



- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To provide for a range of ecologically sustainable agricultural and rural land uses and development on broad acre rural lands.
- To protect significant agricultural resources (soil, water and vegetation) in recognition of their value to Gunnedah's longer term economic sustainability.
- To conserve and enhance the quality of valuable environmental assets, including waterways, riparian land, wetlands and other surface and groundwater resources, remnant native vegetation and fauna movement corridors as part of all new development and land use.

The development is defined as *electricity generating works* which means a building or place used for the purpose of making or generating electricity. This use is permitted with consent in zone RU1.

The following clauses of Gunnedah LEP 2012 apply to the proposed development.

Clause 6.5 Essential services

This clause requires a consent authority to be satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required:

- (a) the supply of water,
- (b) the supply of electricity,
- (c) the disposal and management of sewage,
- (d) stormwater drainage or on-site conservation,
- (e) suitable vehicular access.

The supply of reticulated water and sewerage services is not required for the proposed development. However, portaloos for wastewater disposal (see https://www.kennards.com.au/site-equipment/showers-toilets.html) and water supply by way of a portable tank or cart (see https://www.kennards.com.au/site-equipment/showers-toilets.html) and water supply by way of a portable tank or cart (see https://www.kennards.com.au/site-equipment/showers-toilets.html) are proposed to be installed during the construction phase.


Electrical services are available to the site. Stormwater management is proposed to be addressed by controls recommended in this Statement with full details to be provided with the application for a construction certificate. An existing access off Mandobah Road is proposed to provide access to the site.

There are no draft environmental planning instruments that are on exhibition or have been exhibited but not yet published that apply to the site, or that relate to the proposed development of electricity generating works.

4.4 Development Control Plans

4.4.1 Gunnedah Development Control Plan 2012

Gunnedah DCP 2012 provides guidance for development, however, the DCP does not contain any provisions that applies to the development of a solar farm. Section 6.3 of the DCP requires that landscaping comprise low maintenance, drought and frost tolerant species. Section 6.6 applies environmental controls to all development. These are:

6.6.1 Environmental Effects

The application documentation shall identify any potential environmental impacts of the development and demonstrate how they will be mitigated. These impacts may relate to:

- Traffic
- Flood liability
- Slope
- Construction impacts
- Solid and Liquid Waste
- Air quality (odour and pollution)
- Noise emissions
- Water quality
- Sustainability

6.6.2 Erosion and Sediment Control

- Runoff shall be managed to prevent any land degradation including offsite sedimentation.
- Reference shall be made to the NSW Governments Managing urban stormwater: soils and construction Volume 1 (available from Landcom), commonly referred to as "The Blue Book".
- Cut and fill will be minimised and the site stabilised during and after construction.
- Arrangements are to be in place to prompt revegetation of earthworks to minimise erosion.



6.6.3 Conflicting Land Uses

Buffers are an important tool to reduce land use conflicts where competing or conflicting uses are proposed. People intending to develop within a rural area or within the rural/residential interface should contact Council to find out about the buffer requirements for their locality, site and the land use proposed.

Buffer zones and management options will vary according to the significance of a site, its locality, the topography of the land and its relationship to a range of other geographic and culturally relevant factors.

6.6.4 Waste Management

General waste storage and collection arrangements shall be specified.

6.6.5 Noise

Where relevant, applications are to contain information about likely noise generation and the method of mitigation.

6.6.6 Geology

The design process must give consideration to the potential impacts of erosive soils, saline soils, soils of low wet strength, highly reactive soils and steep slopes and document how these constraints are addressed.

These matters are addressed in specialist reports prepared to support the development application which are summarised in section 5. Environmental Effects of this Statement. Waste Management is addressed in section 3. Details of the proposed development above.

4.5 Land use strategies

4.5.1 New England North West Regional Plan 2036

The *New England North West Regional Plan 2036* was released in August 2017. It establishes a framework for growth over the next 20 years for the New England and North West Region. Gunnedah LGA is located in the centre of the region. Economic opportunities identified in the plan include a focus on renewable energy generation along with agriculture, horticulture, green industries and tourism.

A series of goals, directions and actions are to guide land use planning priorities and decision making. Direction 5 is to *grow New England North West as the renewable energy hub of NSW*. It is noted in the plan that the region receives 19 to 20 megajoules of solar exposure making it the



second highest solar penetration region in the state and that a strategic and integrated approach will assist to achieve the NSW Government's goal of carbon neutrality by 2050.

Action 5.2 is to facilitate appropriate smaller scale renewable energy projects using biowaste, solar, wind, hydro, geothermal or other innovative storage technologies. In the case of the proposed Gunnedah Solar Farm, ITP Development have identified the development site as being suitable in terms of existing power infrastructure to enable connection and proximity to the township of Gunnedah in order to directly generate power for use by the local community. This complies with the local government narrative for Gunnedah Shire Council to Identify and promote wind, solar and other renewable energy production opportunities.

4.5.2 Gunnedah Shire Local Strategic Planning Statement Future 2040

Gunnedah Shire Local Strategic Planning Statement Future 2040 responds to community aspirations and sets a vision and framework to guide detailed land use planning. The LSPS aims to:

- Strengthen Gunnedah Shire's productivity and competitiveness
- Nurture quality lifestyles and sustain population growth
- Value, protect and diversify Gunnedah Shire's primary production land and natural resources
- Promote regional connections to ensure a diverse industry base with a skilled and stable workforce
- Build effective responses to climate change and natural hazards
- Preserve the environment and protect the heritage, history and character of Gunnedah Shire

The LSPS is informed by the *Gunnedah Community Strategic Plan 2017 -2027* and gives effect to the *New England North West Regional Plan 2036* by implementing the goals, directions, and actions at a local level.

THE LSPS contains four themes – (1) boundless opportunity, (2) places for people, (3) connected and accessible, and (4) sustainable and resilient. The first two of these are relevant to this planning proposal. Local Planning Priorities and Actions support these themes. The proposed amendment to *Gunnedah LEP* is consistent with:

- Theme (1) boundless opportunity, Local Planning Priority 4 Develop infrastructure to support growth and change
- Theme (4) Places for People, Local Planning Priority 11 Preserve biodiversity and prepare for climate change

Actions listed against these themes and planning priorities are matters for Gunnedah Shire



Council to address over the coming 20 years. The proposed development supports these actions by facilitating diversification of the energy sector through the development of a smaller scale renewable solar project.

4.5.3 Gunnedah Shire Rural Strategy

The *Gunnedah Shire Rural Strategy* was prepared by Edge Land Planning in 2007 with two subsequent amendments in 2008 and 2015. The objectives of the strategy are to identify rural zones and management strategies for the subdivision, settlement patterns and primary production. Relevantly, the rural landscape of Gunnedah Shire is described in the strategy. This is useful in assessing the impact of the proposed development on landscape character and visual amenity.

Gunnedah Shire has 2 distinctly different landscape forms which are as follows:

- Flat open plains to the west and north with some small vegetated hills
- Steep and undulating, mostly vegetated land in the northeast, east and south

The flat open plains are characterised by a mixture of cropping and grazing whilst the hills are mostly heavily vegetated with some cleared land that is used for grazing of sheep and cattle.

The broadscale visual catchment of the Shire is limited to the east and south by the steep escarpment of the Great Dividing Range. The northeastern limit is defined by the Melville Range. The northern and western boundaries are not defined as this land is characterised by flat open plains with no defined edges.

The varying topography is the dominant visual feature of the landscape as it provides a framework for other elements such as vegetation, agriculture, viewpoints and the location of major transport and communication corridors. The topography also defines the broader visual catchment of the Shire, which is generally enclosed to the east, northeast and south by hills.

The predominant rural character of Gunnedah Shire is created by the numerous rural activities, large lot sizes, vegetation and expansive views. The landscape changes with the varying topography of the Shire – it is open and flat in the south and in the north has some hills which create different landscapes. The unique landscape character of the Shire is a visual resource as it generates tourism, development and environmental management. The visual resource also plays an important role in promoting environmental awareness and well being for residents and visitors. This varies from steep land associated with the ranges to simplicity of grazing lands and formal patterns of agricultural crops.



The retention of roadside vegetation is an issue which may require future negotiations with service providers. Controls which may be considered for retaining the rural character include:

- Planting controls for screening undesirable elements and incorporating buffers to significant environmental communities,
- Building controls for siting and advertising,
- Planning controls for lot sizes, the design and siting of residential dwellings and ancillary buildings, in relation to the visual amenity of road corridors.

It is important to recognise the visual amenity of open paddocks, post and rail fencing, distant views, heritage items and rural activities. It can be seen therefore that the preservation of the landscape character of the Shire is of importance.

The strategy contains an objective to minimise impacts on scenic landscapes by incorporating provisions into a development control plan. At the time of writing, *Gunnedah DCP 2012* does not contain provisions to protect scenic landscapes other than the requirement to utilise low maintenance drought and frost tolerant plant species when landscaping a property, implying that native species are appropriate.

4.5.4 NSW Renewable Energy Action Plan

The *NSW Renewable Energy Action Plan* supports the achievement of the national target of 20% renewable energy by 2020. It aims to position NSW to increase the use of energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW. The plan is predicated on the following three goals:

- Attract renewable energy investment and projects
- Build community support for renewable energy
- Attract and grow expertise in renewable energy technology

These goals are supported by 24 actions which include considering a more strategic and integrated approach to assessment of renewable energy projects and promoting NSW as a leader of research and innovation in renewable energy.

The plan notes that the NSW Government is in the process of streamlining the state planning system and advocates new planning legislation founded on the principle of sustainable development that meets the needs of the current generation without compromising the ability of future generations to meet their needs. Renewable energy projects are a good example of sustainable development in action. Streamlining will focus public participation on strategic planning in order to provide greater certainty for applications and the community in development assessment.



5. ENVIRONMENTAL EFFECTS

5.1 Biodiversity

5.1.1 Assessment of impacts

A biodiversity assessment has been carried out by Red-Gum Environmental Consulting Pty Ltd to determine the potential impact on any threatened species and endangered ecological communities that are present on the development site and in the vicinity of the site. The findings of the assessment are summarized below. Reference should be made to the *Biodiversity Inspection Report* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

Methodology for the biodiversity assessment involved desktop research and a site inspection. The assessment covered details of recorded sightings of threatened species including koalas and identification of vegetation communities in the vicinity of the development site. The *Biodiversity Inspection Report* provides a test of significance in accordance with requirements of the *Biodiversity Conservation Act 2016* and a Koala Assessment Report as required by *SEPP (Koala Habitat Protection) 2020*, and also satisfies requirements of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

5.1.2 Findings

The development requires less than 1 hectare clearance of native grass and zero remnant native trees. The proposed activities are unlikely to have an adverse effect on the foraging ability or the life cycle of threatened species that may be opportunistically using the site or surrounding areas.

The small amount of native grass that will be impacted by the development will not endanger or have a significant effect on any existing native vegetation, habitats within the site, or fauna species that may be using the site.

The development will not displace any rare or threatened species, however, it is likely that a number of threatened and declining bird species and koalas may be using the area to the south and along the heavily wooded road reserve along the western boundary, hence the construction activities may prove to disturb foraging activities for a short period.

The area assessed was largely exotic species and pasture grasses, with many species commonly regarded as 'highly invasive' in more natural woodland settings – like that to the west in the road reserve. While the proposed works are unlikely to introduce noxious weeds, vermin, feral species



or genetically modified organisms into an area, the movement of vehicles, plant, equipment and people on and off the development site has the potential to introduce such impacts. Wherever possible, removal of weeds should be undertaken prior to seed developing, which for most species occurs during summer months.

The typical home ranges of koalas are from 2 hectares of connected vegetation to hundreds of hectares. Koala feed almost exclusively on a few preferred tree species which are of primary and secondary importance. The occurrence of both primary and secondary tree species varies widely on a regional, local and even a seasonal basis, meaning that koalas are unevenly distributed across their range.

In the study area, primary food tree species are River red gum (*E. camaldulensis*) and Coolabah (*E. coolabah*) with secondary food tree species including Dirty (or Baradine) gum (*E. chloroclada*), Blakely's red gum (*E. blakelyi*), E. camaldulensis, Poplar or Bimble box (*E. populnea*), white box (*E. albens*), and *Callitris glaucophylla*.

Two large Coolabah (*E. coolabah*) are present in the development area but are not designated for removal. Importantly, there are numerous core vegetation areas surrounding the site which represent areas of viable Koala habitat. The site is highly unlikely to be traversed or used by the species who are much more likely to stay within the connected canopy of the roadside vegetation corridor. No vegetation will need to be removed to enable access to the site during construction and once operational.

The report concludes that the proposed development will not have a significant effect on any threatened species and ecological communities and/or their conservation.

5.1.3 Mitigation measures

By way of a clearing process that minimizes the risk to threatened species that may be opportunistically using the site, it is recommended that:

- I. Construction limits and exclusion zones clearly identified prior to work;
- II. A visual inspection is conducted by environmental staff before construction commences to identify any areas of site that might be supporting native fauna;
- III. Vehicle movements around the site will be restricted to the construction footprint and away from any existing planted trees and flagging exclusion fencing to be installed.
- IV. Soil disturbance by vehicle and pedestrian access is to be kept to a minimum outside the construction footprint.
- V. Any weeds removed (particularly those bearing seeds) are to be disposed of appropriately at the nearest waste management facility.



5.2 Natural hazards

5.2.1 Flooding

The site is not mapped as being a Flood Planning Area in *Gunnedah LEP 2012*. An analysis of flood potential is summarised in section 5.3 Water resources of this Statement.

5.2.2 Bushfire

The site is not mapped as being a bushfire buffer on the bushfire prone land map. Infrastructure comprising electricity generating works is not a habitable building and is not listed as a *special fire protection purpose* under section 100B of the *Rural Fires Act 1997*.

However, defendable space is available within the 8 metre setback between the array and the security fence. It is also proposed that a fire emergency management plan be prepared through liaison with Council, Essential Energy and the Rural Fire Service. That plan would establish procedures to respond to a fire event and other measures such as maintenance of ground fuels, access arrangements, on site fire-fighting equipment and isolation of electrical infrastructure.

5.2.3 Land contamination

The development site is not identified as contaminated land and is not listed on a register of contaminated land. The property has been cleared and farmed for many years. There has been no known historical usage that would cause the land to be contaminated. NSW Health advise that the use of farm chemicals such as pesticides and fertilisers is not considered to contaminate soils to the extent that mediation is required. It is considered that a preliminary investigation is not required for the development of a solar farm.

5.2.4 Mitigation measures

See section 5.3 Water resources for recommended mitigation measures to address flooding.

Prepare a fire emergency management plan and include that plan in the environmental management plan.

There are no mitigation measures recommended in relation to land contamination.



5.3 Water resources

5.3.1 Assessment of impacts

A *Water Assessment* of potential impacts on groundwater and surface water flows and flooding has been carried out by ITP Renewables. The findings of the assessment are summarized below. Reference should be made to the *Water Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

5.3.2 Findings

Potential adverse surface water-related impacts to the site relate to site accessibility and managing downstream sedimentation. There will be no extraction of groundwater or interference with the groundwater table and the works are not expected to contribute to any regional groundwater issues.

The flood planning area mapped in *Gunnedah LEP 2012* and 100 year ARI floodway modelling indicate that the project site is at low risk of flooding from the direction of Blackjack Creek and the Namoi River. There is some potential for minor localized inundation from minor drainage lines running from a steep hill to the west. The water will flow in a north-easterly direction towards the Mooki River.

The development has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas.

However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels.

Furthermore, as the site has been historically used for farming there is very little natural ground cover vegetation. There is the potential that site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.

5.3.3 Mitigation measures

The following mitigation measures given in Table 5 are recommended to manage downstream sedimentation.



The potential for site accessibility and the potential for inundation issues during flood events should be reviewed and procedure developed to halt construction during heavy rainfall to reduce potential impacts to the development and to increases in downstream sedimentation.

Stage	Measure	Activities/approach
Design	Site drainage	Design Basis
	and water	Undertake hydrological
	quality controls	assessment of the site's
		catchment in accordance with
		relevant methods outlined in
		Australian Rainfall and Runoff
		Determine sediment
		management targets and
		drainage control standards in
		accordance with Managing
		Urban Stormwater: Soils and
		(DECC, 2008).
		• Develop a site erosion and
		sediment control plan in
		accordance with the Blue Book.
		• Develop site drainage design
		incorporating detention basins
		and sedimentation management
		structures where relevant.
		Permanent site drainage should
		coincide with temporary
O a sector a time	Oite ducing and	arrangements where possible
construction	Site drainage	General site works:
and/or demonston	and water quality controls	Catch drains to be located downslope of any proposed road
	quality controls	works.
		Install location appropriate
		sediment fences or other
		applicable control measures
		depending on whether the
		feature is upstream or
		downstream of a disturbed part
		of the site or will need to be
		trafficable.
		• All stormwater collection points
		need to have appropriate
		need to have appropriate sedimentation and erosion
		need to have appropriate sedimentation and erosion controls.
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to control
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness.
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. Wibration gride or week how at
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. Vibration grids or wash bays at all construction evits
		 need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. Vibration grids or wash bays at all construction exits. Level spreaders at locations

Table 5: Proposed mitigation measures to manage downstream sedimentation



Stage	Measure	Activities/approach
		discharged offsite to ensure
		sheet flow like conditions are
		maintained.
		• Flat land erosion control options
		include erosion control
		blankets, gravelling, mulching,
		soil binder, turfing and
		revegetation
Construction	Stormwater	In the event of concrete works:
and/or	point source	• Do not undertake works if
Demolition	control	chance of heavy rain.
		• Store rinsate water, if
		applicable, separately to other
		water on site and dispose of
		offsite as appropriate.
		• Block on site drains in the area
		of the works and remove any
		contaminated runoff
		In the event that dewatering
		practices are required:
		• Elevate nump hase intakes for
		withdrawing water from
		exceptions to minimise
		sediment numping and direct
		hose to a containment area for
		settling prior to discharge of
		water
		Limit direct discharge off site
		Limit direct discharge on site (consistent with the design
		requirements for addiment pand
		discharge)
		Charge (1)
		• Stormwater collected on site
		should be reused where
		possible. Controls should be
		inspected and maintained on a
		regular basis. All water released
		from sediment basins should be
		venicie.
		Material and waste storage
		areas should be designed and
		operated to minimise interaction
		with surface waters.
		• Vehicle washdown areas should
		be located away from water
		courses



5.4 Air quality

5.4.1 Assessment of impacts

The Department of Planning, Industry and Environment maintain air quality monitoring stations across rural NSW. The instruments used at most rural network sites are low cost indicative particulate monitors that respond to all aerosols including smoke and fog.

Total Suspended Particles are measured at this station. Total suspended particles are solid particles and liquid droplets 100 micrometres or less in diameter. They come from natural and human-made sources, such as pollen, bushfires and motor vehicle emissions. Dust emissions are also a source of air pollution and can cause poor air quality. The pollutants measured by the Department are nitrogen dioxide, sulphur dioxide and ammonia.

Particles are also measured as PM_{10} and $PM_{2.5}$. PM_{10} are particles less than 10 micrometres in diameter. Sources include crushing or grinding operations and dust stirred up by vehicles on roads. $PM_{2.5}$ are fine particles less than 2.5 micrometres in diameter. Sources include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

Table 6 gives average hourly readings of total suspended particles, PM_{10} particles, $PM_{2.5}$ particles and the DPIE rating for the nearest monitoring station to the development site.

Monitoring station	Gunnedah	
Period	17 March 2021, 2pm-3pm	
Particles	Reading	Rating
Total suspended particles	n/a	n/a
PM ₁₀	1.7	Good
PM _{2.5}	0.2	Good

Table 6: Average hourly air quality readings

Activities that disturb the earth's surface and that are carried out with the use of machinery have the potential to generate dust emissions. This may be exacerbated by wind exposure to an exposed ground surface. The previous use of the land for farming may have involved regular tilling, sowing and harvesting that may create dust and impact on air quality. Similarly, grazing would generate dust as animals trample the ground surface. The land has been modified for agriculture with the consequent loss of most native vegetation leading to exposed soil surfaces.

The construction of the solar farm will not involve extensive earthworks. Pile driving for footings for the array framework and excavation for roads and ancillary structures will be carried out.



Along with the delivery of materials using heavy vehicles, these construction works may generate dust, however, once operational the change of use of the land from agricultural to solar photovoltaic electricity generation is expected to reduce particulate emissions and lead to an improvement in local air quality. Vehicle movements would be restricted to internal access roads and the majority of the site would be revegetated with native or pasture grasses.

5.4.2 Mitigation measures

To minimize dust generation during the construction and operational phases the following mitigation measures are proposed:

During construction:

- Limit vehicle movements to areas necessary to deliver panels, ancillary structures and equipment
- Suppress dust emissions using watering and cease works during dry and windy conditions
- Ensure ground disturbance is limited to areas necessary to place footings or to be used for access
- Ensure minimal handling of excavated materials
- Ensure stockpiles of excavated material is bunded and protected from wind and vehicle movements

During operation:

- Grade and add road base to internal accessways
- Revegetate the site with suitable endemic native groundcover immediately construction works are completed
- Ensure all plant and equipment operates in accordance with specifications

5.5 Noise

5.5.1 Assessment of impacts

A *Noise Assessment* of the impacts of noise emissions has been carried out by Muller Acoustic Consulting. The findings of the assessment are summarized below. Reference should be made to the *Noise Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.



The purpose of the *Noise Assessment* is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, recommendations are made to mitigate and manage noise. The location of noise sensitive receptors are shown in Figure 9.



Figure 9: Location of noise sensitive receivers. Source: Muller Acoustic Consulting

5.5.2 Findings

Predicted construction noise levels are expected to exceed NMLs at the nearest of nine sensitive receivers. The receiver is R1 which is the residence on the same property as the solar farm. The exceedances would be temporary and of short duration. The exceedances would be due primarily to piling and earthworks. Operational noise levels satisfy the management levels for all assessed receivers. However, recommendations to ensure noise levels are verified have been provided in this report. Additionally, the noise assessment demonstrates that road noise criteria will be satisfied at all receivers on the proposed transport route during the construction phase.



5.5.3 Mitigation measures

The following mitigation measures are recommended to address noise emissions during the construction phase:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community,
- where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (e.g. unloading and laydown areas),
- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations,
- selection of the quietest suitable machinery available for each activity,
- avoidance of noisy plant/machinery working simultaneously where practicable,
- minimise impact noise wherever possible,
- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm,
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities,
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site, and
- utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

It is recommended that noise emissions from the solar farm be minimised when operational. To assist in noise management, it is recommended that a one-off noise validation monitoring assessment be completed to quantify emissions from the site and to confirm that relevant criteria are satisfied.

5.6 Traffic and access

5.6.1 Assessment of impacts

A *Traffic Assessment Report* of the impacts on traffic and the adequacy of access arrangements has been carried out by Triaxial Consulting. The findings of the assessment are summarized below. Reference should be made to the *Traffic Assessment Report* that is submitted with the



development application for further information or clarification of any matter concerning the assessment and recommendations.

The traffic assessment includes a description of the existing road network and considers expected traffic generation during site construction and operation. Site access arrangements and intersection capacity are also considered.

5.6.2 Findings

During the three month construction period 45 heavy vehicles will access the site with an expected daily maximum of 4 trucks. Access to the site for heavy vehicles will be limited to between 10.00am and 2.00pm. The greatest interaction with traffic external to the site will be during the peak afternoon period, estimated to be between 4.00pm and 5.00pm, as construction workers leave the site. The morning peak period with traffic heading to the site will not generate as many interactions due to the expected peak arrival time of 6.00am to 7.00am by the workers.

The proposed access entry to the development site which is to be located at the north-western corner of the property off Wandobah Road has in excess of 250 metres sight distance in each direction which satisfies the requirements of Austroads Guide to Road Design and Gunnedah Shire Council's specifications.

5.6.3 Mitigation measures

It is recommended that the site entry location be constructed in accordance with Triaxial plan TX15008.00-SK01. The proposed site entrance has been designed to accommodate the turning path of a B-Double truck with a sealed entrance a minimum of 26 metres into the site to minimise disruption to Wandobah Road and ensure that a B-Double is able to que off the road if required to when accessing the site.

5.7 The community and economy

5.7.1 Population and accommodation

The population of Gunnedah state suburb in 2016, as defined by the Australian Bureau of Statistics and which includes the development site, the town of Gunnedah and rural land surrounding the settlement, was 9,726 persons. The total population of Gunnedah local government area in 2016 was 12,215 persons. The median age of people in Gunnedah state suburb in 2016 was 38 years compared to 40 for the LGA.



Unemployment at the time of the 2016 Census of Population and Housing was 5.6% of the labour force comprising persons aged 15 years and over in Gunnedah state suburb. The labour force participation rate in 2016 was 45.6%. The top three occupations were machinery operators and drivers, technicians and trade workers, and professionals. The top three industries of employment were coal mining, supermarket and grocery stores, and takeaway food services.

Occupied private dwellings accounted for 90.1% of dwellings in Gunnedah state suburb and 9.9% or 399 dwellings were unoccupied. 87.6% of dwellings were separate houses and the remainder were medium density dwellings.

There are 13 establishments offering accommodation for visitors to Gunnedah and the surrounding district listed on the NSW Government's VisitNSW website. These include holiday parks, motor inns, bed and breakfasts, serviced apartments and hotels. In addition to these establishments there are 399 unoccupied private dwellings some of which may be available as short term rentals, and unregulated accommodation places such as AirBnB and Stayz.

Sector	Characteristic	Gunnedah (state suburb)	Gunnedah LGA	NSW
Population	Total persons	9,726	12,215	7,480,228
ropulation	Median age	38	40	38
Feeloweet	Labour force participation rate	45.6%	46.6%	48.2%
Employment	Unemployment rate	5.6%	5.5%	6.3%
	Occupied private dwellings	90.1%	88.4%	90.1%
	Unoccupied private dwellings	9.9%	11.6%	9.9%
	Total private dwellings	4,298	5490	2,889,061
Housing	Average occupancy rate	2.4	2.5	2.6
	Median monthly mortgate repayment	\$1,517	\$1,473	\$1,986
	Median weekly rent	\$250	\$240	\$380
	Proportion separate houses	87.6%	89.7%	66.4%

Table 7: Key demographic statistics. Source: ABS Census of Population and Housing 2016

5.7.2 Agriculture and land capability

Gunnedah is located in the New England and North West region of NSW. According to the Commonwealth Department of Agriculture the gross value of agricultural production in the region in 2018-2019 was \$1.8 billion, which was 15 per cent of the total gross value of agricultural production in New South Wales of \$11.7 billion. Agricultural land in the region occupies 79,400 square kilometres, or 80 per cent of the region. The most common land use by area is grazing modified pastures, which occupies 39,200 square kilometres or 40 per cent of the New England and North West region (<u>https://www.agriculture.gov.au/abares/research-topics/aboutmyregion/nsw-new-england#regional-overview</u>).



The region has a diverse agricultural sector. The most important commodities in the region based on the gross value of agricultural production were cattle and calves (\$611 million), followed by cotton (\$390 million) and wool (\$115 million). These commodities together contributed 64 per cent of the total value of agricultural production in the region. ABS data indicates that in 2018–2019 there were 4,023 farms in the New England and North West region. Beef cattle farms (1,736 farms) were the most common, accounting for 43 per cent of all farms in the region, and of beef cattle farms New South Wales 25 per cent all in (https://www.agriculture.gov.au/abares/research-topics/aboutmyregion/nsw-newengland#agricultural-sector).

DPI Agriculture uses the land and soil capability mapping scheme as the preferred methodology for the classification of agricultural land. Eight classes of rural land are mapped plus flood irrigation, and mining and quarrying land. Figure 11 below shows land capability mapping for the development site and surrounding land. The development site has a land capability of classes 4 and 5. The development footprint at the northern half of the site has a land capability of class 5. Class 5 is moderate–low capability land. This land has high limitations for high-impact land uses and is largely restricted to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation (*The land and soil capability assessment scheme – A general rural land evaluation scheme for* NSW, 2^{nd} Approximation, OEH).



Figure 11: Land capability mapping. Source: OEH 2021



5.7.3 Potential socio-economic impacts

The benefit to the community of the solar farm will be through an understanding of sustainable development and by gaining a commitment to greater reliance on renewable energy. Similarly, the clustering of solar power generation would bring regional economic development benefits to the New England and North West region as the area gains a reputation as a suitable location for renewable energy and linked industries.

It is anticipated that there will be 50 personnel directly involved in construction on site which is expected to take approximately three months. Varying levels of expertise will be required ranging from labourers to qualified electricians and project managers. In addition, personnel would be involved in transport and delivery of materials to the site. Some of this employment is to be sourced locally. Once operational the site will be unmanned, however, two to three personnel will be necessary to carry out maintenance every quarter or as required. The skills required to be involved in the construction and ongoing maintenance of the solar farm may require some personnel to undergo further training and education, leading to an upskilling of the local workforce and enhanced employment opportunities generally.

Employment and education will bring direct economic benefits to the local economy through wages and salaries and indirect benefits through the need for accommodation and sustenance in the area for non-local employees. Restaurants, cafes, bakeries, supermarkets, pubs, newsagents would all benefit from the additional custom this will bring.

During the initial planning phase ITP (Development) Pty Ltd commissioned local professionals to carry out the land survey of the development site. This initial expenditure generates flow on effects throughout the local economy through income and employment. If necessary, sites officers employed by the Local Aboriginal Land Council will be engaged to carry out a cultural survey prior to commencement of works to identify any Indigenous items or places present on the development site.

It is considered that there is adequate accommodation available to cater to the 50 construction workers given the number of visitor accommodation establishments in the area plus short term rentals and unregulated accommodation providers. It is understood that approximately. There is likely to be negligible effects on the availability of affordable rental over the short construction period as it is not expected that landlords would evict long-term tenants in preference of short term workers. Workers coming to the area would be likely to take up tourist accommodation similar to mine workers across country NSW, however, construction may be limited to the off-peak tourist season if necessary.



The loss of agricultural land due to the development of the solar farm would be minimal – less than a quarter of the entire property and a fraction of agricultural land in the region. The loss of agricultural land would be offset by the contribution that the solar farm will make to the local economy through direct and indirect employment and expenditure over the short term and through the benefits that renewable energy power supply will bring to the region. The landowner may also choose to continue to graze livestock within and around the array, activities that do not require consent, and the additional lease income may be put to improvements elsewhere on the property.

If necessary and practical in terms of security, the land surrounding panel arrays can continue to be used for farming purposes such as the cultivation of vegetables or flowers, or potentially livestock grazing during the operation of the solar farm. The arrays of panels can be removed once the facility is decommissioned and the land can be returned to agricultural use.

It is considered that the impact in terms of loss of productive agricultural land should be seen in the context of the impacts on farmland of other forms of power generation, for example, fracking for coal seam gas, and mining for coal and uranium as well as the infrastructure to support the processing of coal and gas. The loss of agricultural land would be offset by the contribution that the solar farm will make to the local economy through direct and indirect employment and expenditure over the short term and through the benefits that renewable energy power supply will bring to the region.

In summary:

- The solar farm will generate community economic benefits through local employment opportunities during the planning and construction phases as well as limited maintenance and inspection jobs once operational. The development of a solar farm will create a new market for local contractors and expand diversity of income for the land holder
- The loss of productive agricultural land is minimal and temporary. The array of panels can be removed once the facility is decommissioned and the land can be fully returned to agricultural use
- If necessary and practical in terms of security, the land can continue to be used for farming purposes such as the cultivation of vegetables or flowers, or the grazing of sheep during the operation of the solar farm





Plate 2: Sheep grazing amongst a PV array. Source: Sydney Morning Herald 17 February 2021

5.7.6 Mitigation measures

It is recommended that labour to construct the solar farm and for ongoing maintenance be sourced from within Gunnedah LGA wherever possible. Where labour needs to be brought into the area, it is considered that there would be sufficient accommodation options for employees in the LGA for the estimated 50 workers engaged during the three month construction phase.

It is recommended that advertising be placed in local media and to approach local businesses to determine whether there is the capacity and expertise available in Gunnedah and surrounding districts to participate in the construction and ongoing maintenance activities.

5.8 Heritage

5.8.1 Indigenous heritage

The generic due diligence process outlined in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* was implemented to ensure that an adequate due diligence process that addresses Aboriginal cultural heritage issues has been carried out. This process follows the following five steps:



1. Will the activity disturb the ground surface?

Earthworks will involve trenching which is required for cabling of each PV array/module to inverters and a substation. Other earthworks would be pile-driving to support module frames, and to enable the placement of concrete slabs and gravel accessways. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

2a. Search the AHIMS database

In accordance with the code, an on-line search was carried out of the *Aboriginal Heritage Information Management Service (AHIMS)* that is maintained by Heritage NSW. The search is part of the due diligence process and remains valid for 12 months.

A search of Lot 48 DP 755474 with a buffer of 50 metres was performed on 17 March 2021. The search results are:

- There are no Aboriginal sites recorded in or near the selected location, and
- There are no Aboriginal places that have been declared in or near the selected location.

It is noted that surveys for Aboriginal objects have not been carried out in all parts of NSW and Aboriginal objects may exist on a parcel of land even though they have not been recorded in *AHIMS*. Further, not all known Aboriginal sites are registered on the *AHIMS* database and not all sites consist of physical evidence or remains, e.g. dreaming and ceremonial sites.

2b. Activities in areas where landscape features indicate the presence of Aboriginal objects

The development area does not possess landscape features that indicate the presence of Aboriginal objects.

3. Can you avoid harm to the object or disturbance of the landscape features

Not applicable as the development area has been disturbed and farmed, does not possess significant landscape features and no known Aboriginal objects are listed in *AHIMS*.

4. Desktop assessment and visual inspection

The desktop assessment found that no known Aboriginal objects are listed in *AHIMS*. A site inspection was made in September 2020 and there was no obvious evidence of any artefacts or items of cultural significance on the surface of the land.



5. Further investigations and impact assessment

An extensive search of *AHIMS* records, is not necessary given that there are no Aboriginal sites or places that have been recorded on the development site.

The property lies within the area managed by Red Chief Local Aboriginal Lands Council. The LALC has been advised of the plans to develop the solar farm by email. As not all culturally significant items or places are made public and listed on AHIMS, a request was forwarded to the LALC enquiring as to whether the organization has any knowledge of Indigenous items or places of significance on the property and whether a sites officer should conduct a site survey prior to commencement of works. Red Chief LALC advised that a site survey is required to be conducted prior to commencement of works.

It is acknowledged that a condition of consent may be imposed to require a site survey to be carried out by an LALC sites officer either before any work commences or prior to the issue of a construction certificate. Council may also recommend a condition of consent to comply with provisions of the *National Parks and Wildlife Act 1974* should any evidence of Aboriginal occupation be found during site works. An *Aboriginal Heritage Impact Permit* may be required to be obtained if indigenous heritage objects are found during ground disturbance.

5.8.2 Non-indigenous heritage

The development site is not listed as a heritage item in Schedule 5 Environmental heritage of *Gunnedah LEP 2012*. The closest listed items to the site are I024 Trelawny located at 1352 Wandobah Road, a distance of almost 6 kilometres to the south west from the development area and the edge of the heritage listed property. This property is listed as being of local heritage significance. There is no visual or physical connection between the development site and the item. It is considered that a heritage management document is not required.

5.8.3 Mitigation measures

Council may recommend that a condition of consent be imposed to require a site survey be carried out by an LALC sites officer either before any work commences or prior to the issue of a construction certificate. Council may also recommend a condition of consent to comply with provisions of the *National Parks and Wildlife Act 1974* should any evidence of Aboriginal occupation be found during site works. An *Aboriginal Heritage Impact Permit* may be required to be obtained if indigenous heritage objects are found during ground disturbance.

There are no recommendations in relation to non-Indigenous heritage.



5.9 Glare and glint

5.9.1 Assessment of impacts

A *Glint and Glare Assessment* has been carried out using the Solar Glare Hazard Analysis Tool by ITP Renewables. The findings of the assessment are summarized below. Reference should be made to the *Glint and Glare Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The assessment is based on identifying the potential sensitive receptors in close proximity to the development site having regard to the elevation of the site relative to surrounding land and structures or vegetation that would act as visual barriers. Potential glare and glint impacts are assessed and if necessary mitigation measure are recommended to reduce potential impacts to an acceptable level.

5.9.2 Findings

As a result 25 residential premises and five road routes were identified as potential visual receptors. The results of the analysis indicate that persons occupying the selected properties are unlikely to be affected as a result of the proposed solar farm. Many residences will also not have direct view of the solar farm due to visual obstruction from trees and other structures.

Existing roadside vegetation and the proposed landscape screening around the array are expected to provide a physical obstruction between the solar farm and motorists using Mandobah Road. Motorists using along other local roads in the vicinity of the site are also not likely to be affected.

5.9.2 Mitigation measures

No mitigation measures are necessary in relation to glare and glint.

5.10 Landscape character and visual amenity

5.10.1 Assessment of impacts

Impacts on landscape character and visual amenity of the proposed solar farm have been assessed by Zenith Town Planning Pty Ltd using the RMS guideline *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment*



(EIA-N04 Version 2-0 released on 14 December 2018). The findings of the assessment are summarized below. Reference should be made to the *Landscape Character and Visual Amenity Impact Assessment* that is submitted with the development application for further information or clarification of any matter concerning the assessment and recommendations.

The assessment estimates the likely impacts on landscape character and viewpoints based on the sensitivity to physical change and the magnitude, or relative size and scale, of the works and then applies an impact ranking. The methodology included a site inspection of the location of the proposed works and the surrounding area to identify observation points and the visual catchment, land uses and characteristics of the surrounding area. The greater the distance from the development site the less clear is the view of the solar farm. The ability to distinguish the type of land use and the actual composition of materials diminishes with distance. Planning principles established by the NSW Land and Environment Court were also considered as a check on the findings of the landscape character and visual assessment. The observation points located within the visual catchment of the site of the proposed solar farm are shown in Figure 12 below.



Figure 12: Observation points in the visual catchment. Source: SIX Maps

5.10.2 Findings

The character of the landscape near the site of the Gunnedah Solar Farm is a modified agricultural landscape with expansive views across farmland. The landscape in the immediate vicinity of the development site is generally flat and cleared of most vegetation although some remnant/regrowth vegetation remains along road reserves and property boundaries. It is surrounded by low vegetated hills to the west, south, east and north-east. Structures within the



vicinity of the site comprise rural farm buildings and large lot residential development. A quarry is located on the western side of Wandobah Road but it is not known whether this is operating at the time of writing.

The overall impact on landscape character is assessed to be moderate-high for both private property and the public domain. However, distance, the presence of native vegetation and topography temper influence on landscape character from most surrounding land. It is acknowledged that the landscape is scenic and warrants protection. However, it is also a primary production landscape and appropriate uses are permissible in the zone. The presence of the solar farm in the landscape can be reversed without permanent impact. The land will return to its current appearance after the solar farm is decommissioned in approximately 35 years time. The process of decommissioning will see the removal of all panels, supporting frames, ancillary items such as the inverter stations and fencing.

The presence of a solar farm in the rural landscape will eventually be accepted without question as the need for alternative sources of energy becomes greater and apparent. Over time, solar farms will become a common component of rural landscapes as they are less intrusive than all other forms of electricity generation and the visual impact can be managed through appropriate screening.

The visual impact of the proposed works is assessed to range from low to moderate for the residential observation points identified in this assessment. The impact is assessed to be moderate for the clusters of rural lifestyle dwellings located north of the site due to sensitivity associated with the perceived conflict between expectations of views being retained and permitted uses on rural land. The proposed landscaping along the northern and southern edges of the array will provide effective screening to neighbouring observation points. Elevated observation points to the east and north-east are likely to have unimpeded views across the site which cannot be mitigated by landscape screening. Distance separation would mean that the facility would be a relatively small component of the total view from elevated observation points to the east and north-east and north-east. Elsewhere there would be nil visual connection with the facility.

Impacts are assessed to be high for motorists using Wandobah Road due to the flat topography and lack of roadside vegetation. Landscape screening along the eastern boundary of the array will provide effective screen once mature. Visibility from Booloocooroo Road will be unimpeded where there is no roadside vegetation and screening is unlikely to mitigate views due to the elevation above the development site. The impact on users of this road is assessed to be moderate.



The findings of the assessment acknowledge that there will be impacts on the landscape and visual amenity as there are with any type of development. However, there is no view loss; the impact is a change to the view – a new element within the landscape. Impacts are greatest in close proximity to the solar farm as the further the distance a viewpoint is from the site the less the overall visual impact as the development occupies a lesser proportion of the total view.

On balance and having regard to other matters for consideration under section 4.15 Evaluation of the Environmental Planning and Assessment Act 1979, the impacts are considered acceptable given that:

- the solar farm will contribute to renewable energy generation and provide a source of electricity for local domestic and commercial use whilst at the same time assisting to reduce greenhouse gas emissions and our reliance on fossil fuels,
- It will also generate employment opportunities during the construction phase and once operational will provide employment for maintenance crews,
- The placement of the array within the property downslope has been chosen to maximise distance separation from neighbouring dwellings,
- Existing vegetation along road reserves and property boundaries is to be maintained,
- The proposed landscaping will grow to a height that will screen the facility from observation points including public roads that are on level ground with the development site and elsewhere will soften the visual impact from land that is slightly elevated above the development site.

5.10.3 Mitigation measures

To mitigate impacts on the landscape and visual amenity, it is recommended that the vegetation screen to be planted around the northern, western and southern sides of the array comprise native plants endemic to the Gunnedah district that grow to a maximum height of 2.5 to 3 metres. It is recommended that Gunnedah Shire Council be consulted to determine appropriate plant species.



6. CONCLUSION

6.1 Findings

The site is considered suitable for the proposed development of the Gunnedah Solar Farm. A connection is available to connect to the Essential Energy Gunnedah zone substation to transfer power generated by the solar panels to the township and on to the grid.

The development area is relatively flat, is free of constraints and is accessible to large delivery vehicles during the construction phase and utility vehicles for ongoing maintenance.

The likely impacts of the development have been considered in this Statement and supporting documents. Considerations include impacts on biodiversity, natural hazards, visual and scenic amenity, glare and glint, traffic, noise, air quality, water resources, indigenous and non-indigenous heritage, the community and the local economy. Any impacts on these interests have been found to be acceptable and mitigation measures have been recommended where necessary.

According to the Australian Radiation Protection and Nuclear Safety Agency, which maintains continual oversight of emerging research into the potential health effects of the EMF exposure, there is no established evidence of health effects from exposure to electric and magnetic fields from powerlines, substations, transformers or other electrical sources, regardless of the proximity, causes any health effects. The location of the solar farm and the distance separation between nearby dwellings and the site mean that any potential impacts on health are mitigated.

The solar farm is designed to generate in excess of 12.71GWh of energy annually which will offset almost 8.5 thousand tonnes of CO² equivalent emissions (Sources: *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Schedule 1)* and Department of the Environment and Energy) and providing enough energy to power about 2,150 NSW homes.

Electricity generated by the system will be directed to the settlement via existing electrical infrastructure to contribute to the supply of electricity for use by households and businesses in the town centre. Any surplus electricity will be sent to the grid and any deficit will be drawn from the grid. As well as the potential to utilize local contractors to construct the facility, the township will benefit through the ability to provide clean energy that is generated adjacent the settlement.

The cumulative impacts of the proposed development are minor. There are other electricity generating works in the Gunnedah area that are either being assessed or have been approved. These are a 5MW solar farm located at 262 Hunts Road 3.5km north-west of the subject development site that is under assessment and a 29.5MW solar farm at 131 Quia Road



approximately 7km north of the subject site that has been approved. These facilities are some distance from the proposed Gunnedah Solar Farm and therefore would not lead to adverse cumulative effects in terms of visual impact or emissions. There is sufficient capacity in the electricity grid system to accommodate the Gunnedah Solar Farm as evidenced by prior arrangements to connect to Essential Energy infrastructure.

The proposed development is consistent with the strategic planning framework that applies to the local government area, the site itself and to the development of electricity generating works. The solar farm is permissible with consent under provisions of *SEPP (Infrastructure) 2007* which prevails over provisions of the local environmental plan and is satisfactory to other applicable SEPPs. The use is suited to a rural location due to the need for a large land area as evidenced by permissibility under SEPP (Infrastructure) 2007. The addition of another solar farm to the rural area of Gunnedah would not detract unreasonably from local amenity or the natural environment.

The proposed rural location implements the planning priorities, goals and actions of the *New England North West Regional Plan 2036*, the *Gunnedah Local Strategic Planning Statement Future* 2040 and the *NSW Renewable Energy Action Plan*. These objectives seek to capitalize on solar energy resources to increase the provision of renewable energy using rural land in locations that will not cause land use conflict.

The development of the solar farm will assist the transition of our economy from reliance on fossil fuels to renewable sources. It will assist Commonwealth and NSW Governments to achieve targets and objectives relating to emissions and addressing climate change.

Given these local, regional and national benefits of renewable energy generation and based on implementation of the recommended mitigation measures to avoid, minimize or mitigate impacts to the existing natural and built environment, the development is considered to be in the public interest.

6.2 Summary of mitigation measures

Table 8 provides a summary of mitigation measures. It is recommended that an environmental management plan be prepared to cover the construction and operational phases.

Where necessary Table 8 includes a recommendation as to whether the mitigation measure should be included in the management plan.

In addition to the mitigation measures detailed below, it is recommended that a waste management plan be prepared for inclusion in an environmental management plan.



Table 8: Summary of mitigation measures

Consideration	Mitigation measures	Environmental
		Management Plan
Biodiversity	 By way of a clearing process that minimizes the risk to threatened species that may be opportunistically using the site, it is recommended that: I. Construction limits and exclusion zones clearly identified prior to work; II. A visual inspection is conducted by environmental staff before construction commences to identify any areas of site that might be supporting native fauna; III. Vehicle movements around the site will be restricted to the construction footprint and away from any existing planted trees and flagging exclusion fencing to be installed. IV. Soil disturbance by vehicle and pedestrian access is to be kept to a minimum outside the construction footprint. V. Any weeds removed (particularly those bearing seeds) are to be disposed of appropriately at the 	Yes, with reference to ongoing site access during both construction and operational phases, and to the storage of materials within the site
	nearest waste management facility.	
NT / 11 1		X. C
Natural hazards	Prepare a fire emergency management plan and include that plan in the environmental management plan	Yes, for construction and operational phases
Water resources	 Design - site drainage and water quality controls: Undertake hydrological assessment of the sites catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). Develop a site erosion and sediment control plan in accordance with the Blue Book. Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. Permanent site drainage should coincide with temporary arrangements where possible 	Yes, for construction and operational phases. Include an erosion & sediment control plan or soil and water management plan
	 Construction and/or demolition - site drainage and water quality controls: Catch drains to be located downslope of any proposed road works. Install location appropriate sediment fences or other applicable control measures depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable. All stormwater collection points need to have appropriate sedimentation and erosion controls. 	



	 Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. Vibration grids or wash bays at all construction exits. Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow like conditions are maintained. Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation 	
	source control:	
	In the event of concrete works:	
	• Do not undertake works if chance of heavy rain.	
	• Store rinsate5 water, if applicable, separately to	
	other water on site and dispose of offsite as	
	 Block on site drains in the area of the works and 	
	remove any contaminated runoff.	
	In the event that dewatering practices are required:	
	Pump hose intakes for withdrawing water from	
	excavations will be elevated to minimise sediment	
	settling prior to discharge	
	 Limit direct discharge off site (consistent with the 	
	design requirements for sediment pond discharge).	
	• Stormwater collected on site should be reused	
	where possible. Controls should be inspected and	
	maintained on a regular basis. All water released	
	from sediment basins should be clear or disposed	
	• Material and waste storage areas should be	
	designed and operated to minimise interaction with	
	surface waters.	
	• Vehicle washdown areas should be located away	
	from water courses	
Air quality	During construction:	Yes, for construction
	Limit vehicle movements to areas necessary to	and operational
	equipment	phases
	 Suppress dust emissions using watering and 	
	cease works during dry and windy conditions	
	• Ensure ground disturbance is limited to areas	
	necessary to place footings or to be used for	
	access	
	Ensure minimal handling of excavated materials	
	Ensure stockpiles of excavated material is	
	movements	
	During operation:	
	• Grade and add road base to internal accessways	



	• Pewegetate the site with suitable groundcover	
	• Revegetate the site with suitable groundcover	
	Ensure all plant and equipment operates in	
	accordance with specifications	
Noise	The following mitigation measures are recommended to	Ves for construction
110100	address poise emissions during the construction phase:	and operational phases
	• a construction noise management protocol to	
	minimise noise emissions manage out of hours	
	(minor) works to be inaudible and to respond to	
	notential concerns from the community	
	• where possible use localised mobile screeps or	
	construction hoarding around plant to act as	
	barriers between construction works and	
	receivers, particularly where equipment is near the	
	site boundary and/or a residential receiver	
	including areas in constant or regular use (e.g.	
	unloading and laydown areas),	
	• operating plant in a conservative manner (no over-	
	revving), shutdown when not in use, and be	
	parked/started at farthest point from relevant	
	assessment locations,	
	• selection of the quietest suitable machinery	
	available for each activity,	
	• avoidance of noisy plant/machinery working	
	simultaneously where practicable,	
	• minimise impact noise wherever possible,	
	• utilise a broadband reverse alarm in lieu of the	
	traditional high frequency type reverse alarm,	
	• provide toolbox meetings, training and education	
	to drivers and contractors visiting the site during	
	construction so they are aware of the location of	
	noise sensitive receivers and to be cognisant of any	
	noise generating activities,	
	• signage is to be placed at the front entrance	
	advising truck drivers of their requirement to	
	minimise noise both on and off-site, and	
	• utilise project related community consultation	
	forums to notify residences within close proximity	
	of the site with project progress,	
	proposed/upcoming potentially noise generating	
	works, its duration and nature and complaint	
	procedure.	
	It is recommended that the noise emissions from the	
	solar farm be minimised when operational. To assist in	
	noise management, it is recommended that a one-off	
	noise validation monitoring assessment be completed to	
	quantity emissions from site and to confirm emissions	
Traffic	It is recommended that the site entry location be	Yes, with reference to
	constructed in accordance with Triaxial plan	site access during the
	TX15008.00-SK01. The proposed site entrance has been	construction phase
	designed to accommodate the turning path of a B-Double	
	truck with a sealed entrance a minimum of 26 metres into	
	the site to minimise disruption to Wandobah Road and	



	ensure that a B-Double is able to que off the road if required to when accessing the site	
The community & local economy	 labour to construct and maintain the solar farm be sourced from within the local government area wherever possible advertising be placed in local media and local businesses contacted to determine whether there is the capacity and expertise available to participate in the construction and ongoing maintenance activities 	n/a
Heritage	Council may recommend that a condition of consent be imposed to require a site survey be carried out by an LALC sites officer either before any work commences or prior to the issue of a construction certificate. Council may also recommend a condition of consent to comply with provisions of the <i>National Parks and Wildlife</i> <i>Act 1974</i> should any evidence of Aboriginal occupation be found during site works. An <i>Aboriginal Heritage Impact</i> <i>Permit</i> may be required to be obtained if indigenous heritage objects are found during ground disturbance. There are no recommendations in relation to non- Indigenous heritage.	n/a
Landscape character & visual amenity	It is recommended that the vegetation screen to be planted around the northern, western and southern sides of the array comprise native plants endemic to the Gunnedah district that grow to a maximum height of 2.5 to 3 metres. It is recommended that Gunnedah Shire Council be consulted to determine appropriate plant species.	n/a
Glare and glint	No mitigation measures are proposed.	n/a



AHIMS Web Services (AWS) Search Result



Purchase Order/Reference : 1920

Client Service ID : 576970

Date: 17 March 2021

Zenith Town Planning P O Box 591 Moruya New South Wales 2537 Attention: Allen Grimwood Email: zenithplan@bigpond.com

Dear Sir or Madam:

<u>AHIMS Web Service search for the following area at Lot : 48, DP:DP755474 with a Buffer of 50 meters,</u> <u>conducted by Allen Grimwood on 17 March 2021.</u>

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0 Aboriginal sites are recorded in or near the above location.
0 Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

GUNNEDAH 2A 5MW SOLAR FARM

DEVELOPMENT APPLICATION

ADDRESS: WANDOBAH ROAD GUNNEDAH NSW 2380



DEVELOPED BY:



info@itpau.com.au

+61 (0) 2 6257 3511 Level 1, 19-23 Moore St Turner, ACT 2612 itpau.com.au

IT Power (Australia) Pty Ltd | ABN 42 107 351 673 | Part of The ITPEnergised Group

Sheet List Table

SHEET NUMBER	SHEET TITLE
G - 0100	TITLE
G - 0400	LOCATION PLAN
G-2100	GENERAL ARRANGEMENT PLAN
G-2200	SITE ELEVATIONS
C-4300	INVERTER FOOTING DETAILS
C-5300	FENCING DETAILS
C-5301	GATE DETAILS
C-6300	ACCESS PATH DETAILS
E-3400	NEXTRACKER ARRAY DETAILS
E-4300	INVERTER STATION DETAIL


NO.	STAGE	DATE	NOTES	PARTNERS		DRAWN MJB	DRAWING	LOCATION PLAN		
1	DEVELOPMENT APPLICATION	02/03/2021			l itn N	APPROVED SD				
2					icp /	DO NOT SCALE.	PROJECT	GUNNEDAH 2A 5MW SOLAR FARM	SCALE AS NC	IOTED
3						ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED	CLIENT		SHEET SIZE A3	
4					RENEWABLES	THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE	ADDRESS	WANDOBAH ROAD	ORIG DATE 7/1/21	1
5					P: +61 2 6257 3511 PO POY 6217	WHO HAVE RECEIVED EXPRESS PERMISSION FROM TP. THE USE OF		GUNNEDAH, NSW 2380	REV. DATE 23/2/2	21
6					info@itp.com.au O'CONNOR, ACT 2602 www.itpau.com.au AUSTRALIA	THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.	DRAWING NO		REV NO.	



(1)	GENERAL ARRANGEMENT PLAN
- /	SCALE: 1:5000

RAWN MJB PARTNERS STAGE DATE CHECKED EM 1. CCTV SECURITY SYSTEM WILL BE USED, AND SECURITY CAMERAS WILL BE INSTALLED AROUND THE SITE. ISSUED FOR INFORMATION 24/07/2020 PPROVED SD DEVELOPMENT APPLICATION 02/03/2021 DO NOT SCALE. ALL MEASUREMENTS IN MM UNLES: OTHERWISE STATED. THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR TH WHO HAVE RECEIVED EXPRESS RENEWABLES ----------------ERMISSION FROM ITP. THE USE P: +61 2 6257 3511 info@itp.com.au www.itpau.com.au PO BOX 6217 O'CONNOR, ACT 2602 AUSTRALIA ---------WAS OR GINALLY PREF

SITE INFORMATION

LOT / DP	48/755474
ADDRESS	WANDOBAH ROAD, GUNNEDAH, NSW 2380
LGA	GUNNEDAH SHIRE COUNCIL
LAT / LONG	-31.040244, 150.219391
LOT AREA	49.76 ha
FENCED AREA	12.30 ha
DNSP	ESSENTIAL ENERGY

PROJECT INFORMATION

AC CAPACITY	5.0 MW
INVERTERS	2 x 3.4 MW AC
TRACKER SPACING (N-S)	4.0 - 7.0 m
ARRAY PITCH	6.25 m
CONNECTION VOLTAGE	22 kV
CONNECTION FEEDER	ESSENTIAL ENERGY GDH8B6
CONNECTION SUBSTATION	ESSENTIAL ENERGY GUNNEDAH ZONE SUBSTATION
SECURITY FENCE SETBACK	MIN. 3 m FROM OPTION BOUNDARY
ARRAY SETBACK	MIN. 8 m FROM SECURITY FENCE
ACCESS PATH WIDTH	4 m

DEVELOPMENT APPLICATION

RAWING	GENERAL ARRANGEMENT PLAN		
ROJECT	GUNNEDAH 2A 5MW SOLAR FARM	SCALE	AS NOTED
LIENT		SHEET SIZE	A3
DDRESS	WANDOBAH ROAD	ORIG. DATE	3/11/20
	GUNNEDAH, NSW 2380	REV. DATE	1/3/21
RAWING NO.	A5000 GND2A-G-2100	REV NO.	2





g:\itp solar farm development\a5000 engineering team\6 site-specific work\gnd2a gunnedah 2a\4 system design\4.01 cad\DWG\C-4300 INVERTER FOOTING DETAIL.dwg, PLOTTED BY MATTHEW BARRETT AT 2/3/2021 4:05 PM



g:\itp solar farm development\a5000 engineering team\6 site-specific work\gnd2a gunnedah 2a\4 system design\4.01 cad\DWG\C-5300 FENCING DETAILS.dwg, PLOTTED BY MATTHEW BARRETT AT 2/3/2021 4:05 PM



DEVELOPMENT APPLICATION

RAWING GATE DETAILS

RAWING NO.	A5000 GND2A-C-5301	REV NO.	1
	WANDOBAH ROAD GUNNEDAH, NSW 2380	REV. DATE	22/1/21
DDRESS		ORIG. DATE	23/11/18
LIENT		SHEET SIZE	A3
ROJECT	GUNNEDAH 2A 5MW SOLAR FARM	SCALE	AS NOTED





NO.	STAGE	DATE	NOTES	PARTNERS		DRAWN MJB	DRAWING	ACCESS PATH DETAILS	
1	DEVELOPMENT APPLICATION	02/03/2021			itn 🔪	APPROVED SD			
2						DO NOT SCALE.	PROJECT	GUNNEDAH 2A 5MW SOLAR FARM	SCALE AS NOTED
3						ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.	CLIENT		SHEET SIZE A3
4					RENEWARI ES	THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE	ADDRESS	WANDOBAH ROAD	ORIG. DATE 5/9/18
5					P: +81 2 6257 3511 PO DOX 5247	WHO HAVE RECEIVED EXPRESS PERMISSION FROM TP. THE USE OF		GUNNEDAH, NSW 2380	REV. DATE 4/2/21
6			4		info@itp.com.au O'CONNOR, ACT 2602 www.itpau.com.au AUSTRALIA	THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.	DRAWING NO	A5000 GND2A-C-6300	REV NO. 1

DEVELOPMENT APPLICATION



g:\itp solar farm development\a5000 engineering team\6 site-specific work\gnd2a gunnedah 2a\4 system design\4.01 cad\DWG\E-3400 NEXTRACKER DETAILS.dwg, PLOTTED BY MATTHEW BARRETT AT 2/3/2021 4:06 PM





G:\itp solar farm development\a5000 engineering team\6 site-specific work\gnd2a gunnedah 2a\4 system design\4.01 cad\DWG\C-7300 LANDSCAPE DETAILS.dwg, Plotted By Matthew Barrett at 12/03/2021 2:42:06 PM



Gunnedah 2A Solar Project

Project estimate cost breakdwon. Value of works to assist in fee calculations and to determine developer contributions.

Project Name	VIP Solar 1 (Temora)
DC Capacity (Wdc)	6,400,000
AC Capacity (Wac	5,000,000

Item	Cost AUD	AUD/wdc	Supplier	% of Value	Notes
1 Engineering costs	\$ 126,000.00	\$ 0.0197	Longi	-	
2 Construction costs & BOS	\$ 2,380,618.93	\$ 0.3720	Longi	-	
3 Inverters	\$ 555,000.00	\$ 0.0867	SMA	-	
4 Transformers	\$ -	\$ -	SMA	-	Included in '3 Inverters'
5 Inverter Spare Parts	\$ 28,750.00	\$ 0.0045	SMA	-	
6 Tracking System	\$ 864,791.77	\$ 0.1351	Soltec	-	
7 PV Modules	\$ 1,914,425.50	\$ 0.2991	Longi	-	
8 Spare PV Modules	\$ 4,979.00	\$ 0.0008	Longi	0.2%	% of '7 PV Modules'
9 Fencing	\$ 125,333.33	\$ 0.0196	Pending	-	
10 Combiner boxes	\$ 83,333.33	\$ 0.0130	Pending	-	
11 Scada/DAS	\$ 62,666.67	\$ 0.0098	Pending	-	
12 Security monitoring	\$ 62,666.67	\$ 0.0098	Pending	-	
13 Connection Works + MV Works	\$ 150,000.00	\$ 0.0234	Pending	-	
14 Contingency	\$ 237,255.87	\$ 0.0371	Pending	3.0%	% of lines 1 through 13
15 Battery Energy Storage System	\$ -	\$ -	Pending	-	
Total CapEx	\$ 6,595,821.07	\$ 1.0306			

Printed 07/04/21

Mr Zaed Aznam ITP Development Project Manager – Planning PO Box 6127 O'Connor, ACT 2602



By email on 15/03/2021 to zaznam@itpau.com.au

Re: Biodiversity inspection report – Gunnedah 2A 5MW Solar Farm, Wandobah Road Gunnedah, NSW 2380.

Dear Zaed,

Thank-you for the opportunity to assist with the project. Please be advised that in this engagement, I am assuming the role of your Ecological Consultant and Biodiversity Assessment Method (BAM) Accredited Assessor. I confirm that I am listed on the Biodiversity Assessment Method (BAM) Accredited Person database.

Desk-top review

Database searches concluded that the likely Plant Community Type (PCT) adjacent to the area is either PCT 101 (Poplar Box - Yellow Box - Western Grey Box grassy woodland), PCT 433 (White Box grassy woodland to open woodland) or PCT 592 (Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest) in the Brigalow Belt South Bioregion. Aerial photography confirmed that as at 22/2/2021 the entire site is likely cleared of native shrubs and trees, but native grasses may persist under a likely grazing regime (i.e. nil cropping evident on 100% of the development area).

EPBC Protected Matters Online Search Tool

Consultation with the EPBC Protected Matters Online Search Tool searched a 5km radius of the site area for threatened *Flora* and *Vegetation Communities* returning 6 threatened species and 6 threatened communities. Of which there were 4 Vulnerable, 3 Critically Endangered and 5 Endangered species whose habitat may occur within that specified geographic range. **Table 1** considers their likelihood of occurring in the proposed site. Consultation with the same online database for threatened *Fauna* in the same geographic range returned 34 Vulnerable, 21 Migratory, 7 Endangered and 5 Critically Endangered species. **Table 2** considers their likelihood of occurring in the proposed site.

NSW BioNet (The Atlas of NSW Wildlife)

Consultation with NSW BioNet (The Atlas of NSW Wildlife) for listed *Flora* considered threatened in NSW, returned 1 Vulnerable species recorded within 10km by 10km radius of the site (**Map 1**). Ooline (*Cadellia pentastylis*) occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield, there is a strong correlation with low-to-medium nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth. The species was not recorded on site during the inspection period and is considered not present due to a lack of suitable habitat and structure. Consultation with the same online database for threatened *Fauna* in the same geographic range returned 25 species records, 22 Vulnerable, 2 endangered and JAMBA/ROKAMBA species. **Table 3** considers their likelihood of occurring in the proposed site.

Biodiversity Values Map and Threshold Tool

The Biodiversity Offsets Scheme Threshold (BOSET) is a test used to determine when is necessary to engage an accredited assessor to apply the Biodiversity Assessment Method (the BAM) to assess the impacts of a proposal. A search conducted on 26/2/21 revealed that the project site does not intersect any areas mapped as possessing 'Biodiversity Values' (Attachment 4).



Map 1: Recorded threatened species, NSW BioNET. Data download, 21/2/21

Koala Assessment

In 2018, the then Office of Environment & Heritage (now DPIE) produced '*A review of koala tree use across New South Wales'* which assessed evidence of koala tree use, for whatever purpose, across New South Wales. The study was intended as a platform to inform the predictive modelling of koala tree species and to contribute to a koala habitat suitability information base and importantly, the data collected for the seven (7) Koala Management Areas (KMAs) (after Phillips 2000 & DECC 2008) 'allows for a bottom-up consideration of a fundamental driver of koala habitat selection – local tree use patterns and tree associations' (OEH, 2018).

The assessment site at Gunnedah is in the Western Slopes and Plains KMA in which the study identified 19 tree species regularly used by Koalas, including 13 eucalypts (24% of 54 with >9 BioNet VIS records) and six (6) non-eucalypts. All eucalypts used were from *Symphyomyrtus* sub-genus (Trees or mallees; bark smooth, excorticating in small or large flakes or ribbons, or persistent, shortly fibrous-flaky, fibrous, or shortly fibrous and heavily impregnated with kino).

Pre-inspection database searches revealed sixty-nine (69) sightings of Koala (*Phascolarctos cinereus*) within a 5km buffer of the site, with the closest being less than 150m from the western boundary of site. The record is over 40 years old and is likely recording a sighting from the vegetated roadside corridor (**Map 2**). It is likely that the record coordinate was of the location the recorded 'spotted' the Koala and not the actual location of the individual itself. It is entirely feasible that Koala could be using the roadside corridor on the western boundary of the site, however none have been recorded in that zone previously.



Map 2: Nearest Recorded Koala sighting, NSW BioNET. Data download, 21/2/21

Site inspection

Site inspection on 23/2/2021 was conducted late afternoon, conditions were clear and 29°C. The designated 'clear zone' was thoroughly inspected in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*. I confirm that the proposed area for development will not see the loss of >1 ha of native grass or any dead or alive remnant trees. The following observations were made at the time of inspection:

- If any threatened native fauna (birds) are present in the surrounding connected native vegetation (in particular Swift Parrot, Little Lorikeet & Turquoise Parrot) they were not recorded during survey on the loss site on 23/2/2021 and the nesting period for these species is closed (both typically breed between June and December) meaning that the possibility of harming a fledgling is unlikely.
- **2.** The site is a highly modified grazing paddock with some native grasses present and an obvious history of pastoralism and or cultivation;

- **3.** No threatened species, scats or other evidence of the use of this zone or the development site were recorded during the survey effort.
- **4.** No Koalas, scats or other evidence of use of this zone or the development site were recorded during the survey effort.
- 5. The remnant vegetation on the roadside on the western boundary is of High Conservation Value (HCV) and impacts to this zone are to be minimized by use of existing access tracks entering the propoerty. This zone is potential Koala habitat.

Summary of Findings

Red-Gum contends that the project requires <1 ha clearance of native grass and zero remnant native trees. The proposed activities are unlikely to have an adverse effect on the foraging ability or the life cycle of threatened species that may be opportunistically using the site or surrounding areas.

The small amount of native grass that will be impacted by the development will not endanger or have a significant effect on any existing native vegetation, habitats within the site, or fauna species that may be using the site.

This project will not displace any rare or threatened species, however it is likely that a number of threatened and declining bird species and Koala may be using the area to the south and along the road reserve on the western boundary, hence the construction activities may prove to disturb foraging activities for a short period.

The area assessed was largely exotic species and pasture grasses, with many species commonly regarded as 'highly invasive' in more natural woodland settings – like that to the west in the road reserve. While the proposed works are unlikely to introduce noxious weeds, vermin, feral species or genetically modified organisms into an area, the movement of vehicles, plant, equipment and people on and off the subject site/s has the potential to introduce such impacts. Wherever possible, removal of weeds should be undertaken prior to seed developing, which for most species occurs during the warmer months (i.e. summer).

The typical home ranges of Koalas are from 2ha of connected vegetation to hundreds of hectares. Koala feed almost exclusively on a few preferred tree species which are of primary and secondary importance. The occurrence of both primary and secondary tree species varies widely on a regional, local and even a seasonal basis, meaning that koalas are unevenly distributed across their range. In the study area, primary food tree species are River red gum (*E. camaldulensis*) and Coolabah (*E. coolabah*) with secondary food tree species including Dirty (or Baradine) gum (*E. chloroclada*), Blakely's red gum (*E. blakelyi*), E. camaldulensis, Poplar or Bimble box (*E. populnea*), white box (*E. albens*), and *Callitris glaucophylla*.

Two (2) large Coolabah (*E. coolabah*) are present in the development area but are not designated for removal. Importantly, there are numerous core vegetation areas surrounding the site which represent areas of viable Koala habitat. The site is highly unlikely to be traversed or used by the species who are much more likely to stay within the connected canopy of the roadside vegetation corridor.

I am of the opinion that the activities as proposed will not have a significant effect on any threatened species and ecological communities and/or their conservation as noted within this assessment.

Recommendations

By way of a clearing process that minimizes the risk to threatened species that may be opportunistically using the site, I recommend:

- I. Construction limits and exclusion zones clearly identified prior to work;
- **II.** A visual inspection is conducted by environmental staff before construction commences to identify any areas of site that might be supporting native fauna;
- **III.** Vehicle movements around the site will be restricted to the construction footprint and away from any existing planted trees and flagging exclusion fencing to be installed.
- **IV.** Soil disturbance by vehicle and pedestrian access is to be kept to a minimum outside the construction footprint.
- **V.** Any weeds removed (particularly those bearing seeds) are to be disposed of appropriately at the nearest waste management facility.

Regards

rall

Mr Damian Wall **Managing Director** BAppSc, MEnvMgt, GradCert CHM, MAACAI

15/3/21

Attachment 1: Database Search Results v Likelihood Tables

¹ Five categories for the 'likelihood of occurrence' of species has been used. The categories are based on recorded sightings listed in credible databases, the presence or absence of suitable habitat, other features of the site, results of the field survey and professional judgement. The 5 categories are:

'Yes'	The species/community was or has been observed on the site.
'Likely'	A medium to High probability that a species uses the site
'Potential'	A suitable habitat for a species occurs on the site, but there is insufficient information to
	categorise the species as 'likely' or 'unlikely' to occur.
'Unlikely'	A Very Low to Low probability that a species uses the site.
'No'	Habitat on the site and in the vicinity in unsuitable for the species.

Table 1: EPBC Protected Matters Database results – Flora (5km x 5km)

Species Preferred Habitat		EPBC Act Status	Likelihood ¹
White Box-Yellow Box Blake	ely's Red-Gum Grassy Woodland and	Critically	No
Derived Native Grassland		Endangered	-
Grey Box (Eucalyptus micro	carpa) Grassy Woodlands and Derived	Endangered	
Native Grasslands of South-	eastern		No
Australia			
Poplar Box Grassy Woodlan	d on Alluvial Plains	Endangered	No
Weeping Myall Woodlands		Endangered	No
Coolibah – Black Box Wood	lands of the Darling Riverine Plains and	Endangered	No
the Brigalow Belt South Bio	regions.	Linuangereu	110
Natural grasslands on basal	t and fine-textured alluvial plains of	Critically	No
northern NSW and Souther	n Queensland.	Endangered	NO
Eurphrasia arguta	Only current known distributions are	Critically	
	in Nundle area of the NSW north	critically	No
	western slopes and tablelands	endangered	
Cadellia pentastylis -	Strong correlation between the		
Ooline	presence of Ooline and low- to	Vulnorable	No
	medium-nutrient soils of sandy clay or	vullerable	NO
	clayey consistencies		
Dichanthium setosum -	Disturbed areas such as cleared		
Bluegrass	woodland, grassy roadside remnants	Vulnerable	No
	and highly disturbed pasture.		
Androcalva procumbens	Grows in sandy sites, often along	Mula sashis	No
	roadsides.	vuinerable	NO
Tylophora linearis	Grows in dry scrub and open forest.	Endangered	No
Swainsona murrayana –	Bladder saltbush, black box and		
Slender Darling pea	grassland communities on level plains,	Mula sashis	No
	floodplains and depressions and is	vuinerable	
	often found with Maireana species.		

Table 2: EPBC Protected Matters Database results – Fauna (5km x 5km)

Species	Species Preferred Habitat			
Birds				
Anthochaera hrvaia –	Dry open forest and woodlands on inland slopes	Critically		
Regent Honeyeater	and valleys particularly Box Woodlands.	Endangered	No	
Hirundapus caudacutus -	Feed, drink and rest on the wing in large groups.			
White-throated Needletail	May rest at night in forested country.	Vulnerable	No	
Falco hypoleucos	Usually restricted to shrubland, grassland and			
Grey Falcon	wooded watercourses of arid regions	Vulnerable	NO	
Lathamus discolor –	Forests and woodlands dominated by winter	Critically	Unlikely	
Swift Parrot	flowering eucalypts	Endangered	Unlikely	
Rostratula australis -	Margins of densely vegetated swamps and	Endangered	Ne	
Australian Painted Snipe	wetlands	Endangered	NO	
Botaurus poiciloptilus –	Found in wetlands with tall, dense vegetation,	Endangered	No	
Australasian Bittern	favours permanent freshwater habitats.	Linualigereu	NO	
Calidris ferruginea –	Occur on intertidal mudflats in sheltered coastal	Critically	No	
Curlew Sandpiper	areas, such as estuaries, bays, inlets and lagoons	Endangered	NO	
Polytelis swainsonii –	Mainly inhabits forests and woodlands	Vulnerable	Unlikely	
Superb Parrot	dominated by eucalypts.	vullerable	Officery	
Grantiella picta –	Inhabits Boree/ Weeping Myall (Acacia pendula),	Vulnerable	No	
Painted Honeyeater	Brigalow and Box-Gum Woodlands	vullerable	NO	
Mammals			-	
Dasyurus maculatus –	Mature wet forest habitat in areas with rainfall	Endangered	No	
Spot-tailed Quoll	600 mm/year.	Lindangered	NO	
Nyctophilus corbeni –	Mallee, bulloke, Allocasuarina and box eucalypt			
Corben's Long-eared Bat	dominated communities, but more common in	Vulnerable	No	
	box/ironbark/cypress-pine.			
Pteropus poliocephalus –	Requires foraging resources and roosting sites.	Vulnerable	No	
Grey-headed Flying-fox				
Phascolarctos cinereus –	Temperate, sub-tropical and tropical forest,			
Koala	woodland and semi-arid communities dominated	Vulnerable	Unlikely	
	by Eucalyptus species			
Chalinolobus dwyeri – Large	Roosts in caves (near their entrances), crevices in			
-eared Pied Bat	cliffs, old mine workings and in the disused,	Vulnerable	No	
	(Detrocholiden arial)			
Poptilos				
Aprasia parapulchella –	Small rocks (15–60 cm basal area) shallowly			
Pink-tailed Worm-lizard	embedded in the soil	Vulnerable	No	
Lividicolus sphrurus – Border	Forest and woodland areas with boulders, rock			
Thick-tailed Gecko	slabs fallen timber and deen leaf litter	Vulnerable	No	
Migratory Marine Birds				
Anus nacificus –	Spend most their life airborne, Build their pests			
Fork-tailed Swift	on cliffs	Migratory	No	
Migratory Terrestrial Birds				
Hirundanus caudacutus –	Eeed drink and rest on the wing in large groups			
White-throated Needletail	May rest at night in forested country.	Vulnerable	No	
Motacilla flava –	Found in short grass, bare ground, swamp			
Yellow Wagtail	margins, sewage ponds and town lawns.	Migratory	No	
Mviaara cvanoleuca –	Tall wet eucalypt forests of SE Australia.			
Satin Flycatcher		Migratory	No	
Rhipidura rufifrons - Rufous	Occurs in open woodlands, shrublands,			
Fantail	grasslands and forests including riparian areas.	Migratory	NO	
Migratory Wetland Birds				
Calidris ferruginea –	Occur on intertidal mudflats in sheltered coastal	Critically		
Curlew Sandpiper	areas, such as estuaries, bays, inlets and lagoons	Endangered	NO	
	· · · · · · · · · · · · · · · · · · ·		÷	

Species	Preferred Habitat	EPBC Act Status	Likelihood ¹
Gallinago hardwickii —	Freshwater swamps and marshes as well as salt	Migratory	No
Latham's Snipe	marshes and mud flats	ivilgratory	NO
Actitis hypoleucos –	Found in coastal or inland wetlands, both saline	Migratory	No
Common Sandpiper	or fresh.	iviigratory	NO
Calidris acuminata - Sharp-	Prefers the grassy edges of shallow inland	Migratory	No
tailed Sandpiper	freshwater wetlands.	iviigratory	NO
Calidris melanotos —	Prefers the grassy edges of shallow inland	Migratory	No
Pectoral Sandpiper	freshwater wetlands.	iviigratory	NO
Listed Marine Birds			
Apus pacificus —	Spend most their life airborne. Build their nests	Migratory	No
Fork-tailed Swift	on cliffs.	Ivingratory	NO
Ardea ibis –	Shallow water and open dry grassy habitats	Migratory	No
Cattle Egret		iviigratory	NO
Ardea alba –	Wetland habitats, inland and coastal, freshwater	Migratory	No
Great Egret	and saline, permanent and ephemeral water.	iviigratory	NO
Rostratula benghalensis	Generally inhabits shallow terrestrial freshwater		
(sensu lato) —	(occasionally brackish) wetlands	Endangered	No
Painted Snipe			
Hirundapus caudacutus –	Feed, drink and rest on the wing in large groups.	Vulnarabla	No
White-throated Needletail	May rest at night in forested country.	vumerable	NO
Motacilla flava –	Found in short grass, bare ground, swamp		No
Yellow Wagtail	margins, sewage ponds and town lawns.	wigratory	NO
Myiagra cyanoleuca —	Tall wet eucalypt forests of SE Australia.	Migratory	No
Satin Flycatcher		iviigratory	NO
Calidris ferruginea -	Occur on intertidal mudflats in sheltered coastal	Critically	No
Curlew Sandpiper	areas, such as estuaries, bays, inlets and lagoons	Endangered	NO
Gallinago hardwickii -	Freshwater swamps and marshes as well as salt		No
Latham's Snipe	marshes and mud flats	harshes and mud flats	
Haliaeetus leucogaster -	Surface waters along coasts, islands, inlets also	Migratory	
White-bellied Sea-Eagle	along larger inland rivers and lakes.	Ivingratory	110
Merops ornatus -	Occurs in open woodlands, shrublands,	Migratory	Linlikely
Rainbow Bee-eater	grasslands and forests including riparian areas.	Ivingratory	Officery
Lathamus discolor -	Forests and woodlands dominated by winter	Endangered	Unlikely
Swift Parrot	flowering eucalypts	Enddrigered	oninkery
Actitis hypoleucos -	Found in coastal or inland wetlands, both saline	Migratory	No
Common Sandpiper	or fresh.	iviigi acory	110
Calidris acuminata - Sharp-	Grassy edges of shallow inland freshwater	Migratory	No
tailed Sandpiper	wetlands.	Ivingratory	110
Calidris melanotos —	Prefers shallow fresh to saline wetlands	Migratory	No
Pectoral Sandpiper			110
Chrysococcyx osculans -	Found in drier country where species such as		Unlikely
Black-eared Cuckoo	mulga and mallee form open woodlands		Chinkery
Rhipidura rufifrons – Rufous	Rainforest, dense wet forests, swamp woodlands		
Fantail	and mangroves, preferring deep shade, and is	Migratory	No
	often seen close to the ground.		

Table 3: BioNet Atlas of NSW Wildlife – Fauna (10km x 10km)

Species	Preferred Habitat	BC Act Status	Likelihood ¹	
Aves				
Circus assimilis - Spotted	Occurs in grassy open woodland including Acacia			
harrier	and mallee remnants, inland riparian woodland,	Mada ana kita	N -	
	grassland and shrub steppe. Builds stick nests in	vulnerable	NO	
	trees.			
Hamirostra melanosternon -	Timbered watercourses are the preferred breeding			
Black-breasted Buzzard	habitat.	vulnerable	NO	
Lophoictinia isura –	Dry woodlands and open forests. Shows a	Mula sus bla	No	
Square-tailed Kite	particular preference for timbered watercourses.	vuinerable	NO	
Hieraaetus morphnoides -	Occupies open eucalypt forest, woodland or open			
Little Eagle	woodland. Nests in tall living trees within a	Vulnorabla	No	
	remnant patch, where pairs build a large stick nest	vumerable	NO	
	in winter.			
Gallinago hardwickii -	Freshwater swamps and marshes as well as salt	JAMBA,	No	
Latham's Snipe	marshes and mud flats	ROKAMBA	NO	
Lathamus discolor - Swift	Woodland species, forages in winter flowering	Endangered	No	
Parrot	eucalypt species.	Linualigereu	NO	
Neophema pulchella -	Edges of eucalypt woodland adjoining clearings,	Vulnarabla	Unlikoly	
Turquoise Parrot	timbered ridges and creeks in farmland.	vuillerable	Uninkely	
Tyto novaehollandiae -	Dry eucalypt forests and woodlands, hunts along	Vulnorabla	No	
Masked Owl	the edges of forests, including roadsides.	vuillelable	NO	
Chthonicola sagittata	Found in a wide range of Eucalyptus dominated			
Speckled Warbler	communities that have a grassy understorey, often	Vulnerable	No	
	on rocky ridges or in gullies			
Glossopsitta pusilla –	Forages primarily in the canopy of open Eucalyptus			
Little lorikeet	forest and woodland, yet also finds food in	Vulnerable	Unlikely	
	Angophora, Melaleuca and other tree species.	Vullerubic	onincery	
	Preference to Riparian habitats.			
Artamus cyanopterus	Open forests and woodlands, and may be seen			
cyanopterus –	along roadsides and on golf courses.	Vulnerable	No	
Dusky Woodswallow				
Stagonopleura guttata -	Found in open grassy woodland, heath and		No	
Diamond Firetail	farmland or grassland with scattered trees.			
Grantiella picta –	Inhabits Boree/ Weeping Myall, Brigalow and Box-		No	
Painted Honeyeater	Gum Woodlands and Box-Ironbark Forests.			
Daphoenositta chrysoptera	Found in eucalypt woodlands and forests, prefer			
Varied Sittella	rough-barked trees like stringybarks and ironbark's	Vulnerable	No	
	or mature trees with hollows or dead branches.			
Mammalia				
Phascolarctos cinereus -	Temperate, sub-tropical and tropical forest,			
коаја	woodland and semi-arid communities dominated	vuinerable	Unlikely	
Determine a sufete susie	by Eucalyptus species			
Petaurus norfoicensis -	Innabits mature or old growth Box, Box-Ironbark	Vulnerable	No	
Squirfeigilder	Berwines foreging recourses and reacting sites			
Croy, booded flying for	Requires foraging resources and roosting sites.	Vulnerable	No	
Grey- fielded flying lox	Mature wet forest babitat in areas with reinfell 600			
Dasyurus maculatus -	mm/vear		No	
Spotted-tailed Quoli	- Roosts in tree hollows and buildings; in treeless			
Succolulinus Juviventris -	Roosts in tree honows and buildings; in treeless	Vulnorabla	No	
hat	areas they are known to utilise maninal puffows.	vuinerable		
Chalinolobus nigrogrisous	Dry open eucalynt forests, dominated by Spottad			
Hoary Wattled Bat	Gum hoves and ironbarks, and heathy coastal			
	forests where Red Bloodwood and Scribbly Gum	Vulnerable	No	
	are common			
L			1	

Species	Preferred Habitat	BC Act Status	Likelihood ¹
Nyctophilus corbeni	Mallee, bulloke Allocasuarina and box eucalypt		
Corben's Long-eared Bat	dominated communities, but it is distinctly more	Vulnerable	No
	common in box/ironbark/cypress-pine.		
Vespadelus troughtoni -	Cave-roosting species, usually found in dry open	Vulnorablo	No
Eastern Cave Bat	forest and woodland, near cliffs or rocky overhangs	vuillerable	NO
Reptilia			
Aprasia parapulchella —	Small rocks (15–60 cm basal area) shallowly	Vulnerable	
Pink-tailed Worm-lizard	embedded in the soil.	vumerable No	
Uvidicolus sphrurus –	Forest and woodland areas with boulders, rock	Vulperable No	
Border Thick-tailed Gecko	slabs, fallen timber and deep leaf litter	vuillerable	NO
Hoplocephalus bitorquatus -	Mainly in dry eucalypt forests and woodlands,		
Pale headed snake	cypress forest, favour habitats close to riparian	Vulnerable	No
	areas.		

Table 4: BioNet Atlas of NSW Wildlife – Flora (10km x 10km)

Species	Preferred Habitat	BC Act Status	Likelihood ¹
<i>Cadellia pentastylis –</i> Ooline	Low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth.	Vulnerable	No



Attachment 2: Proposed Design and Impacts. Source: ITP Development, 2021

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94 Kirby Flat Rd, Yackandandah, VIC 3749

Attachment 3: Photos from the Site Inspection – 23/2/21



Photo 1: Access through roadside vegetation off Wandobah Road. Potential Koala habitat. Photo: D. Wall 2021



Photo 2: Scattered remnant small trees on the west boundary of the development site. Trees not designated for removal. Photo: D. Wall 2021



Photo 3: Mixed Exotic (Rye) and native (Astrstipa Spp) dominated pasture, mid site, east orientation. D. Wall 2021



Photo 4: Remnant hollow bearing tree on north boundary. Not to be removed. Photo: D. Wall 2021



Photo 5: Boxthorn at base of remnant trees to be managed as priority weed. Photo: D. Wall 2021



Photo 6: Cooba on northern fence line. Not to be removed. Photo: D.Wall 2021

Attachment 4: BOSET Report Results





Legend

Biodiversity Values that have been mapped for more than 90 days

Biodiversity Values added within last 90 days

Notes

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GLINT AND GLARE ASSESSMENT

Gunnedah 2A Solar Farm

March 2021





About ITP Renewables

ITP Renewables (ITP) is part of the ITP Energised Group which, established in 1981, specialises in renewable energy, energy efficiency and carbon markets consulting. The Group has offices and projects throughout the world.

ITP was established in Australia in 2003 and has undertaken a wide range of projects, including designing grid-connected renewable power systems; providing advice for government policy; feasibility studies for large, off-grid power systems; developing micro-finance models for community-owned power systems in developing countries; and modelling large-scale power systems.

The staff at ITP have backgrounds in renewable energy and energy efficiency, research, development and implementation, managing and reviewing government incentive programs, high-level policy analysis and research, engineering design and project management.





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LIST OF ABBREVIATIONS

AC	Alternating current
CASA	Civil Aviation Safety Authority
DC	Direct current
FAA	Federal Aviation Administration (United States)
На	Hectare
ITP	ITP Renewables
MW	Megawatt, unit of power (1 million Watts)
MWp	Megawatt-peak, unit of power at standard test conditions used to indicate PV system capacity
NSW	New South Wales
OP	Observation point
PV	Photovoltaic
SGHAT	Solar Glare Hazard Analysis Tool



1. INTRODUCTION

1.1. Overview

ITP Development is proposing to develop a solar farm as described in Table 1. It will be located approximately 6.5km south of the town of Gunnedah, NSW (see Figure 1).

Table	1.	Site	information

Parameter	Description	
Solar farm name	Gunnedah 2A Solar Farm	
Site reference	Gunnedah 2A	
Lot/DP(s)	48/755474	
Street address	781 Wandobah Road, Gunnedah, NSW 2380	
Council	Gunnedah Shire Council	
AC capacity	5MW	
DC capacity	6.4MW	
Project area	Approx 12 ha	
Current land use	Grazing	

This report provides a desktop glint and glare assessment to support the Development Application for the project. It provides:

- Identification of potential receptors of glint and glare from the proposed solar farm; and
- Assessment of the glint and glare hazard using the Solar Glare Hazard Analysis Tool (SGHAT) GlareGauge analysis.

1.2. Glint and Glare

Glint is defined as a momentary flash of bright light, while glare is a continuous source of excessive brightness relative to ambient lighting (Federal Aviation Administration [FAA], 2018). The GlareGauge analysis used to assess the glint and glare hazard (see Section 3) was run with a simulation interval of one minute, as sunlight reflection from PV modules typically lasts for at least one minute. Glint, which lasts for less than one minute, is unlikely to occur from the sun based on how slowly the sun and modules move, so has not been considered further in this assessment.

Solar photovoltaic (PV) modules are designed to absorb as much light as possible to maximise efficiency (generally around 98% of the light received). To limit reflection, the modules are constructed from dark, light-absorbing material and the glass is treated with an anti-reflective coating. As a result, the glare generated from PV modules is lower than from many other surfaces, including cropping/grassland and concrete (an albedo of 20% is typically assumed for





PV modules, compared to 25-30% for grass and up to 25% for concrete; Ramírez & Muňoz, 2012).

However, the glass modules still have the potential to generate glare. This needs to be assessed to ensure that visual receptors—such as road users, nearby buildings, air traffic control towers and aircraft pilots—are not impacted by the development of solar farms.



Figure 1. Proposed 49.6 ha solar farm site and surrounding farm area (Note: the project will comprise 12 ha within this area).


2. PROJECT DESCRIPTION

ITP Development is proposing to construct a solar farm with a DC capacity of 6.4 MW_p and AC output of 5 MW, on an approximately 49.6 ha site that is currently used for grazing.

There are to be approximately 12,100 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The hub height of each tracker will be around 1.5m, with the peak of the modules reaching a height of approximately 2.75m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm is shown on drawing GND2A-G-210, and the array tracker details on drawing GND2A-E-341.

The solar farm will also comprise two 3MW inverter stations. These inverters are to be located within the array and are both mounted on a 12.19m skid. Each of these inverter stations incorporates the high voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing GND2A-E-430.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7am - 4pm, Monday to Friday. The construction is expected to take approximately 3 months. Once operational, the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 - 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site will be returned to the pre-development land use.

3. ANALYSIS



In a fixed-tilt PV array, the angle of incidence at which direct sunlight hits the PV modules varies as the sun moves across the sky. It will be smallest around noon when the sun is overhead and largest in the early morning and late afternoon when the sun is near the horizon. If the PV array is mounted on a single-axis tracking system as proposed in this project, the variation in the angle of incidence will be much smaller since the modules rotate to follow the sun. The main variation will be seasonal, i.e. because the sun is higher in the sky during summer and lower during winter. A PV array that is mounted on a tracking system therefore has less potential to cause glare.

The SGHAT was developed by Sandia National Laboratories to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation and specifications of the PV modules. This tool is required by the United States FAA for glare hazard analysis near airports and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The GlareGauge analysis uses SGHAT to provide an indication of the type of glare that can be expected at each potential receptor. Glare is indicated by three colours according to severity:

- Green glare: Low potential for temporary after-image;
- Yellow glare: Potential for temporary after-image; and
- Red glare: Retinal burn, not expected for PV.

The parameters used in the SGHAT model for the project are detailed in Table 2. GlareGauge default settings were adopted for the analysis time interval, direct normal irradiance, observer eye characteristics and slope error. The heights of the observation points were assumed to be 1.5m for a road user (i.e. sitting in a car) and 1.65m for a person (i.e. standing).

Parameters	Input
Time zone	UTC+10:00
Module tracking	Single
Module surface material	Smooth glass with ARC (anti-reflective coating)
Tracking axis tilt	0°
Tracking axis orientation	0°
Module offset angle (angle between module and tracking axis)	0°
Maximum tracking angle	60°
Resting angle	30°
Height of modules above ground	1.7m

Table 2.	SGHAT	specification	inputs
		0,000,000,000,000,000	



3.2 Potential Receptors

For this project, visual receptors within 2 km of the site were considered including residences and road users. A 2-km radius from the site was considered appropriate based on it being highly unlikely for glint and glare impacts at distances greater than this.

As shown in Figure 2, 25 residential observation points were identified as potential visual receptors of the site (red indicators). The potential for glare was also assessed along five different road routes (light blue lines). While there was a greater number of residential/commercial properties considered, some were discounted based on structures such as existing properties and trees acting as visual barriers.



Figure 2. Map showing potential visual receptors within 2 km of the site

3.3 Assumptions

The visual impact of solar farm development depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site. Some potential viewpoints were discounted because of significant existing features (such as trees or buildings), however, minor screening—such as roadside vegetation—was not assessed in detail. The GlareGauge analysis results are



therefore considered conservative as the model assumes there is no screening. It is noted that the site is almost entirely cleared with only a few trees within the property.

Atmospheric conditions such as cloud cover, will also influence light reflection and the resulting impact on visual receptors. The same is true of varying tilt angles of the modules. Varying atmospheric conditions have not been accounted for in the GlareGauge analysis, nor have the complexities of backtracking (due to the software's limitations). The GlareGauge analysis assumes clear sky conditions, with a peak direct normal irradiance (DNI) of 1,000W/m² which varies throughout the day.

3.4 Results

The results of the GlareGauge analysis (attached in Appendix A) at each of the observation points are summarised in Table 3. None of the residences or road users are expected to experience any glare from the solar farm. Some residences will also not have direct view of the solar farm due to visual obstruction from other structures.

Table 3.	Glare potential	at observation	points
----------	-----------------	----------------	--------

	Type of observation point	Location relative to solar farm	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP1	Residence	2 km north-west	0	0	No Glare
OP2	Residence	1.96 km north-west	0	0	No Glare
OP3	Residence	1.98 km north-west	0	0	No Glare
OP4	Residence	1.89 km north-west	0	0	No Glare
OP5	Residence	1.8 km north-west	0	0	No Glare
OP6	Residence	1.73 km north-west	0	0	No Glare
OP7	Residence	1.68 km north-west	0	0	No Glare
OP8	Residence	1.63 km north-west	0	0	No Glare
OP9	Residence	1.57 km north-west	0	0	No Glare
OP10	Residence	1.56 km north	0	0	No Glare
OP11	Residence	1.4 km north	0	0	No Glare
OP12	Residence	1.41 km north	0	0	No Glare
OP13	Residence	1.51 km north	0	0	No Glare
OP14	Residence	1.52 km north	0	0	No Glare
OP15	Residence	1.59 km north-east	0	0	No Glare
OP16	Residence	1.43 km north-east	0	0	No Glare
OP17	Residence	730 m north	0	0	No Glare
OP18	Residence	1.63 km north-east	0	0	No Glare

	Type of observation point	Location relative to solar farm	Green glare (minutes)	Yellow glare (minutes)	Glare potential
OP19	Residence	2 km east	0	0	No Glare
OP20	Residence	1.64 km south-east	0	0	No Glare
OP21	Residence	1.36 km south	0	0	No Glare
OP22	Residence	2 km south-west	0	0	No Glare
OP23	Residence	2 km west	0	0	No Glare
OP24	Residence	1.64 km north-west	0	0	No Glare
OP25	Residence	1.03 km north-west	0	0	No Glare
Wandobah Road	Road Route	Immediate west	0	0	No Glare
Black Jack Forest Road	Road Route	North	0	0	No Glare
Carlyon Avenue	Road Route	North-west	0	0	No Glare
Booloocooroo Road	Road Route	North-east	0	0	No Glare
Unnamed Road	Road Route	Immediate east	0	0	No Glare



4. SUMMARY

The results of the GlareGauge analysis indicated that the selected observation points are unlikely to receive glare due to the proposed solar farm.

Road users approaching the solar farm along Wandobah road, Black Jack Forest Road, Carlyon Avenue, Booloocooroo Road and the Unnamed road on the immediate east of the site, are also not expected to experience any glare.

5. **REFERENCES**

- Federal Aviation Administration (FAA) (2018). Solar Guide: Technical Guidance for Evaluating Selected Solar Technologies on Airports. Retrieved from the FAA website: https://www.faa.gov/airports/environmental/
- Ramírez, A. Z., & Muňoz, C. B (2012). Albedo effect and energy efficiency of cities. Sustainable Development – Energy, Engineering and Technologies – Manufacturing and Environment. Retrieved from https://www.intechopen.com/books/sustainable-development-energyengineering-and-technologies-manufacturing-and-environment/albedo-effect-and-energyefficiency-of-cities



APPENDIX A.FORGESOLAR GLARE ANALYSIS



FORGESOLAR GLARE ANALYSIS

Project: GND2A

Site configuration: All receptors

Analysis conducted by ITP Engineering (engineering@itpau.com.au) at 05:43 on 14 Sep, 2020.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- · Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- · Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m² Time interval: 1 min Ocular transmission coefficient: 0.5 Pupil diameter: 0.002 m Eye focal length: 0.017 m Sun subtended angle: 9.3 mrad Site Config ID: 41784.7638



PV Array(s)

Name: PV array GND2A - KMZ Axis tracking: Single-axis rotation Tracking axis orientation: 0.0° Tracking axis tilt: 0.0° Tracking axis panel offset: 0.0° Max tracking angle: 60.0° Resting angle: 30.0° Rated power: 6400.0 kW Panel material: Smooth glass with AR coating Reflectivity: Vary with sun Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.041899	150.217243	325.13	1.70	326.83
2	-31.038835	150.218104	322.83	1.70	324.53
3	-31.039355	150.221577	323.60	1.70	325.30
4	-31.042442	150.220962	325.16	1.70	326.86

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-31.025064	150.208706	353.41	1.65
OP 2	2	-31.025625	150.209897	345.95	1.65
OP 3	3	-31.025055	150.210970	342.26	1.65
OP 4	4	-31.025367	150.212118	336.51	1.65
OP 5	5	-31.026011	150.212815	334.45	1.65
OP 6	6	-31.025478	150.213910	332.25	1.65
OP 7	7	-31.025735	150.215508	329.70	1.65
OP 8	8	-31.025809	150.217300	331.83	1.65
OP 9	9	-31.026167	150.219103	333.00	1.65
OP 10	10	-31.026471	150.219982	332.70	1.65
OP 11	11	-31.027911	150.221571	328.62	1.65
OP 12	12	-31.027984	150.222279	325.95	1.65
OP 13	13	-31.027957	150.225594	321.39	1.65
OP 14	14	-31.028361	150.226635	320.60	1.65
OP 15	15	-31.028582	150.228974	320.28	1.65
OP 16	16	-31.031579	150.230626	317.80	1.65
OP 17	17	-31.033940	150.220521	326.34	1.65
OP 18	18	-31.036707	150.236185	309.41	1.65
OP 19	19	-31.039115	150.242107	300.07	1.65
OP 20	20	-31.044282	150.236249	303.11	1.65
OP 21	21	-31.051909	150.214265	322.63	1.65
OP 22	22	-31.054331	150.204423	337.96	1.65
OP 23	23	-31.042897	150.195655	381.57	1.65
OP 24	24	-31.030468	150.206402	359.50	1.65
OP 25	25	-31.031277	150.216187	340.53	1.65

Discrete Observation Receptors

Route Receptor(s)

Name: Black Jack Forest Road Path type: Two-way Observer view angle: 50.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.028359	150.220395	331.00	1.50	332.50
2	-31.030091	150.232813	323.68	1.50	325.18

Name: Booloocooroo Road Path type: Two-way Observer view angle: 50.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.020796	150.231334	336.99	1.50	338.49
2	-31.021844	150.231699	337.54	1.50	339.04
3	-31.031589	150.229639	318.03	1.50	319.53
4	-31.043801	150.239819	299.54	1.50	301.04
5	-31.052360	150.238231	300.20	1.50	301.70

Name: Carlyon Avenue Path type: Two-way Observer view angle: 50.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.025708	150.221088	329.00	1.50	330.50
2	-31.023745	150.208715	352.00	1.50	353.50

Name: Unnamed Road Path type: Two-way Observer view angle: 50.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.061029	150.217821	317.95	1.50	319.45
2	-31.028826	150.223825	323.99	1.50	325.49

Name: Wandobah Road Path type: Two-way Observer view angle: 50.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-31.057295	150.203399	335.99	1.50	337.49
2	-31.056306	150.205841	334.86	1.50	336.36
3	-31.049137	150.212128	328.57	1.50	330.07
4	-31.042175	150.216589	326.90	1.50	328.40
5	-31.041044	150.216965	326.90	1.50	328.40
6	-31.020372	150.222534	317.82	1.50	319.32

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV array GND2A - KMZ	SA tracking	SA tracking	0	0	18,870,000.0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
Black Jack Forest Road	0	0
Booloocooroo Road	0	0
Carlyon Avenue	0	0
Unnamed Road	0	0
Wandobah Road	0	0

Total annual glare received by each receptor

Results for: PV array GND2A - KMZ

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
OP 24	0	0
OP 25	0	0
Black Jack Forest Road	0	0
Booloocooroo Road	0	0
Carlyon Avenue	0	0
Unnamed Road	0	0
Wandobah Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 24

0 minutes of yellow glare 0 minutes of green glare

Point Receptor: OP 25

0 minutes of yellow glare 0 minutes of green glare

Route: Black Jack Forest Road

0 minutes of yellow glare 0 minutes of green glare

Route: Booloocooroo Road

0 minutes of yellow glare 0 minutes of green glare

Route: Carlyon Avenue

0 minutes of yellow glare 0 minutes of green glare

Route: Unnamed Road

0 minutes of yellow glare 0 minutes of green glare

Route: Wandobah Road

0 minutes of yellow glare 0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. "Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time. Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Refer to the Help page at www.forgesolar.com/help/ for assumptions and limitations not listed here.

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Landscape character & visual impact assessment

Lot 48 DP 755474 No 781 Wandobah Road, Gunnedah, NSW

Gunnedah 2A Solar Farm





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Attachment A: Photographs



Document Details & History

Project number	1920		
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1. Introduction

The purpose of this report is to assess the landscape character and visual impacts of a proposed solar farm at Gunnedah, located in Gunnedah local government area and to be known as the Gunnedah Solar Farm.

The scope of this report is to evaluate the potential impacts on landscape character and visual amenity. To achieve this end the report addresses:

- the location and physical characteristics of the site on which the works are proposed,
- the character or the surrounding landscape and the visual catchment within which the proposed works may be of significance,
- potential impacts on the landscape, viewpoints and receivers located within the visual catchment, and
- means to avoid or mitigate potential impacts.

A site visit was carried out on 23 September 2020 and a meeting with Gunnedah Shire Council staff was held on the same day.

2. Methodology

Impacts on the visual and scenic amenity of the proposed Gunnedah Solar Farm have been assessed by Zenith Town Planning Pty Ltd using the RMS guideline *Environmental Impact Assessment Practice Note– Guideline for Landscape Character and Visual Impact Assessment* (EIA-N04 Version 2.1 released on 14 December 2018). Details of methodology are given below.

A site inspection of the location of the proposed works and the surrounding area has been carried out to identify the visual catchment, the context of the site of the proposed works and observation points. Land uses and characteristics of the environment such as topography, vegetation, architecture of neighbouring buildings and any heritage values of any significant sites in the vicinity of the proposed solar farm were noted and the capacity of the area to absorb physical change is assessed.

Development plans for the solar farm have been reviewed and the likely impacts on landscape character identified. This is determined by the sensitivity of the landscape to physical change and the magnitude, or relative size and scale, of the works.

The visual significance of the site to observation points and receivers within the visual catchment is described in terms of proximity to the site, landscape character, the composition of views and the



sensitivity to change that will affect scenic values. The visual impacts that will be experienced by each receiver are identified and evaluated in terms of the sensitivity of each receiver to change and the magnitude of that change in terms of the proposed works.

The impacts are calculated and ranked according to negligible, low, moderate or high impact based on the following matrix (Table 1).

Table 1: Landscape character and visual impact grading matrix. Source: RMS Guideline for LandscapeCharacter and Visual Impact Assessment, 2018

Landscape character and visual impact grading matrix					
	Magnitude				
		High	Moderate	Low	Negligible
vity	High	High impact	High-moderate	Moderate	Negligible
siti	Moderate	High-moderate	Moderate	Moderate-low	Negligible
Sen	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

An explanation of the rankings of impacts on landscape character and visual amenity are provided in Table 2, sourced from *Pacific Highway HW10 and Wyong Road MR335 intersection and approaches upgrade Tuggerah* by Peter Andrews & Associates Pty Ltd/Corkery Consulting Pty Ltd, September 2012.

Table 2:	Explanation	of rankings b	based on s	ensitivity and	magnitude.
					<u> </u>

Rank	Landscape character	Visual amenity
High	The development would be the dominant feature in the landscape and would significantly affect and alter character	There is a substantial change to visual amenity or a total loss of view towards key features caused by the introduction of new elements that contrast with existing landscape character
Moderate	The development introduces a new element to the landscape and would form a significant and recognisable part of the landscape that alters character	There is partial loss or change of visual amenity towards key features caused by the introduction of new elements that may be prominent but not substantially in contrast with existing landscape character.
Low	The development constitutes a minor element of the wider view that merges with other land uses	There is a minor loss or change of visual amenity towards key features caused by the introduction of new elements that are consistent with existing landscape character
Negligible	The development is either not visible or only a small part is visible that due to distance separation does not alter character	There is very minor loss or change to visual amenity towards key features caused by the introduction of new elements that are consistent with existing landscape character approximating no change



Where magnitude and sensitivity impacts differ, the ranking would be a hybrid of the two impacts, e.g. moderate-high. Such a ranking would combine elements of both the explanation of a moderate rank and that of a high rank.

The RMS methodology has been validated by the Land and Environment Court for uses other than roads and bridges. For example, in the case of Houghton V Shoalhaven City Council [2016] NSWLEC 1195 the commissioner upheld an appeal by the applicant and agreed with the findings of the visual assessment that was prepared using this methodology to consider the impact of tourist development.

The methodology of the guidelines addresses impacts in both qualitative and quantitative terms. The qualitative assessment involves the use of descriptive and conceptual data such as descriptions of landscape characteristics and the setting of the development or viewpoint. The quantitative assessment uses numbers and values such as the distance of a viewpoint from the development and the direction of the view towards the development. The purpose of the assessment is to identify impacts and to determine whether these impacts are acceptable given the benefits of the development to the community and economy.

Although the proposed development is not classified as a state significant project reference has been made to the Large-Scale Solar Energy Guideline during the preparation of plans, drawings and reports. The document provides the following guidance for assessing visual impacts:

The impacts on landscape character and values and the visual amenity of landholders and communities.

Using the RMS methodology, which is based on the magnitude (size and scale) of the development and the sensitivity of the landscape and visual receivers to change, ensures that an objective judgement of impacts is made by the assessor. The methodology prevents the assessor from making subjective judgements. Sensitivity is a measure of how sensitive the character of the setting is to the proposed change and its capacity to absorb the change. Magnitude refers to the scale, form and character of a development proposal.

Planning principles established by the NSW Land and Environment Court were also considered as a check on the findings of the landscape character and visual assessment. These principles are derived from the case *Tenacity Consulting v Warringah* [2004] NSWLEC 140 when considering the acceptability of the impact of a proposed development on views enjoyed from private property in the vicinity of that development, and from *Rose Bay Marina Pty Ltd V Woollahra Municipal Council and Anor* [2013] NSWLEC 1046 when assessing the impact of a development on the public domain.



THE RMS methodology has been compared with that required by government guidelines that apply in other states, i.e. South Australia, Victoria and Queensland. South Australia's guideline is silent on the issue of visual assessment and the Queensland guideline suggests that visual amenity and proximity to sensitive receptors should be investigated when assessing the feasibility and impacts of a project. The Victorian guideline includes advice on minimising impacts on landscape values and on providing screening to reduce visual impacts. It also recommends that design includes visual simulations (photomontages) to illustrate the development in the context of the surrounding area and key viewpoints, and that an assessment of the impacts have regard to the scale of the project, the sensitivity of the landscape to change, visibility to private property and public places, the locations and distances from which a facility may be seen, the significance of the landscape and landscape/environmental values. This assessment applies a methodology that would comply with the Victorian guidelines.

The findings of the landscape character and visual impact assessments are summarised in the conclusion. Recommendations as to refinements of the development plans to avoid or mitigate significant landscape and visual impacts are made if necessary.

3. Proposed works

ITP (Development) Pty Ltd proposes to develop a solar farm and ancillary facilities with an AC output of 5.0MW at 781 Wandobah Road, Gunnedah, NSW. The site is located approximately 7.4 kilometres to the south-west of the town centre of Gunnedah and is an irregular shape with a total area of 49.76 hectares. The proposed development would occupy approximately 12 hectares of the total site. The land slopes gently to the east with a slight crossfall to the south.

Components of the facility which would impact on the landscape and visual amenity are:

- 12,000 solar modules ranging in height from 1.5 metres to 2.75 metres installed in 140 rows running north to south with approximately 6.25 metres centre to centre spacing between each row,
- Two 3MW inverter stations each mounted on a 12.2 metre long skid,
- A temporary car parking and materials laydown area,
- A 1.8 metre high security fence topped with three rows of barbed wire to give a total height of 2.3 metres, and
- Perimeter landscaping on the outer side of the security fence on the northern, western and southern sides of the array with shrubs that will grow to a height of 2.5 to 3 metres

The layout of the solar farm is shown on General Arrangement Plan (Drawing No GND2A-G-2100) prepared by ITP Renewables.



4. Description of the landscape

The character of the landscape near the development site of the Gunnedah Solar Farm is summarized in Table 3 below.

Table 3: Landscape character in the vicinity of the development site

Item	Description
Land use	The development site is zoned RU1 Primary Production. The closest part of urban
	area of Gunnedah is approximately 1.7 kilometres from the site to the north. This
	area is developed as large lot residential. Land to the west of the site is occupied by
	a quarry at the foothills of a low range zoned for environmental management. Larger
	properties used for agriculture are located to the south and east.
Structures	The site is occupied by a dwelling house and farm sheds located at the centre of the
	property. A dam is located at the eastern boundary of the property east of the
	dwelling and sheds. Structures within the vicinity of the site comprise scattered rural
	residential dwellings and farm houses and sheds to the south and east
Topography	The topography of the site is flat with a gentle fall to the south and east. An
	intermittent creek runs across the centre of the property. The surrounding landscape
	is similar with low hills in the distance to the south, north-east and east and a low
	range to the west
Vegetation	Much of the rural landscape has been cleared in the past for agricultural use other
	than scattered native trees and shrubs along roadsides and boundaries and riparian
	vegetation along watercourses. A few scattered trees and shrubs remain close to
	boundaries of the property. Low hills surrounding the area are vegetated. Farms are
	mostly cleared
Infrastructure	Local roads are adjacent the site. An 11kV and a 22kV power line run in a north-
	south direction within an easement parallel to the eastern boundary of the site that
	connect to the Essential Energy Gunnedah Zone substation

Below is an aerial image of the development site. Photographs of the landscape and surrounding development are appended as Attachment A. All photographs were taken by Zenith Town Planning Pty Ltd at the time of the site inspection.





Figure 1: Aerial image of the development site. Source: SIX Maps, 28 July 2011

The *Gunnedah Shire Rural Strategy* was prepared by Edge Land Planning in 2007 with two subsequent amendments in 2008 and 2015. The objectives of the strategy are to identify rural zones and management strategies for the subdivision, settlement patterns and primary production. Relevantly, the rural landscape of Gunnedah Shire is described in the strategy. This is useful in assessing the impact of the proposed development on landscape character and visual amenity.

Gunnedah Shire has 2 distinctly different landscape forms which are as follows:

- Flat open plains to the west and north with some small vegetated hills
- Steep and undulating, mostly vegetated land in the northeast, east and south

The flat open plains are characterised by a mixture of cropping and grazing whilst the hills are mostly heavily vegetated with some cleared land that is used for grazing of sheep and cattle.

The broadscale visual catchment of the Shire is limited to the east and south by the steep escarpment of the Great Dividing Range. The northeastern limit is defined by the Melville Range. The northern and western boundaries are not defined as this land is characterised by flat open plains with no defined edges.

The varying topography is the dominant visual feature of the landscape as it provides a framework for other elements such as vegetation, agriculture, viewpoints and the location of major transport and communication corridors. The topography also defines the broader visual catchment of the Shire, which is generally enclosed to the east, northeast and south by hills.



The predominant rural character of Gunnedah Shire is created by the numerous rural activities, large lot sizes, vegetation and expansive views. The landscape changes with the varying topography of the Shire – it is open and flat in the south and in the north has some hills which create different landscapes. The unique landscape character of the Shire is a visual resource as it generates tourism, development and environmental management. The visual resource also plays an important role in promoting environmental awareness and well being for residents and visitors. This varies from steep land associated with the ranges to simplicity of grazing lands and formal patterns of agricultural crops.

The retention of roadside vegetation is an issue which may require future negotiations with service providers. Controls which may be considered for retaining the rural character include:

- Planting controls for screening undesirable elements and incorporating buffers to significant environmental communities,
- Building controls for siting and advertising,
- Planning controls for lot sizes, the design and siting of residential dwellings and ancillary buildings, in relation to the visual amenity of road corridors.

It is important to recognise the visual amenity of open paddocks, post and rail fencing, distant views, heritage items and rural activities. It can be seen therefore that the preservation of the landscape character of the Shire is of importance.

The strategy contains an objective to minimise impacts on scenic landscapes by incorporating provisions into a development control plan. At the time of writing, *Gunnedah DCP 2012* does not contain provisions to protect scenic landscapes other than the requirement to utilise low maintenance drought and frost tolerant plant species when landscaping a property, implying that native species are appropriate.

5. Assessment of impacts on landscape character

The character of the landscape near the site of the Gunnedah Solar Farm is a modified agricultural landscape with expansive views across farmland and towards forested hills in most directions. The landscape in the immediate vicinity of the development site is generally flat and cleared of vegetation although some remnant/regrowth vegetation remains along road reserves and property boundaries. It is surrounded by low vegetated hills to the west, south, east and north-east. Structures within the vicinity of the site comprise rural farm buildings and large lot residential development. A quarry is located on the western side of Wandobah Road but it is not known whether this is operating at the time of writing.



The project occupies approximately 12 hectares and the 12,000 panels have a maximum height of 2.75 metres. The development footprint is situated on a collector road (Wandobah Road) and over 5 kilometres from the arterial road (Kamilaroi Highway) at the nearest point to the east.

The size and scale, or magnitude, of the project and impact on landscape character is considered to be high due to the introduction of a new type of development that is substantial in size and scale, and will change the nature of the rural landscape in the immediate vicinity of the site. It will be visible from local roads and there will be distant views over the site from elevated locations.

The sensitivity of private property to landscape change is considered moderate given the existing modified landscape which is predominantly agricultural or uninhabited environmental lands. Topography and vegetation would provide effective screening of the facility from most dwellings to the north and north-east. The sensitivity would decrease with distance so that visibility of the solar farm to neighbouring farms to the east and south would be negligible. There are no dwellings located immediately west of the site. The works would be visible from Mandobah Road. The sensitivity of Mandobah Road to landscape change would be moderate in close proximity to the development but low for other roads due to distance separation and vegetation on intervening land.

The overall impact on landscape character is assessed to be moderate-high for both private property and the public domain. However, distance, the presence of native vegetation and topography temper influence on landscape character from most surrounding land.

The presence of a solar farm in the rural landscape will eventually be accepted without question as the need for alternative sources of energy becomes greater and apparent. Over time, solar farms will become a common component of rural landscapes as they are less intrusive than all other forms of electricity generation and the visual impact can be managed through appropriate screening.

6. The visual catchment

The visual impact of solar farms depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment; vegetation; and any proposed screening measures to reduce visibility of the site. Some potential observation points may not have a clear line of sight towards the solar farm because of significant existing features such as built structures and vegetation. The greater the distance from the development site the less clear is the view of the solar farm. The ability to distinguish the type of land use and the actual composition of materials diminishes with distance.



For the purposes of this analysis the visual catchment of the site of the proposed development is defined by an area within 2 kilometres of the development site from which the works may be visible as shown on the visual catchment map below (Figure 2). The visibility of the site from properties located beyond 2 kilometres would be negligible.

The separation distances from each dwelling to the nearest point of the development area are given in Table 4. The distance has been measured as a straight-line from the nearest point of a neighbouring dwelling to the centre of the solar array. Whilst it is acknowledged that the array may be visible from unoccupied parts of a property, it is considered that the view from a dwelling is more critical than from yards and paddocks. GDA94 Geographic coordinates are also provided.



Figure 2: The visual catchment. Source: SIX Maps

Observation points are shown in Figure 3. The observation points are all located within 2 kilometres of the centre of the development footprint. This is considered sufficient distance to assess visual impacts given the very flat landscape surrounding the site and the moderate rise of distant hills.

There are 11 residential dwellings within the visual catchment plus several rural lifestyle dwellings on Black Jack Forest Road, Carylon Avenue and Booloocooroo Road within the catchment. These clusters of rural lifestyle dwellings are assessed as a single observation point and at the closest point to the



development site to assume a worst-case scenario. There are additional observation points just beyond the 2 kilometre radius, however, the assessment of impact of nearby properties that are within the catchment is representative of those just beyond.

Five public roads being Wandobah Road, Black Jack Forest Road, Carylon Avenue, Booloocooroo Road and an unnamed road are also within the visual catchment.

The residence on the development site that is occupied by the landowner is located 240 metres south of the centre of the proposed facility (161 metres from the security fence). Commercial properties such as quarries are not considered sensitive receivers in terms of visual impact and consequently an impact rating is not assigned to these properties.

Views from high points of the nearby forested ranges are further than 2 kilometres from the development site meaning that the facility will have negligible visual impact for persons visiting those ranges.

Observation points are shown in Figure 3. The observation points located within the visual catchment coincide with those used to assess potential impacts in the *Glare and Glint Assessment* prepared by ITP Renewables. catchment.

Whilst it is acknowledged that the array may be visible from unoccupied parts of a property, it is considered that the view from a dwelling is more critical than from yards and paddocks.



Figure 3: Observation points. Source: SIX Maps



7. Assessment of visual impacts

The magnitude of the proposed solar farm in terms of the quantum of change to views and proximity to each observation point, and the degree of sensitivity based on the quality of the view, whether the site is clearly visible or obscured by landform or vegetation, the direction and composition of the view is assessed in Table 4 below. An impact rating is then given based on magnitude and sensitivity using the landscape character and visual impact grading matrix provided in section 2 *Methodology*.

Observation point	Relative location	Comment	Magnitude	Sensitivity	Impact rating
R1 Residential	240m south	Dwelling on the same property as the solar farm and in same ownership	n/a	n/a	n/a
R2 Residential	815m north	Partially obscured vision of the site. Scattered vegetation will avoid a direct line of sight. The proposed landscaping along the northern boundary will provide effective screening	Moderate	Moderate	Moderate
R3 Residential	1.1km north- west	Roadside vegetation and the fall of the site to the east and south will obstruct direct visibility	Low	Moderate	Low- moderate
R4 Commercial	1.7km north- west	Roadside vegetation and the fall of the site to the east and south will obstruct direct visibility	Low	Moderate	Low- moderate
R5 Residential	1.2km south	Direct line of sight to the development site. The dwelling and surrounding vegetation will provide partial screening. The proposed landscape screening will obscure visibility to this receiver	Moderate	Moderate	Moderate
R6 Residential	1.8km south	Direct line of sight to the development site. The dwelling and surrounding vegetation will provide partial screening. The proposed landscape screening will	Moderate	Moderate	Moderate

Table 4: Visual impacts on observation points



Observation point	Relative location	Comment	Magnitude	Sensitivity	Impact rating
		obscure visibility to this receiver			
R7 Residential	1.7km east	Potential elevated views over the site from sections where there is no roadside vegetation. Screening will not mitigate visibility	Low	Moderate	Low- moderate
R8 Commercial	1.7km north- east	Potential elevated views over the site from sections where there is no roadside or private vegetation. Screening will not mitigate visibility	Low	Moderate	Low- moderate
R9 Infrastructure	1.5km north- east	Distant views towards the site partially obstructed by vegetation on intervening land and by the flat topography	Moderate	Moderate	Moderate
R10 Residential	1.95km north- east	Potential elevated views over the site from sections where there is no roadside or private vegetation. Screening will not mitigate visibility	Low	Moderate	Low- moderate
R11 Residential	1.95km north- east	Potential elevated views over the site from sections where there is no roadside or private vegetation. Screening will not mitigate visibility	Low	Moderate	Low- moderate
R12 Residential	1.4km north (at closest point)	No direct visual connection. Sensitivity is high due to potential for perceived land use conflict between rural lifestyle inhabitants and rural uses	Low	High	Moderate
R13 Commercial	1.5km north (at closest point)	No direct visual connection. Sensitivity is high due to potential for perceived land use conflict between rural lifestyle inhabitants and rural uses	Low	High	Moderate
Wandobah Road (road route)	Immediate west	Direct visual connection along the development site boundary with limited screening by roadside vegetation. Visibility is partially obscured to	High	High	High



Observation point	Relative location	Comment	Magnitude	Sensitivity	Impact rating
		the north of the site by intervening vegetation. There is no obstruction to the view on approach to the site from the south.			
Black Jack Forest Road (road route)	North	No direct visibility of the site	Negligible	Negligible	Negligible
Carlyon Avenue (road route)	North-west	No direct visibility of the site	Negligible	Negligible	Negligible
Booloocooroo Road (road route)	North-east	Potential elevated views over the site from sections where there is no roadside vegetation. Screening will not mitigate visibility	Moderate	Moderate	Moderate
Unnamed road (road route)	Immediate east	This road is unformed but may be occasionally used to access nearby farms	High	Negligible	Negligible

The visual impact of the proposed works is assessed to range from low to moderate for the residential observation points identified in this assessment. The impact is assessed to be moderate for the clusters of rural lifestyle dwellings located north of the site (observation points R12 and R13) due to sensitivity associated with the perceived conflict between expectations of views being retained and permitted uses on rural land. Two dwellings to the south and one to the north will have a direct line of sight to the solar farm that is only partially obscured by existing vegetation. However, the proposed landscaping along the northern and southern edges of the array will provide effective screening to these observation points. Elevated observation points to the east and north-east are likely to have unimpeded views across the site which cannot be mitigated by landscape screening. However, distance separation would mean that the facility would be a relatively small component of the total view.

The dwelling on the same site as the proposed solar farm would have unimpeded views towards the facility from the residence, outbuildings and yards, however, this is acceptable given that the land owner has entered into a lease agreement to construct and operate the facility. It is assessed as 'not applicable' in Table 4.

Impacts are assessed to be high for motorists using Wandobah Road due to the flat topography and lack of roadside vegetation. Landscape screening along the western boundary of the array will provide effective screen once mature. Visibility from Booloocooroo Road will be unimpeded where there is no


roadside vegetation and screening is unlikely to mitigate views due to the elevation above the development site. The impact on users of this road is assessed to be moderate.

8. Assessment against planning principles

The Land and Environment Court consistently applies a set of planning principles derived from the case *Tenacity Consulting v Warringah* [2004] NSWLEC 140 when considering the acceptability of the impact of a proposed development on views enjoyed from private property in the vicinity of that development. These planning principles are addressed below in relation to the proposed solar farm.

The planning principles are not predicated on a position that a landowner or occupant has a proprietary right to retain all or part of the views enjoyed from their land. The Court has acknowledged that even entire view loss is reasonable in certain circumstances (Lindsay Taylor Lawyers, November 2015).

Impact on private property

Step 1: The views to be affected

The solar farm would be visible to dwellings located to the north and south of the development site and potentially to dwellings located north-east of the site on elevated positions. Elsewhere vegetation, topography and distance would obstruct direct visibility of the array. The view enjoyed from these properties is one of a cleared rural farm landscape interspersed with remnant or regrowth native vegetation along road reserves and boundaries and within private properties. Views are expansive and across cleared fields with scattered farm dwellings and sheds. These views will remain unaffected.

Step 2: From what part of the property the views are obtained

Views are available from dwellings and surrounding farms of properties to the immediate north and south. Visibility from elevated positions would be limited to west-facing facades of buildings and parts of yards that have unobstructed views across the landscape to the west.

Step 3: The extent of the impact

The array will occupy 12 hectares of the 49.6 hectare property. Topography is generally flat extending south with hills to the north-east, east and west. Extensive district views are generally only available from land to the east that is elevated. Elsewhere views across an expansive rural landscape that is not interrupted by topography and/or vegetation. The extent of the impact is therefore considered minimal, given that the proposed footprint of the array is less than a quarter of the whole property.



Step 4: The reasonableness of the proposal that is causing the impact

The proposed solar farm is a project that is suited to a rural location. The property has been a working farm in the past but the property is currently under-utilised. The production of solar energy is an activity that is mandated by *SEPP (Infrastructure)* as permissible in a rural zone and the land owner has a reasonable expectation to develop a use that is permissible.

Impact on the public domain

The case *Rose Bay Marina Pty Ltd V Woollahra Municipal Council and Anor* [2013] NSWLEC 1046 established planning principles to be considered when assessing the impact of a development on the public domain. The process must account for reasonable development expectations as well as the enjoyment of members of the public of outlooks from public places.

Step 1: The nature and scope of existing views

Views from the public domain towards the development site are from Mandobah Road to the west and from the unnamed unformed road to the east. Some elevated public roads beyond 2 kilometres from the development site may overlook the site with distant views of the facility. The scope of views from Mandobah Road is only partially hindered by roadside vegetation. Views from easterly aspects are similar.

Step 2: The locations from which the potentially interrupted view is enjoyed

Views from the immediate adjoining section Mandobah Road and no for more than 200 metres on approach from either direction would be affected. Land owners that occasionally use the unnamed unformed road would also see the facility.

Step 3: The extent of the obstruction at each relevant location

There are no significant landscape features other than intermittent vegetation that would obscure views of the solar farm from immediately adjoining road reserves.

Step 4: The intensity of public use of those locations where that enjoyment will be obscured

Mandobah Road is a local collector road that connects the town of Curlewis to Gunnedah. It is used by commuters and local traffic accessing services in Gunnedah as well as farm vehicles. The intensity of use is judged to be moderate. However, speed is limited to 100km/hr along Mandobah Road meaning



that there would be only reasonably short periods of visibility of the facility. The intensity of use of the unnamed unformed road is negligible.

Step 5: Whether or not there is any document that identifies the importance of the view

The *Gunnedah Shire Rural Strategy* prepared in 2007 identifies the significance of rural landscapes in Gunnedah LGA. A recommendation of the strategy is to include provisions in a development control plan to protect scenic landscapes. However, the DCP has not been amended to include scenic protection provisions and the land is not mapped as a scenic landscape or as visually sensitive land in *Gunnedah LEP 2012.*

In summary, assessment against the planning principles established by the NSW Land and Environment Court finds that the potential impacts of the proposed solar farm on views from both private property and the public domain are acceptable. It is important to note that all development has a visual impact, irrespective of the size or scale of that development.

9. Conclusion and recommendations

The character of the landscape near the site of the Gunnedah Solar Farm is a modified agricultural landscape with expansive views across farmland. The landscape in the immediate vicinity of the development site is generally flat and cleared of most vegetation although some remnant/regrowth vegetation remains along road reserves and property boundaries. It is surrounded by low vegetated hills to the west, south, east and north-east. Structures within the vicinity of the site comprise rural farm buildings and large lot residential development. A quarry is located on the western side of Wandobah Road but it is not known whether this is operating at the time of writing.

The overall impact on landscape character is assessed to be moderate-high for both private property and the public domain. However, distance, the presence of native vegetation and topography temper influence on landscape character from most surrounding land. It is acknowledged that the landscape is scenic and warrants protection. However, it is also a primary production landscape and appropriate uses are permissible in the zone. The presence of the solar farm in the landscape can be reversed without permanent impact. The land will return to its current appearance after the solar farm is decommissioned in approximately 35 years time. The process of decommissioning will see the removal of all panels, supporting frames, ancillary items such as the inverter stations and fencing.

The presence of a solar farm in the rural landscape will eventually be accepted without question as the need for alternative sources of energy becomes greater and apparent. Over time, solar farms will become a common component of rural landscapes as they are less intrusive than all other forms of electricity generation and the visual impact can be managed through appropriate screening.



The visual impact of the proposed works is assessed to range from low to moderate for the residential observation points identified in this assessment. The impact is assessed to be moderate for the clusters of rural lifestyle dwellings located north of the site due to sensitivity associated with the perceived conflict between expectations of views being retained and permitted uses on rural land. The proposed landscaping along the northern and southern edges of the array will provide effective screening to neighbouring observation points. Elevated observation points to the east and north-east are likely to have unimpeded views across the site which cannot be mitigated by landscape screening. Distance separation would mean that the facility would be a relatively small component of the total view from elevated observation points to the east and north-east. Elsewhere there would be nil visual connection with the facility.

Impacts are assessed to be high for motorists using Wandobah Road due to the flat topography and lack of roadside vegetation. Landscape screening along the western boundary of the array will provide effective screen once mature. Visibility from Booloocooroo Road will be unimpeded where there is no roadside vegetation and screening is unlikely to mitigate views due to the elevation above the development site. The impact on users of this road is assessed to be moderate.

The findings of the assessment acknowledge that there will be impacts on the landscape and visual amenity as there are with any type of development. However, there is no view loss; the impact is a change to the view – a new element within the landscape. Impacts are greatest in close proximity to the solar farm as the further the distance a viewpoint is from the site the less the overall visual impact as the development occupies a lesser proportion of the total view.

To mitigate impacts on the landscape and visual amenity, it is recommended that a vegetation screen be planted around the northern, western and southern sides of the array. Native plants that grow to a maximum height of 2.5 to 3 metres should be selected. It is recommended that Gunnedah Shire Council be consulted to determine appropriate plant species.

On balance and having regard to other matters for consideration under section *4.15 Evaluation* of the *Environmental Planning and Assessment Act 1979*, the impacts are considered acceptable given that:

- the solar farm will contribute to renewable energy generation and provide a source of electricity for local domestic and commercial use whilst at the same time assisting to reduce greenhouse gas emissions and our reliance on fossil fuels,
- It will also generate employment opportunities during the construction phase and once operational will provide employment for maintenance crews,



- The placement of the array within the property downslope has been chosen to maximise distance separation from neighbouring dwellings,
- Existing vegetation along road reserves and property boundaries is to be maintained,
- The proposed landscaping will grow to a height that will screen the facility from observation points including public roads that are on level ground with the development site and elsewhere will soften the visual impact from land that is slightly elevated above the development site.



Attachment A

Photographs



Plate 1: Looking Looking across the development site from the entry to the dwelling



Plate 2: Looking towards the development site on approch from the south of Mandobah Road



Plate 3: Looking north-east from within the development site towards large lot residential



Plate 4: Looking west towards the quarry west of the development site



Plate 5: Looking towards the northern extent of the development site from Mandobah Road



Plate 6: The adjoining property to the north of the development site



Plate 7: Looking across the development site towards the residence from Wandobah Road



Plate 8: Looking across the development site from Wandobah Road



Plate 9: A dwelling to the north-west of the development site on Wandobah Road



Plate 10: Property to the north at the intersection of Black Jack Forest Road and Booloocooroo Road



Plate 11: Large Lot residential development to the north



Plate 12: Farmland and low hills to the south



Plate 13: Farmland to the south



Plate 14: Dwelling on hill to the east



Plate 15: Looking south from within the development site towards the dwelling on the same site



Plate 16: Looking south-east from within the development site



Plate 17: Looking north-east from within the development site



Plate 18: Looking across the development site from Wandobah Road



Attachment B

Photomontages



Relative location of photomontage images

Gunnedah Solar Farm



Image 1a: Looking north-east from the property entrance before development of the solar farm



Image 1b: Looking north-east from the property entrance after development and before landscaping



Image 1c: Looking north-east from the property entrance after development and landscape planting



Image 1d: Looking north-east from the property entrance after development with semi-mature landscaping



Image 1e: Looking north-east from the property entrance after development with mature landscaping



Image 2a: Looking east from Wandobah Road before development of the solar farm



Image 2b: Looking east from Wandobah Road after development before landscaping



Image 2c: Looking east from Wandobah Road after development with landscape planting



Image 2d: Looking east from Wandobah Road after development with semi-mature landscaping



Image 2e: Looking east from Wandobah Road after development with mature landscaping

Noise Assessment

Gunnedah 2A Solar Farm Gunnedah, NSW.



Prepared for: ITP Development Pty Ltd September 2020 MAC180781-12RP1V1

Document Information

NOISE ASSESSMENT

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APPENDIX A – GLOSSARY OF TERMS



1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by ITP Development Pty Ltd (ITP) to complete a Noise Assessment (NA) for the proposed Gunnedah 2A Solar Farm near Gunnedah, NSW (the 'project'). This report presents the methodology and findings of the NA for the construction and operation of the project.

1.1 Purpose and Objectives

A NA is required as part of the Statement of Environmental Effects (SEE) to be submitted to the Gunnedah Shire Council (GSC) as part of the Development Application (DA). The purpose of the NA is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

1.2 Scope of the Assessment

The NA includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receivers;
- provide a comparison of predicted noise levels against relevant construction and operational criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs or operational criteria may be exceeded.

A glossary of terms, definitions and abbreviations used in this report is provided in Appendix A.



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2 Project Description

2.1 Background

ITP propose to construct and operate a 5 Megawatt (MW AC) solar farm using photovoltaic (PV) technology at 781 Wandobah Road, approximately 6.5km south of Gunnedah, NSW.

2.2 Description of Proposed Construction Works

The project includes installation of groups of north facing PV modules (approximately 2m x 1m) on mounting structures up to approximately 2.7m in height. An estimated 12,000 PV panels will be installed using a single axis tracking system, tilted +/- 60° along the north-south axis. The PV mounting structure would comprise steel posts driven up to approximately 1.5m to 3.5m below ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Earthworks will primarily involve trenching which is required for cabling of each PV array/module to the inverters. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

It is anticipated that the solar farm would be constructed in stages, with two to three stages in construction at any one time over a three month period during standard construction hours.

During construction and operational phases, all vehicles would access the project from the Wandobah Road directly to the site.

During construction, traffic generated by the project would include employee and delivery vehicles. During the peak construction period, the daily traffic volume is expected to be up to four heavy vehicles (semi-trailers or b-doubles) per hour and 25 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peaks.



2.3 Description of Proposed Operation

PV infrastructure on site will comprise of groups of PV panels installed in rows running north to south. Each row of PV modules will rotate to track the sun across the sky from east to west each day. There is approximately 6.25m spacing between each row. The hub height of each tracker is 1.5m with the peak of the modules reaching a height of 2.7m when the array is fully tilted.

Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Inverters will be located centrally to groups of PV panels and connected to each other by underground cables. The PV modules will be on a single axis tracker system which will follow the sun and move in an east to west direction.

The project will be contained solely within the site as shown in Figure 1.

The project would operate 24 hours a day, 7 days a week, with no permanent staff on site. During operation, the PV panels would generate electricity which would be fed into the power grid via connection located on Wandobah Road. Key noise emissions from the operation of the project are associated with the inverter and transformer(s). It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receivers.

When required, maintenance activities will occur during standard working hours (except for emergencies) and are expected to include:

- panel cleaning;
- repairs or replacement of infrastructure, as required; and
- Iand management including mowing to control vegetation as required.

Typical noise sources associated with maintenance activities would include light vehicle movements on site and maintenance of equipment.



2.4 Potentially Sensitive Receivers

Using aerial photography, geospatial information and other project design information, MAC has identified the following potentially sensitive receivers that may be affected by noise from operation or construction activities and project related road traffic. **Table 1** presents a summary of receiver identification address and coordinates. These are reproduced visually in **Figure 1**.

Table 1 Noise Sensitive Receivers						
חו	Description/Address	Receiver Type —	Coordinates	Coordinates (MGA 56)		
	Description/Address		Easting	Northing		
R1	781 Wandobah Road	Residential	234474	6562235		
R2	671 Wandobah Road	Residential	234708	6563296		
R3	239 Booloocooroo Road	Residential	235623	6563586		
R4	309 Booloocooroo Road	Residential	236172	6563049		
R5	367 Booloocooroo Road	Residential	236771	6562779		
R6	400 Booloocooroo Road	Residential	236305	6562254		
R7	934 Wandobah Road	Residential	233620	6560984		
R8	886 Wandobah Road	Residential	232354	6562234		
R9	Carlyon Avenue	Residential	234636	6564141		




3 Noise Policy and Guidelines

This Noise Assessment has been conducted in accordance with the following key policy and guidelines:

- NSW Department of Environment and Climate Change, NSW Interim Construction Noise Guideline (ICNG), 2009;
- NSW Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017;
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011; and
- US Federal Highways Administration/Environmental Protection Agency-Report 550/9-74-004 March (US FHWA).

The assessment has also considered and applied the following additional policy, guidelines and standards where relevant:

- Australian Standard AS 2436–2010 (R2016) (AS 2436) Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites;
- Australian Standard AS 1055:2018 Description and Measurement of Environmental Noise;
- Australian Standard AS /NZS IEC 61672.1–2019 (AS 61672) Electro Acoustics Sound Level Meters Specifications Monitoring; and
- Australian Standard AS IEC 60942-2004 (AS 60942) Electroacoustics Sound Calibrators.

3.1 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.



The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; or
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest relevant receivers. The qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. This study has adopted a quantitative assessment approach.

The quantitative approach includes identification of potentially affected receivers, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receivers and, provides management and mitigation recommendations. **Table 2** summarises the ICNG recommended standard hours for construction.

Table 2 Recommended Hours for Construction																								
Hour Commencing	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM
Monday		-	-	-	-	-	-			-	-	_		-	-	_	_	_	-	_	-	-		-
Tuesday	-																							
Wednesday								Standard Hours OOH																
Thursday				001	I															Peri	od 1			
Friday	-		P	eriod	2																			
Saturday	-																							
Sunday	-											~									00	ЭН		
Public Holiday	-											00		erioc	11						Peri	od 2		

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

- **Period 1** (evening/low risk period): Monday to Friday 6pm to 10pm, Saturdays 1pm to 6pm, Sundays 8am to 6pm.
- **Period 2** (night/medium to high risk period): Monday to Friday 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

There are no out of hours work proposed for this project.



3.1.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 3** provides the ICNG recommended LAeq(15min) NMLs and how they are to be applied.

Table 3 Noise Manage	ment Levels	
Time of Day	Management Level	How to Apply
	LAeq(15min) ¹	
Recommended standard	Noise affected	The noise affected level represents the point above which there
hours: Monday to Friday	RBL + 10dB	may be some community reaction to noise.
7am to 6pm Saturday		Where the predicted or measured $\ensuremath{LAeq}(15\ensuremath{min})$ is greater than the
8am to 1pm No work on		noise affected level, the proponent should apply all feasible and
Sundays or public		reasonable work practices to meet the noise affected level.
holidays.		The proponent should also inform all potentially impacted
		residents of the nature of work to be carried out, the expected
	_	noise levels and duration, as well as contact details.
	Highly noise affected	The highly noise affected level represents the point above which
	75dBA	there may be strong community reaction to noise.
		Where noise is above this level, the relevant authority (consent,
		determining or regulatory) may require respite periods by
		restricting the hours that the very noisy activities can occur,
		taking into account times identified by the community when they
		are less sensitive to noise such as before and after school for
		work near schools, or mid-morning or mid-afternoon for work
		near residences; and if the community is prepared to accept a
		longer period of construction in exchange for restrictions on
		construction times.
Outside recommended	Noise affected	A strong justification would typically be required for work outside
standard hours.	RBL + 5dB	the recommended standard hours.
		The proponent should apply all feasible and reasonable work
		practices to meet the noise affected level.
		Where all feasible and reasonable practices have been applied
		and noise is more than 5dBA above the noise affected level, the
		proponent should negotiate with the community.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.



3.1.2 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

- Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
- 2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
- 3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.



- 4. Consider residual noise impacts that is, where noise levels exceed the PNTLs 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, including consultation with the affected community where impacts are expected to be significant.
- 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.

3.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period.

The RBLs relevant to the project are contained in Section 4.

3.2.3 Project Intrusiveness Noise Level (PINL)

The PINL (LAeq(15min)) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment.



3.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- Amenity Noise Levels (ANL) are determined considering all current and future industrial noise within a receiver area; and
- Project Amenity Noise Level (PANL) is the recommended level for a receiver area, specifically focusing on the project being assessed.

Additionally, Section 2.4 of the NPI states: "to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows":

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The NPI states with respect to high traffic noise areas:

The level of transport noise, road traffic noise in particular, may be high enough to make noise from an industrial source effectively inaudible, even though the LAeq noise level from that industrial noise source may exceed the project amenity noise level. In such cases the project amenity noise level may be derived from the LAeq, period(traffic) minus 15 dB(A).

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in Table 4.



Table 4 Amenity Criteria			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level
	Noise Amenity Area	Time of day	dB LAeq(period)
		Day	50
	Rural	Evening	45
		Night	40
		Day	55
Residential	Suburban	Evening	45
	Day5SuburbanEvening4Night4Night4Day6UrbanEvening5Night4See column 4See column 4See column 4See column 4See column 4See column 4	40	
		Day	60
	Urban	Evening	50
		Night	45
Hotels, motels, caretakers'			5dB above the recommended amenity
quarters, holiday	Soo column 4	Soo column 4	noise level for a residence for the
accommodation, permanent	See column 4	See column 4	relevant noise amenity area and time
resident caravan parks.			of day
Sebeel Classroom	A II	Noisiest 1-hour	35 (internal)
	All	period when in use	45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



3.2.5 Maximum Noise Assessment Trigger Level

The potential for sleep disturbance from maximum noise level events from a project during the nighttime period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- LAeq(15min) 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- LAmax 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 4.3**.



4 Assessment Criteria

Background noise monitoring has not been conducted for this project and hence, the minimum applicable RBLs of 35dBA for the daytime period and 30dBA for the evening and night time periods have been adopted in accordance with NPI methodology.

4.1 Construction Noise Management Levels

Noise Management Levels (NMLs) for construction activities at all residential receivers are 45dB LAeq(15min) (RBL +10dB). Construction activities are planned for standard hours, however the relevant NML standard construction hours and out of hours periods are summarised in **Table 5**.

Table 5 Construction Noise Management Levels						
Location	Assessment Period ¹	RBL, dBA	NML dB LAeq(15min)			
	Day (Standard Hours)	35	45 (RBL+10dBA)			
All Residential Receivers	Evening (OOH Period 1)	30	35 (RBL+5dBA)			
	Night (OOH Period 2)	30	35 (RBL+5dBA)			

Note 1: See table 2 for Recommended Standard Hours for Construction.

4.2 Operational Noise Criteria

4.2.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 6** and have been determined based on the RBLs +5dBA.

Table 6 Project Intrusiveness Noise Levels							
Dessiver	Doriod ¹	Adopted RBL	PINL				
Receiver	Penod	dB LA90	dB LAeq(15min)				
	Day	35	40				
All Residential Receivers	Evening	30	35				
	Night	30	35				

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



4.2.2 Project Amenity Noise Levels

Table 7 Proje	Table 7 Project Amenity Noise Levels						
Receiver	Noise	Assessment	Recommended ANL	PANL	PANL		
Туре	Amenity Area	Period ¹	dB LAeq(period) ²	dB LAeq(period) ³	dB LAeq(15min) ⁴		
		Day	50	50	53		
Residential	Rural	Evening	45	45	48		
		Night	40	40	43		

The PANLs for receivers potentially affected by the project are presented in Table 7.

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods. Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.

Note 2: Recommended amenity holse levels as per Table 2.2 of the NPT.

Note 3: Project Amenity Noise Level equals the amenity noise level as there is no other industry in the area.

Note 4: Includes a +3dB adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the NPI.

4.2.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINLs or the PANLs. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI. For this assessment the night time PNTL of 35dB LAeq(15min) is the limiting criteria for residential receivers.

Table 8 Project	Noise Trigger Level	ls		
Ostalansant	Assessment	PINL	PANL	PNTL
Calchment	Period ¹	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)
Residential	Day	40	53	40
Receivers	Evening	35	48	35
(Rural)	Night	35	43	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.



4.2.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 9** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 9 Maximum Noise Assessment Trigger Levels Residential Receivers LAeq(15min) LAmax 40dB LAeq(15min) or RBL + 5dB 52dB LAmax or RBL + 15dB 40 Trigger Trigger 52 RBL +5dB RBL +15dB 35 45 Highest 52 Highest 40

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays; Night 10pm to 8pm.

Note: As per Section 2.5 of the NPI, the highest of the two criteria are adopted as the trigger level.

4.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, there are receivers along Wandobah Road. The relevant road traffic noise criteria are provided in the RNP and are presented in **Table 10** for residential receivers.

Table 10 Road Traffic Noise Assessment Criteria for Residential Land Uses						
			Assessment Criteria - dBA			
Road category	Road Name	Type of Project/Development	Day	Night		
			(7am to 10pm)	(10pm to 7am)		
		Existing residences affected by				
Arterial Poads	Wandobah Road	additional traffic on existing arterial	60dBA LAeq(15hr)	55dBA LAeq(9hr)		
Arterial Roads	Wandoban Koad	roads generated by land use	external	external		
		developments				

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.



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5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2020.0) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following four scenarios:

- earthworks for internal road and compound construction including the stripping of topsoil and unsuitable soil and the placement and compaction of road base;
- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.



It is envisaged that all construction scenarios have the potential to occur simultaneously at up to three locations across the site. Noise emission data and assumptions used in this assessment are summarised in **Table 11**. All significant noise generating construction activities will be limited to standard construction hours. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly, use of hand tools etc, they will be managed such that they are not audible at any residential receivers.

Table 11 Construction Equi	pment Sound Power Lev	vels, Lw dBA re 10 ⁻¹	² W	
Noise Source/Item	Utilisation %	Quantity	Lw/Item	Total Lw
	Trenching 8	Earthworks		
Backhoe	80	1	104	103
Light vehicle	25	2	76	73
Total – Trenching & Earthworks				103
	Pil	ing		
Piling Rig (hydraulic)	80	1	113	112
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Total – Piling				113
	Asse	mbly		
Mobile Crane/HIAB	75	1	104	103
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Hand tools/Power tools	50	1	102	99
Welder	50	1	105	102
Total – Assembly				109
	Transpor	t (on site)		
Heavy vehicle	40	1	104	101
Tele-handler	50	1	106	103
Total – Transport				105

5.2 Operational Assessment Methodology

5.2.1 Operational Noise Modelling Scenarios

For this assessment, noise predictions were modelled for a typical worst-case operational scenario over a 15-minute assessment period based on the assumptions and sound power levels in **Table 12.** Plant noise emission data used in modelling for this assessment were obtained from manufacturers data or the MAC database. Where relevant, modifying factors in accordance with Section 3.3 and Fact Sheet D of the NPI have been applied to calculations.



Table 12 Operational Equipment Sound Power Levels, Lw dBA re 10 ⁻¹² W						
Noise Source/Item	Activity	Quantity	Lw/Item	Total Lw		
PV Panel Tracking Motor ^{1, 2}	All tracking motors in operation	140	78	83		
3MW Inverter	Constant	2	94 ²	97		
5MVA Transformer	Constant	1	87 ²	87		

Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.

Note 2: Including modifying factor penalty of +5dB added for low frequency and +5dB added for tonality.

5.2.2 Meteorological Analysis

Noise emissions from industry can be significantly influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver.

Fact Sheet D of the NPI provides two options when considering meteorological effects:

- adopt the noise enhancing conditions for all assessment periods without an assessment of how often the conditions occur a conservative approach that considers a source to receiver winds for all receivers and F class temperature inversions with wind speeds up to 2m/s at night; or
- determine the significance of noise enhancing conditions. This requires assessing the significance of temperature inversions (F and G Class stability categories) for the night time period and the significance of light winds up to 3m/s for all assessment periods during stability categories other than E, F or G.

Given that a detailed analysis of the significance of noise enhancing conditions has not been undertaken the meteorological conditions adopted in the noise modelling assessment are summarised in **Table 13**.

Table 13 Modelled Site Specific Meteorological Parameters								
Assessment	Tomporatura	Wind Speed /	Dolotivo Humidity	Stability Class				
Condition ¹	remperature	Direction	Relative Humidity	Stability Class				
Day - Calm	20°C	3m/s all directions	50%	D				
Evening - Calm	10°C	3m/s all directions	50%	D				
Night - Calm	10°C	2m/s all directions	50%	F				

Note 1: Day 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening 6pm to 10pm; Night - the remaining periods.



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6 Results

6.1 Construction Noise Results

Noise levels were predicted at each assessed receiver at a height of 1.5m above ground level for typical construction activities. **Table 14** summarises the maximum predicted noise level from each of the construction scenarios (trenching, piling and assembly) at each receiver.

Table 14 F	Predicted Construction No	ise Levels			
Receiver		Predicted Noise	Highest Predicted	NML Standard	Compliance
חו	Description/Address	Level Range	Noise Level	Hours	Achiovod
U		dB LAeq(15min) ¹	dB LAeq(15min)	dB LAeq(15min)	Achieved
R1	781 Wandobah Road	31-54	54	45	No
R2	671 Wandobah Road	24-45	45	45	Yes
R3	239 Booloocooroo Road	17-36	36	45	Yes
R4	309 Booloocooroo Road	16-34	34	45	Yes
R5	367 Booloocooroo Road	8-27	27	45	Yes
R6	400 Booloocooroo Road	15-33	33	45	Yes
R7	934 Wandobah Road	12-30	30	45	Yes
R8	886 Wandobah Road	8-27	27	45	Yes
R9	Carlyon Avenue	12-32	32	45	Yes

Note 1: Noise levels from construction activities vary due to their location across the project site.

Noise levels at one nearest receiver (R1) are expected to exceed the NMLs when works are nearest to this location. The exceedance would be temporary, and of short duration and is primarily due to piling and earthworks activities when at their closest point to receivers.



6.2 Operational Noise Results

Noise levels were predicted at each assessed receiver at a height of 1.5m above ground level during worst case noise enhancing meteorological conditions. **Table 15** summarises the predicted operational noise levels which are demonstrated to comply with the PNTLs at all residential receivers.

Table 15 Predicted Operational Noise Levels				
Receiver	Description/Address	Predicted Noise Level	Limiting Night PNTL	Compliance
ID	Description/Address	dB LAeq(15min)	dB LAeq(15min)	Achieved
R1	781 Wandobah Road	<30	35	Yes
R2	671 Wandobah Road	<30	35	Yes
R3	239 Booloocooroo Road	<30	35	Yes
R4	309 Booloocooroo Road	<30	35	Yes
R5	367 Booloocooroo Road	<30	35	Yes
R6	400 Booloocooroo Road	<30	35	Yes
R7	934 Wandobah Road	<30	35	Yes
R8	886 Wandobah Road	<30	35	Yes
R9	Carlyon Avenue	<30	35	Yes

6.3 Maximum Noise Level Assessment - Operations

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB LAeq(15min) and there are no operational noise sources that could be considered to cause maximum noise events.



6.4 Road Traffic Noise Assessment

Access to the site will be directly off Wandobah Road which would be the major transport route for all vehicles to the access the project site. During construction, traffic generated by the project include employee/subcontractor and delivery vehicles. The traffic volume over a typical day for standard construction hours is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 25 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peak hour periods.

Predicted noise levels from project related construction traffic at 15m from the road to represent the potential for receivers situated close to Wandobah Road between the project site and the township has been completed using the United States (US) Environment Protection Agency's road traffic calculation method and results are presented in **Table 16**. The US FHWA road traffic calculation method (based on equations in Appendix A-13) was used to predict the LAeq noise levels from construction vehicles travelling past receivers along public roads. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

Table 16 Predicted Construction Road Traffic Noise Levels				
Road Name	Offset Distance to	Predicted Noise Level	RTN Criteria	Compliance
Noad Name	Receiver			Achieved
Wandobah Road	15m	45dB LAeq(15hr)	60dBA LAeq(15hr)	Yes

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.



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7 Recommendations

7.1 Construction Noise Recommendations

It is noted that construction noise emissions are expected to exceed the relevant NMLs at the one nearest receiver to the project. Recommendations for consideration during construction activities to reduce emissions to the surrounding community for this project may include:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community;
- where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);
- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations;
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimise impact noise wherever possible;
- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm;
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.



7.2 Operational Noise Recommendations

Operational noise predictions identify that relevant noise criteria would be satisfied at all receivers. Notwithstanding, it is recommended that the proponent actively minimise potential noise emissions from the project. To assist in noise management for the project it is recommended that a one-off noise validation monitoring assessment be completed to quantify emissions from site and to confirm emissions meet relevant criteria.



8 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by ITP Development Pty Ltd (ITP) to complete a Noise Assessment (NA) for the proposed Gunnedah 2A Solar Farm 6.5km south of the township of Gunnedah, NSW. The assessment has quantified potential noise emissions associated with the construction and operation of the project.

The results of the NA demonstrate that construction noise levels have potential to exceed relevant construction NMLs at one nearest receiver to the project. Recommendations have been provided to minimise the potential noise impacts from construction, albeit of a temporary nature during the daytime over a three month construction period.

Operational noise levels satisfy the NPI PNTLs for assessed receivers. However, recommendations to ensure noise levels are verified have been provided in this report.

Additionally, the NA demonstrates that the road noise criteria as specified in the RNP will be satisfied at receivers on the proposed transport route.

Based on the NA results, there are no noise related issues which would prevent the approval of the project. The results of the assessment shows compliance with the relevant operational and road noise criteria. Accordingly, no additional ameliorative measures will be required.



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Appendix A – Glossary of Terms



A number of technical terms have been used in this report and are explained in Table A1.

Table A1 Glossary of Terms			
Term	Description		
1/3 Octave	Single octave bands divided into three parts		
Octave	A division of the frequency range into bands, the upper frequency limit of each band being		
	twice the lower frequency limit.		
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level		
	for each assessment period (day, evening and night). It is the tenth percentile of the measured		
	L90 statistical noise levels.		
Ambient Noise	The noise associated with a given environment. Typically, a composite of sounds from many		
	sources located both near and far where no particular sound is dominant.		
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human		
	ear to noise.		
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise,		
	the most common being the 'A-weighted' scale. This attempts to closely approximate the		
	frequency response of the human ear.		
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.		
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second		
	equals 1 hertz.		
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average		
	of maximum noise levels.		
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.		
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a		
	source, and is the equivalent continuous sound pressure level over a given period.		
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone		
	during a measuring interval.		
RBL	The Rating Background Level (RBL) is an overall single figure background level representing		
	each assessment period over the whole monitoring period. The RBL is used to determine the		
	intrusiveness criteria for noise assessment purposes and is the median of the ABL's.		
Sound power	This is a measure of the total power radiated by a source. The sound power of a source is a		
level (LW)	fundamental location of the source and is independent of the surrounding environment. Or a		
	measure of the energy emitted from a source as sound and is given by :		
	= 10.log10 (W/Wo)		
	Where: W is the sound power in watts and Wo is the sound reference power at 10-12 watts.		



 Table A2 provides a list of common noise sources and their typical sound level.

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Figure A1 – Human Perception of Sound





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PROVISION OF CONSULTING ENGINEERING SERVICES

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TRAFFIC ASSESSMENT REPORT

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1 INTRODUCTION

Triaxial have been engaged by ITP Development to prepare a traffic assessment report. The purpose of this report is to assess the traffic implications of the development proposal. This report is to be included in the development application lodged with Gunnedah Shire Council.

The site is currently utilised for grazing and is shown in the photo below:



Figure 1: Existing Site

PROPOSAL 2

2.1 **DEVELOPMENT SITE**

The site is proposed to be utilised by ITP Development for the construction of a 5MW AC solar farm on an area of approximately 12Ha size (from a total lot size of 49.6Ha) located at 781 Wandobah Road, Gunnedah.

The proposed development site is located near Gunnedah, approximately 6.5km South of the Gunnedah township, taken as the Wattle Street / Wandobah Road intersection. The site is currently zoned as RU1 primary production. The proposed site has not been identified as a possible future residential release area in the Gunnedah Shire Council Development Control Plan 2012 amended March 2020.

The closest residential subdivision is a rural acreage type development located approximately 1.7km to the North of the development site. The site is surrounded by existing farmland.

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The Wandobah Road along the frontage of the development site is constructed with a bitumen sealed pavement width of approximately 4.0m with unsealed shoulders and table drains approximately 1.0m deep either side.

The Northern end of the site is located approximately 8km from the intersection of the Oxley Highway and the Wandobah Road.

3 DESIGN SERVICE VEHICLES

3.1 CONSTRUCTION PHASE 0-3 MONTHS

It is proposed that the following vehicles will access the site during the following stages of the project:

Vehicles accessing the site during construction will consist of:

- 45 B-Double trucks (total number of B-Doubles over the construction phase.
- Light vehicles suitable for transporting up to 50 workers.
- Bus service for workers if required.

3.2 TYPICAL USE DURING OPERATIONAL PHASE

The following list depicts the weekly schedule of vehicles required for the facility to operate.

• Maintenance access vehicles (1 light vehicle) access to the site in 3 monthly intervals.

4 EXISTING TRAFFIC CONDITIONS

4.1 ROAD HIERARCHY – SURROUNDING ROAD NETWORK

The NSW administrative road hierarchy comprises the following road classifications, which align with generic road hierarchy as follows:

• **Oxley Highway (B56)** is a state highway, managed by Roads and Maritime Services, with primary function of providing vehicular access between Tamworth and Coonabarabran.

The B56 Oxley Highway is listed as an approved B-Double Route by RMS as shown in Figure 2.

• Wandobah Road is a local road, managed by Gunnedah Shire Council, with primary function of providing vehicular access South to for primary production purposes. Part of the Wandobah Road is listed as an approved B-Double Route by RMS as shown in Figure 2.

Approval for B-Doubles on Wandobah Road changes at the intersection of the Wandobah Road and Wattle Street, (near the Rugby Club) excluding a section of Wandobah Road approximately 4.5km from the development site, where B-Doubles are approved with travel conditions. Gunnedah Shire Council was contacted regarding any potential travel restrictions and it was noted none are applicable per the phone conversation with council staff on the 28th August 2020 at 10.10am.



Figure 2: Existing travel conditions. Source: RMS website: <u>http://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/</u>

4.2 EXISTING TRAFFIC DATA

At the time of this report the most recent traffic data available from Gunnedah Shire Council was unable to be sourced along the Wandobah Road.

Online traffic data available from RMS did not include any data for this section of the Wandobah Road.

5 PROPOSED TRAFFIC MANAGEMENT PLAN

5.1 PROJECTED TRAFFIC GENERATION POTENTIAL – TOTAL DEVELOPMENT

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Construction equipment is to be delivered to site via heavy vehicles between 10am – 2pm daily, hence not contributing to the AM or PM peak times.

Construction vehicle maximum trips per hour:

Total Development	30vtph max.	
Light vehicle access (workers	10vtph	
Light vehicle access (workers	s – worst case)	25vtph
B-Double	2vtph (out of pea	ak times)

Vehicle maximum trips per day (vtpd) during construction are listed below:

Total Development 50vtd max.	
Light vehicle access (workers with bus service)	10vpd
Light vehicle access (workers – worst case)	40vtpd
B-Double (Estimate of maximum total vehicles da	aily) 4vtpd

No reduction in these rates has been allowed for with pedestrian and cycle access to the facility. It is assumed that if all workers are accessing the site using light vehicles, there will be at least 2 workers per vehicle. Extra daily trips have been allowed for to access Gunnedah during the day if required. No weekend trips are expected.

Parking provided on site has accounted for these proposed daily trips. There will be 0.8 parking spaces per worker to be provided on site during the construction phase, a total of 40 parking spaces are to be provided.

As previously mentioned, the site will be unmanned during the operational phase and is expected to generate only up to two light vehicle trips in every 3-month period.

It is important to note that the greatest interaction with traffic external to the site will be during the peak PM period, estimated to be between 4pm – 5pm. The AM peak period with traffic heading to the site will not generate as many interactions due to the expected peak arrival time of 6am – 7am by the workers.
5.2 PROPOSED SITE ENTRY

We recommend that the site entry location be constructed in accordance with Triaxial plan TX15008.00-SK01, with a sealed access point from the Wandobah Road. The proposed site entrance has been designed to accommodate the turning path of a B-Double truck, with a sealed entrance a minimum of 26 metres into the site to minimise disruption to the Wandobah Road and ensure that a B-Double is able to que off the road if required to when accessing the site.

Refer Appendix B – Triaxial Plan TX15008.00-SK01

The proposed site entry location will have in excess of 250m of sight distance in either direction in accordance with the requirements of Austroads Guide to Road Design and Gunnedah Shire Council DCP requirements.

Refer Appendix A – Photos 1 and 2

5.3 CONSTRUCTION WORKER SITE ACCESS

As the site is located on the Southern side of Gunnedah and easily accessible via the Wandobah Road, the construction worker site access and parking areas should be constructed in accordance with appropriate safe construction site management principles.

Depending on the accommodation arrangements made by the successful building contractor in the construction phase of the project, care should be taken to avoid any impacts on the Gunnedah town centre. Possible impacts may be mitigated by sourcing accommodation away from the Gunnedah town centre, or the provision of a bus service to convey workers to site.

6 SUMMARY

In summary, the proposed construction of the solar farm will cause no major long-term effects to the surrounding road network due to the unmanned operation of the site requiring only minimal regular maintenance by a small number of staff.

Construction traffic appropriately managed with either a bus service for workers and/or out of peak hour deliveries to the site, combined with the construction of a new appropriate site entry catering for B-Double access will ensure traffic impacts are minimised during the short construction phase of the project.

APPENDIX A - SITE PHOTOS



Photo 1 Proposed site entry location off Wandobah Road looking North

Photo 2 Proposed site entry location off Wandobah Road looking South



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APPENDIX B - TRIAXIAL PLAN TX15008.00-SK01

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ALL CONSTRUCTION B-DOUBLE TURNS EXPECTED FROM
GUNNEDAH TO THE NORTH.
MINIMUM DISTANCE FROM ROAD TO SITE ENTRY REQUIREMENT
ALREADY MET.
REFER TRIAXIAL REPORT FOR SIGHT DISTANCE.

2.0m 0.0	4.0	8.0	12.0	16.0	20.0m
SCALE	1:200 AT A1	SHEET 1:4	400 at a3 sh	EET	
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Water Assessment

Gunnedah 2A Solar Farm



DOCUMENT CONTROL

Report Title		Water Assessment – Gunn	edah 2A Solar Farm	1	
Rev	Date	Status	Author/s	Reviewed By	Approved
1	8/10/2020	Final	M Talent	C Wilson	Approved

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We were established in 2003 and operate out of offices in Canberra (Head Office), Sydney, North Coast NSW, Adelaide and Auckland, New Zealand. We are part of the international ITPEnergised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.

Our regular clients include governments, energy utilities, financial institutions, international development donor agencies, project developers and investors, the R&D community, and private firms.



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1 INTRODUCTION

1.1 Overview

This report, which provides a desktop water assessment to support the Development Application for the project, includes a:

- Desktop review of local hydrology and catchment and water quality data.
- Desktop review of surface and groundwater quality data.
- Desktop review of the flood risk potential against the Local Environmental Plan.
- Desktop impact assessment against NSW policies and referenced industry standards for solar arrays.
- Desktop management assessment with mitigation measures recommended for construction and operation.

1.2 Limitations of Assessment

The assessment is based on publicly available information and data and does not include a site inspection, sampling, or any additional hydrological and/or hydraulic modelling.

2 PROJECT DESCRIPTION

2.1 Solar Farm

ITP Development (ITP) is proposing to develop the Gunnedah 2A Solar Farm (also referred to as Gunnedah 2A), as described in the solar farm summary sheet for this proposal (see Table 1). It will be located 6.5 kilometres to the south south west of the town of Gunnedah, NSW (see Figure 1). Details of the layout are contained in the drawing GND2A-G-210.

Parameter	Description
Site name	Gunnedah 2A Solar Farm
Lot/DP(s)	48/755474
Street address	781 Wandobah Road, Gunnedah, NSW 2380
Council	Gunnedah Shire Council
AC capacity	5.0 MW
DC capacity	6.4 MW
Project area	12 ha

Table 1 - Site Information

ITP is proposing to construct a solar farm with a DC capacity of 6.4 MW and AC output of 5 MW, on an approximately 12 ha site that is currently used for grazing and cropping.

There are to be approximately 12,000 solar modules installed on around 140 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The spacing between each row is 6.25m. The hub height of each tracker is around 1.5m, with the peak of the modules reaching a height of approximately 2.75m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm and the array tracker details are shown in drawing GND2A-G-210.

The solar farm will also include two 3 MW inverter stations. The station is to be located within the array and each are mounted on a 12.19m skid. Each of these inverter stations incorporates the high/medium voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing GND2A-G-210.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 50 personnel on site working from 7 am – 4 pm, Monday to Friday. The construction is anticipated to take approximately 3 months. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.



Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site can then be returned to the pre-development land use.



Figure 1 - Proposed solar farm site and surrounding area

2.2 Hydrology, climate and topographic conditions

The project area for the Gunnedah 2A Solar farm is within the Gunnedah Shire Council Area.

Gunnedah in NSW (264m AHD) is located in the central part of Namoi Water Resource Plan Area. Other towns in the broad vicinity include Tamworth (264m AHD) to the east, Manilla (363m AHD) to the north-east and Boggabri (251m AHD) to the west. The town of Gunnedah is situated on the Namoi River, which as a catchment area occupying 4% of the Murray-Darling Basin. Major tributaries include the Macdonald, Manilla, Peel, Mooki and Cockburn rivers; Coxs, Baradine and Bohena creeks. The topography of the Namoi River catchment is characterised by mountainous ranges with cool temperatures and high rainfall areas in the east to low rainfall areas on extensive riverine plains to the west. The Keepit Dam is upstream of Gunnedah and has a capacity of 426 GL making it a major irrigation storage (MDBA, 2020a). Water Assessment of the Gunnedah 2A Solar Farm October 2020



Agriculture is the main land use in the region and is dominated by cattle and sheep grazing, along with wheat, cotton and other broadacre crops on the alluvial floodplains (MDBA 2010). These landuse practices are dependent on the waterways of the catchment, especially for irrigation purposes (NSWDPI, 2006).



3 LEGISLATIVE CONTEXT

NSW has a comprehensive legislative and policy framework for the management of floodplain risk and flood prone areas of the state with clear areas of responsibility, as outlined below in Figure 2.



Figure 2 - Floodplain risk management and planning process

3.1 Local Government Act 1993

The Local Government Act provides the legal framework for the system of local governments of the state of NSW. Specific to this project is Section 733, which exempts councils from liability in relation to flood prone land under the provision that they have undertaken substantial assessments in accordance with the latest approval manual.

The 2005 gazetted Floodplain Development Manual is the current approved manual and supports section 733 and the NSW Government's Flood Prone Land Policy. Both the manual and the policy provide councils with the framework to implement processes, and sustainable strategies to manage the floodplain risks that specifically impact human occupation.

3.2 Environment Planning and Assessment Act 1979

This is an Act to instate an environmental planning system and assessment arrangement for NSW. In 2017, there were major amendments passed with a view to improving the planning system through simpler processes, improved strategic planning and community participation, in order to enable more balanced and transparent decision making. Section 3.43 makes provision for the preparation of development control plans by relevant authorities (outlined further in Section 3.4.1).

3.3 Water Management Act 2000

The Act offers sustainable and integrated management of the state's water sources for the benefit of both present and future generations. Water management principles are intended to Water Assessment of the Gunnedah 2A Solar Farm October 2020



guide decision-making under the Act in relation to floodplain management. They require the existing and future risk to human life and property, arising from occupation of the floodplain, to be minimised.

3.4 Gunnedah Local Environmental Plan 2012

The Gunnedah Local Environmental Plan (LEP) 2012 (current version for 17 April 2020) aims to make local environmental planning provisions for land in the shire in accordance with the relevant standard environmental planning instrument. The LEP includes specific information for residents in the town Gunnedah.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by specific state environmental planning policies. The Plan (Part 6.1) does provide specific management requirements for flood planning, which applies to land at or below the flood planning level (1 in 100 ARI plus 0.5m freeboard). It requires that development consent cannot be granted unless the proposed development is compatible with the flood hazard of the land, will not cause significantly adverse impacts to other developments, the environment and the community, and incorporates measures to manage risk to life. The site is shown in relation to a series of flood maps showing the flood planning area from the Gunnedah LEP (2012) in figure 3 and a flood risk study published by Lyall & Associates (2005) in figure 4. Figure 4 shows the site in relation to contours for a 100 year ARI floodway for the nearest available maps. The site for the proposed solar farm is approximately 6.5 kilometers from the nearest edge of the flood planning area associated with the Namoi River. Blackjack Creek is subject to 'flash flooding' after three hours of heavy rainfall (Lyall & Associates, 2010). The study site is approximately 700 meters from the upper reaches of Blackjack creek and the identified flood hazard zones, with a low ridge separating the site from the creek. However, it would seem that there is potential for some localized (minor) inundation from minor drainage lines running from a steep hill to the west.





Figure 3 - Site in relation to Gunnedah LEP Flood Planning Area (Source: NSW Legislation, 2020)



Figure 4 - Site in relation to 100 year ARI flood hazard (Source: adapted from Lyall & Associates, 2005 - pages 6 and 45)



3.4.1 Gunnedah Development Control Plan 2012

The Gunnedah Shire Development Control Plan (DCP) 2012 (amended in in March 2020) provides guidance for developments and the statutory planning controls of the Gunnedah Local Environmental Plan 2012 (NSW Legislation, 2020). The guidance provides proponents assistance with criteria to address in development applications.

The guidance on flood protection states that the consent authority must be satisfied on a number of points regarding developments, including that the development:

- a. Is compatible with the flood hazard of the land, and
- b. is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
- c. incorporates appropriate measures to manage risk to life from flood
- d. is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and
- e. is not likely to significantly adversely affect the environment or
- f. cause avoidable erosion, siltation, destruction of riparian
- g. vegetation or a reduction in the stability of river banks or watercourses,

Development Control Plans typically state that planning restrictions will apply to development on land below the 'flood planning level' of watercourses. The 'flood planning level' refers to "...the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard" (NSW Legislation, 2020, page 48).

NSW local government DCPs also typically provide guidance on stormwater drainage systems for rural lots and large residential lots, which are relevant to the proposed solar farm site. Guidelines typically suggest that, where drainage easements over downstream properties is required, consent from the owners of the downstream properties is to be submitted with the development application. The Gunnedah DCP states that measures to control stormwater flow and water quality are required including "...consideration of flows up to the 1 in 100 year ARI for existing natural flow, existing development flow and post developed flow" (Gunnedah Shire Council, 2020, section 5.5).

3.4.2 Gunnedah Shire Community Strategic Plan 2017 - 2027

The Gunnedah Shire Community Strategic Plan 2017-2027 is planned and executed under key themes identified through extensive community consultation. It is an update of the original Gunnedah Community Strategic Plan 2013 – 2023 which was developed following extensive consultation at the time and follows further community consultation in 2017 (Gunnedah Shire Council, 2017).Key outcomes identified for the ten years of the plan include:

• Engaging and Supporting the Community: We will have welcoming towns, villages and rural areas working in partnership to share the good times and bad, looking out for,



and supporting, one another. We genuinely care. Maintain and improve infrastructure that meets the needs of residents and industry.

- **Building Our Shire's Economy:** A prosperous, caring and proud community reflected in the achievements and aspirations of the people. Diversify our economic base to provide resilience and reduce dependence on any one industry;
- **Retaining Our Quality of Life:** We enjoy access to services and facilities in Gunnedah and Tamworth yet benefit from the peace, tranquillity, safety, security, beauty and friendliness of our rural community.
- **Protecting and Enjoying Our Beautiful Surrounds:** We embrace preservation of our heritage, our natural resources and our social fabric to achieve sustainability.

The only theme that specific mentions flood or water management aspects is protecting and Enjoying Our Beautiful Surrounds": "Reduce the impact of flooding on the community" and "Implement catchment management strategies to protect and rehabilitate waterways, artesian and water supplies" (Gunnedah Shire Council, 2017: sections 4.1.5 and 4.3.1): However, also implicit within the themes above, is the need for strategies that minimize the impact on the environment from development activities and to maintain and manage water quantity and quality.

3.5 State Environmental Planning Policy (Infrastructure) 2007

Part 3, Division 7 of the State Environmental Planning Policy (Infrastructure) 2007 relates to 'Flood Mitigation Work'. This policy provides details on the types of works which may be required for land that is susceptible to flooding by the probable maximum flood event, also known as flood liable land. The policy states that consultation with the relevant council is required if the proposal will alter flood patterns other than to a minor extent, and their response must be taken into consideration.

The Project area is not within the mapped flood planning area under the Local Environmental Plan and does not require additional flood mitigation work.

3.6 Protection of the Environment Operations (POEO) Act 1997

The POEO Act aims to protect, restore and enhance the quality of the environment in NSW, while still having regard for the ecologically sustainable development.

With relevance to the site, the Act aims to reduce risks to human health and avoid degradation of the environment by promoting pollution prevention, through the reduction of materials used and advocating the re-use, recovery or recycling of materials. The Act contains the requirements for the management of water discharges and the offences that relate to pollution. Section 148 requires that any pollution incidents, or those that threaten material harm to the environment, must be notified to the relevant authority (e.g., NSW Environment Protection Authority).

Water Assessment of the Gunnedah 2A Solar Farm October 2020



3.7 Soil Conservation Act 1938

This Act makes provisions for the conservation of soil resources and mitigation of erosion. The Act allows the Minister for Primary Industries¹ to issue soil conservation notices, declare areas to be sites of erosion hazard, proclaim works in catchment areas and outlines specific regulations regarding the Rural Assistance Act 1989.

Of general relevance to this project is the promotion of sustainable use and prevention of loss of soil resources from a site.

¹ Except Parts 2A, 3 and 4, and sections 15 and 30A insofar as they relate to Parts 2A, 3 and 4, jointly with the Minister for the Environment.

Water Assessment of the Gunnedah 2A Solar Farm October 2020



4 CATCHMENT AND FLOOD HISTORY

The Project is located in the Gunnedah Shire Council, to the south of the town of Gunnedah. According to spatial data from the Australian Hydrological Geospatial Fabric (Geofabric), the proposed facility is located within a large sub-catchment that includes part of the Mooki River to the East of Gunnedah before flowing into the Namoi River (see Figure 5 below). The project site is within a relatively flat east-facing slope, with heights ranging from approximately 325m (AHD) on the western side of the site to 315m (AHD) on the eastern side. (Figure 6). The surrounding area has some steep hills reaching heights of between 440-665m contour values. The centre of the site has an elevation of 320m (AHD), with the nearest part of the Namoi River having an elevation of 260m (AHD) ². The land is mostly cleared of native vegetation and is currently used for farming.



Figure 5 - Catchment of the project area identified in Geofabric

² Elevation values sourced from ELVIS - Elevation and Depth - Foundation Spatial Data (locations: -31.04165°/ 150.21934°and -30.972487°/ 150.259647°)

Water Assessment of the Gunnedah 2A Solar Farm October 2020





Figure 6 - Site topography

4.1 Historical Floods and Blackjack Creek Floodplain Risk Management Study 2010

The Gunnedah Shire Council (2009) provides a 1% AEP inundation map for the immediate town area which shows the potential for serious flooding of some urban parts of Gunnedah bordering the Namoi River to the North (Gunnedah Shire Council, 2018). Moderate to major flooding at Gunnedah occurs at volumes above 48,500 ML/d (NSWDPI, 2019b). Historically, Gunnedah has been subject to major flood events, with the February 1955 flood being regarded as the biggest single flood in the town's history (Worboys, 2019). A peak height of 707,000 ML was recorded for the February 1955 flood, with large floods in the order of 200,000 ML have occurred on average once per decade since the 1950s (NSW Office of Water, 2011). Recent floods in the Namoi River have been small to medium sized events in December 2010, November 2011 and February 2012, each with a peak flow of 60,000 to 80,000 ML/d (NSWDPI, 2019b)

An-depth floodplain risk study for Blackjack Creek by Lyall & Associates (2010) compliments an earlier flood study in 2005 by the same consultants. These studies show that Blackjack Creek is prone to flash flooding events that can impact some urbanised areas of Gunnedah between Lincoln Street and the Oxley Highway, a distance of 2kms along the main arm of the



creek. Modelling in the 2010 study indicates that a 100 year ARI flood would result in 104 residential properties being flooded at above-flood levels.

Figures 3 and 4 (above – Section 3.4) provide an indication of the location of the project site in relation to the modelled 100 year ARI flood contours and the Gunnedah LEP Flood Planning Area. These maps indicate that the project site is unlikely to flood from the direction of Gunnedah. The study site is approximately 700 meters from the upper reaches of Blackjack creek and the identified flood hazard zones, with a low ridge separating the site from the creek. However, it would seem that there is potential for some localized (minor) inundation from minor drainage lines running from a steep hill to the west.



5 AVAILABLE DATA

Climatic data and water quality and quantity monitoring information is available in the region as outlined in the following sections.

5.1 Rainfall for selected stations

The Bureau of Meteorology (BOM, 2020) has a station at the Gunnedah Pool (station number 055202). Table 2 outlines the average annual and maximum daily, monthly and annual rainfall for the Gunnedah Pool station another selected station (i.e., station number 55202 - Gunnedah Airport AWS). Average monthly values for these rainfall stations are provided in Table 3.

Table 2 - Rainfall

Station Number	Station Name	Period of Record	Rainfall (mm)				
			Average Annual	Highest Annual	Maximum Daily	Highest Monthly	
55023	Gunnedah Pool	2001 - 2020	616.7	1137.5	Not available*	367.6	
55202	Gunnedah Airport AWS	2001 - 2020	555.0	911.8	Not available*	197.2	

* Not available via BOM (2020) web portal [24/09/2020]

Table 3 - Average Monthly Rainfall

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
55023	53.9	49.1	34.4	30.5	32.3	37.6	32.2	34.7	34.0	49.1	53.4	60.8
55202	48.2	53.1	42.8	15.0	27.2	36.4	24.2	25.8	30.6	41.0	47.8	67.0

Flood-producing weather systems across the region include inland troughs, cold fronts, and thunderstorms. Consequently, each rainfall event is a function of the prevailing meteorological conditions. Therefore, the rainfall data provides useful information about expected seasonal rainfall in the area.

5.2 Streamflow

There is a government surface water monitoring site located on the Namoi River within 4.8km of the site. Streamflow records (Table 4) for this site are available for this location from the



WaterNSW Real-time portal. Another water monitoring site on the Mookie River (419084) is listed as having full streamflow records as well.

Table 4 - Stream Gauging Stations

Station Number	Station Name	Available/Relevant Data	Distance from project area
419001	Namoi @ Gunnedah	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	4.8 km northeast
419084	Mooki @ Ruvigne	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	5.8 km east

Generally, data from the available stream gauges do not provide specific information on local site flooding but are more useful in the context of assessing major regional flooding events that may impact on-site access. Information is publicly available from WaterNSW Real-time data portal and could be incorporated into site management plans.

5.3 Groundwater and Hydrogeological Conditions

Gunnedah falls within the Namoi Surface Water Resource Plan Area (SWRPA) as shown in Figure 7 below. The area between Boggabri and Piliga contains a number of high to very high ecological value instream areas (NSWDPI, 2019: 30). The geology of the Namoi SWRPA is characterised by young volcanics and extensive alluvial floodplains which have very productive heavy black and grey clays that are sought after for farming and irrigation (NSWDPI, 2019b: 8). Groundwater is contained in the unconsolidated sediments along the Namoi River and its major tributaries and is managed in as two resources - Upper and Lower Namoi Groundwater Sources. The alluvium of the Namoi River is by far the most important in the state in terms of groundwater use, providing water for stock use, domestic supplies, irrigation, industry and town water supplies (NSWDPI, 2019b: 17). Groundwater quality for the SWRPA varies (see figure 8 below), with the western part of the catchment being mostly saline (7,000 – 14,000 TDS mg/L). The eastern part of the catchment in the Tamworth and Gunnedah areas is moderate to fresh (0 – 500 TDS mg/L). A water sharing plan for the Namoi Alluvial Groundwater Sources 2020 is in place, with Upper Namoi Zone 3, Mooki Valley (Breeza to Gunnedah) Groundwater Source having a domestic and stock rights allocation of 199 ML/year, local water untility access licences of 198 ML/year and aquifer access licences of 17,101 unit shares (MDBA, 2020b). There are groundwater dependent ecosystems along the Namoi and Peel Rivers of high potential near Manilla and Tamworth, with moderate to low potential areas along the Namoi at Gunnedah (see Figure 10 below). The project catchment site does not fall within areas groundwater vulnerability of according to Environmental Planning Instrument (EPI) data (see figure 10 below and NSW Government, 2020).





Figure 7 - The the Namoi SWRPA (source: NSWDPI, 2019: 12)



Figure 8 - Groundwater quality and suitability in the Namoi catchment (source: NSWDPI, 2019b: 19)





Figure 9 - Groundwater management areas for the Namoi catchments (source NSWDPI, 2019b: 18)



Figure 10 - Groundwater dependent ecosystems near Gunnedah (source: BOM, 2020)





Figure 11 - The Project Geofabric Catchment and EPI Groundwater vulnerability areas

5.4 Surface Water and Riparian Conditions

The Namoi SWRP is designed to set out how the obligations of the Murray-Darling Basin Plan 2012 will be met in the area. NSWDPI (2019a) describes the Namoi SWRPA. Key surface flow characteristics for the Namoi River catchments are summarized below:

- The Namoi River flows in a westerly direction from its headwaters in the Great Dividing Range. Its main tributary, the Peel River, joins the Namoi near Gunnedah;
- The Namoi River contributes on average around 23 per cent of the flow of the Darling River upstream of Bourke;
- Gunnedah falls within the midland sub-region of the Namoi where the floodplain begins to broaden. Along these floodplains there are a number of long, narrow lagoons that represent prior channels of the Namoi River;
- The average annual flow in the Namoi River at Gunnedah is 653,000 ML;
- The mean daily flow of the Namoi River decreases from around 1,900 ML/day at Gunnedah to around 1,500 ML/d in the lower River at Bugilbone and Walgett;



- The mean daily flow in the Namoi River has decreased following the construction of the Keepit Dam in 1960 (see figure 12 below);
- The Namoi catchment has a number of significant wetlands. The largest of these is Lake Goran, a large internal drainage basin south of Gunnedah that covers more than 60 km2
- The aquatic and terrestrial environments of the Namoi catchment provide habitat for a large number of threatened species and ecological communities that are protected under the Threatened Species Conservation Act 1995;
- There are 28 threatened plant species, with 11 of these being listed as endangered. There are also 66 threatened animal species found within the catchment, including four species of amphibians, nine bats, 37 birds, 11 mammals and five reptiles.
- Four aquatic species that previously occurred within the Namoi catchment are listed as threatened under the NSW Fisheries Management Act 1994. These are the river snail, silver perch, purple spotted gudgeon, and the olive perchlet,

The majority of the Namoi River riparian area is listed as a key environmental asset as well as Lake Goran, south of Gunnedah which is independent of the river system and the largest wetland in the catchment (NSWDPI, 2019b see figure 13 below)

The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation.
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during project activities, potential for impacts have not been considered further.





Figure 12 – Annual flow in the Namoi River at Gunnedah 1892-2016 (source: NSWDPI, 2019:21)



Figure 13 – Key environmental assets and hydrologic indicator sites (source: NSWDPI, 2019b)



6 POTENTIAL IMPACTS

The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation.
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during project activities, potential for impacts have not been considered further.

6.1 Flooding

The flood planning area from the Gunnedah LEP (2012) and the 100 year ARI floodway modelled by Lyall & Associates (2005; 2010) indicate that the project site is at low risk of flooding from the direction Blackjack Creek and the Namoi River. There is some potential for localized (minor) inundation from minor drainage lines running from a steep hill to the west. The water will flow in a north-easterly direction towards the Mooki River.

6.2 Water quality and erosion

The project has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas. However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels (Cook & McCuen, 2013).

Furthermore, as the site has been historically used for farming there is very little natural ground cover vegetation. The eSPADE resource (NSWOEH, 2020), provides a Soils Profile Report (id: 1000212) for a site with 4.1 kilometres to the north of the proposed solar site (see figure 14 and table 5 below). The eSPADE sites to the west of the site are from open cut mines and not generally representative of the solar farm area. Site 1000212 indicates a soil profile with dark brown sandy loam with a massive structure and minimal cracks in the top horizons and red clayey sand in the lower horizons with a dry texture. There has been extensive clearing at the site with native pasture in the general area. There is the potential that the proposed solar site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.



Table 5 - Site details for eSPADE site 1004554

SOIL DESCRIPTION

Layer 0		
0.00 - 0.00 r	n	
	Coarse Fragments:	many (20-50%), as parent material, dispersed, weakly weathered, rounded, gravel (6-20 mm),
Layer 1	Horizon: A1	
0.00 - 0.30 r	m Texture:	sandy loam
	Colour:	dark brown (7.5YR 3/3) [moist] with no recorded mottles
	Structure:	massive (fabric is earthy)
	Coarse Fragments:	many (20-50%), as parent material, dispersed, weakly weathered, rounded, gravel (6-20 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	dry, texture modifier test result was no change, disruptive test
		result was very weak force, shearing test result was brittle,
	Field chemical tests:	Field pH is 6.0 (Raupach),
Layer 2	Horizon: A2	
0.30 - 0.50 m	Texture:	clayey sand
	Colour:	reddish yellow (orange) (7.5YR 6/6) [moist] or white (light grey) (7.5YR 8/1) [dry] with no recorded mottles
	Structure:	massive (fabric is earthy)
	Coarse Fragments:	many (20-50%), as parent material, dispersed, weakly weathered, rounded, gravel (6-20 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	dry, texture modifier test result was no change, disruptive test result was very weak force, shearing test result was crumbly,
	Field chemical tests:	Field pH is 5.5 (Raupach),
Layer 3	Horizon: B	
0.50 - 1.20 m	Texture:	sandy clay
	Colour:	red (reddish brown) (2.5YR 4/8) [moist] with no recorded mottles
	Structure:	weak pedality (fabric is smooth-faced peds)
	Coarse Fragments:	abundant (50-90%), as parent material, dispersed, weakly weathered, rounded, gravel (6-20 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	dry, texture modifier test result was no change, disruptive test result was moderately weak force, shearing test result was crumbly,
	Field chemical tests:	Field pH is 5.0 (Raupach),





Figure 14 - The location of the eSPADE site 1004554 (source: espade.environment.nsw.gov.au © State of NSW and Office of Environment and Heritage 2020)



7 PROPOSED MITIGATION MEASURES

7.1 Site accessibility and inundation

The site accessibility and potential for inundation issues may be managed in the project's risk management register(s) owing to the regional nature of the events and the potential to impact whole of site works. There should be procedures in place to halt construction during heavy rainfall to reduce impacts to the project construction and to increase sedimentation downstream.

7.2 Downstream sedimentation

Impacts associated with erosion and sedimentation resulting from construction activities can be minimised by undertaking works in accordance with provisions of the NSW government's best practice sediment and erosion control series, Managing Urban Stormwater: Soils and Construction (DECC, 2008).

Proposed mitigation measures associated with managing downstream actionable nuisance (sedimentation) are outlined in Table 6.

Stage	Measure	Activities/Approach
Design	Site drainage and water quality controls	 Design Basis Undertake hydrological assessment of the site's catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). Develop a site erosion and sediment control plan in accordance with the Blue Book. Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. Permanent site drainage should coincide with temporary arrangements where possible.
Construction and/or Demolition	Site drainage and water quality controls	 General site works: Catch drains to be located downslope of any proposed road works. Install location appropriate sediment fences or other applicable control measures, depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable.

Table 6 – Proposed Mitigation Measures

		 All stormwater collection points need to have appropriate sedimentation and erosion controls. Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness. Vibration grids or wash bays at all construction exits. Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow-like conditions are maintained. Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turfing and revegetation.
Construction and/or Demolition	Stormwater point source control	 In the event of concrete works: Do not undertake works if chance of heavy rain. Store rinsate³ water, if applicable, separately to other water on site and dispose of offsite as appropriate. Block on site drains in the area of the works and remove any contaminated runoff. In the event that dewatering practices are required: Pump hose intakes for withdrawing water from excavations will be elevated to minimise sediment pumping and directed to a containment area for settling prior to discharge. Limit direct discharge offsite (consistent with the design requirements for sediment pond discharge). Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed of offsite by vehicle. Material and waste storage areas should be designed and operated to minimise interaction with surface waters. Vehicle washdown areas should be located away from water courses.

³ A dilute solution of chemical resulting from washing the container and equipment with water, as defined by NSW EPA accessed 20 December 2018 https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/authorised-officers/glossary#r Water Assessment of the Gunnedah 2A Solar Farm October 2020



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Water Assessment of the Gunnedah 2A Solar Farm October 2020



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Decommissioning Assessment

Gunnedah 2A Solar Farm

ENGINEERING STRATEGY ANALYTICS CONSTRUCTION



DOCUMENT CONTROL

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Decommissioning Assessment of the Gunnedah 2A Solar Farm March 2021



ABOUT ITP DEVELOPMENT

ITP Development Pty Ltd (ITPD) is a developer of town-scale solar farms in regional Australia designed to match current and future electricity demand. We undertake solar farm landholder engagement, system design, planning approvals, financing, electrical connection approvals and commissioning. ITPD maintains relationships with multiple stakeholders to ensure projects are successfully delivered in accordance with their expectations.

We are part of the international ITPEnergised Group, one of the world's largest, most experienced and respected specialist engineering consultancies focussing on renewable energy, energy efficiency, and carbon markets. The Group has undertaken over 2,000 contracts in energy projects encompassing over 150 countries since it was formed in 1981.



ABBREVIATIONS

ha	hectare
ITPD	ITP Development
MW	Megawatt, unit of power (1 million Watts)
MWp	Megawatt-peak, unit of power at standard test conditions used to indicate PV system capacity
NSW	New South Wales
PV	Photovoltaic

TABLES

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1 INTRODUCTION

The proposed Gunnedah 2A Solar Farm (referred to as the Project) is located on Wandobah Road to the southwest of the Gunnedah township, within the Gunnedah Shire Council area, NSW (Figure 1). ITP Development (ITPD) is proposing to construct a 6.4 MW DC solar facility within the 49.6 ha site.

Parameter	Description
Solar farm name	Gunnedah Solar Farm
Site reference	Gunnedah 2A
Lot/DP(s)	Lot 48 DP755474
Street address	781 Wandobah Road, Gunnedah, NSW 2380
Council	Gunnedah Shire Council
AC capacity	5 MW
DC capacity	6.4 MW
Site area	49.6 ha
Project area	12 ha
Current land use	Grazing

Table 1 - Site information





Figure 1 - Proposed 49.6 ha solar farm site and surrounding farm area (note the project will comprise 12 ha within this area)

Decommissioning Assessment of the Gunnedah 2A Solar Farm March 2021



2 PROJECT DESCRIPTION

ITPD is proposing to construct a solar farm with a DC capacity of 6.4 MWp and AC output of 5 MW on an approximately 12 ha site that is currently used minimally for grazing.

There are to be approximately 12,000 solar modules installed in 140 rows (each row being approximately 103.5 m long and 2 m wide) running east to west. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. There is approximately 6.25 m spacing between each row. The maximum height of each module is 2.75 m.

The solar farm will also consist of an inverter station. The inverter station incorporates the high/medium voltage switchgear and transformers and two 3 MW inverters. The inverter station is ground mounted and incorporated on a 12.19 m skid.

The mounting system is constructed on piles that are driven into the ground. During construction there is expected to be 50 personnel on site working from 7 am -4 pm Monday to Friday. The construction is expected to take approximately 3 months. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 - 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site will be returned to the pre-development land use of agriculture.



3 DECOMMISSIONING

The Gunnedah 2A solar farm is intended to be operational for 35 years, at which point the solar farm will be decommissioned and the site returned to the original state.

3.1 Decommissioning Plan

The decommissioning process for the Gunnedah 2A solar farm will involve:

- Notification of stakeholders of proposed de-energisation
- De-energisation of the solar farm and disconnection of assets
- Removal of PV modules and associated infrastructure
- Removal of electrical wiring
- Rehabilitation of land

Relevant equipment will be brought to site to facilitate decommissioning, including amenities for site crew for the duration of the works. This equipment may include mobile cranes, excavators, skid steers, loaders, rollers/compactors, pile drivers, telehandlers, skip bins, water carts, temporary shipping containers for storage, site office and site ablution blocks.

3.1.1 Notification of stakeholders of proposed de-energisation

ITPD will contact Essential Energy, the state-owned enterprise responsible for operating the distribution network 12 months prior to the commencement of decommissioning.

Gunnedah Shire Council will be notified and any necessary permits or approvals required for decommissioning will be sought from the Council or issuing authority. Any measures stipulated in these approvals will be implemented prior to works commencing on site.

ITPD does not foresee any issues arising from stakeholder notification of decommissioning.

3.1.2 De-energisation of the solar farm and disconnection of assets

Essential Energy crew or subcontractors will be brought to site to disconnect the service mains from the point of connection and ensure full isolation of the site from the grid.

All aspects of the solar system will be turned off for safety prior to commencement of work on the site in accordance with the shut down procedure stipulated in the system operation manuals. All generation assets will be disconnected and isolated.

The inverter, transformer will be removed from the site via a crane onto a semi-trailer or ewaste dismantling, recycling, scrapping and safe disposal at the waste disposal facility identified in Section 5 of the associated waste assessment. If possible, the transformer can be reconditioned and refurbished for additional service life at another site.

The concrete foundations of the inverter, transformer will be excavated and the concrete recycled.

Decommissioning Assessment of the Gunnedah 2A Solar Farm March 2021



3.1.3 Removal of PV modules and associated infrastructure

At the end of their life, the PV modules will be removed from site and recycled appropriately. Reclaim PV are in the late stages of opening an end-of-life panel and battery recycling facility located in South Australia. A number of additional PV recycling plants are expected to be operational around Australia by the time of decommissioning. The PV module tracker structure will be disassembled. The steel piles will be excavated from the ground and recycled at a scrap metal facility.

Other site infrastructure, including the security fence surrounding the solar farm and other concrete on site will be removed and re-used or taken to a waste facility to be recycled where possible.

3.1.4 Removal of electrical wiring

Underground cabling and earthing networks will be excavated and recycled. Other cable materials, including cable covers, will be put into skip bins and taken to landfill. Any trenches excavated during this process will be refilled and levelled.

3.1.5 Rehabilitation of land

Any disruptions to the site created during the decommissioning process will be filled and/or levelled as required, such as the locations where piles were removed.

Gravel surfaces and accessways that were established as part of the development will be removed and the ground remediated unless a request is made by the landholder for it to remain for future use.

The site will be revegetated for cropping or grazing, as per the original use of the site in consultation with the landholder. It is intended that established landscaping, including trees planted during the construction, will remain on-site. If the removal of trees is requested by the landholder, a permit may be required.



4 SUMMARY

The project will predominantly generate waste during the construction and decommissioning phases, rather than during operation. To comply with the NSW legislation and policies, waste will be recycled or re-used where possible and only disposed of if no alternative is available.

Cardboard, scrap metal and wood from the construction phase can be recycled. Plastics and general waste will require disposal at the local waste facilities. Technology for recycling of PV panels is advancing rapidly worldwide and while recycling options currently exist, they are likely to be more advanced and readily available at the time of decommissioning. Options for recycling of PV panels should be reviewed as the project progresses.



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