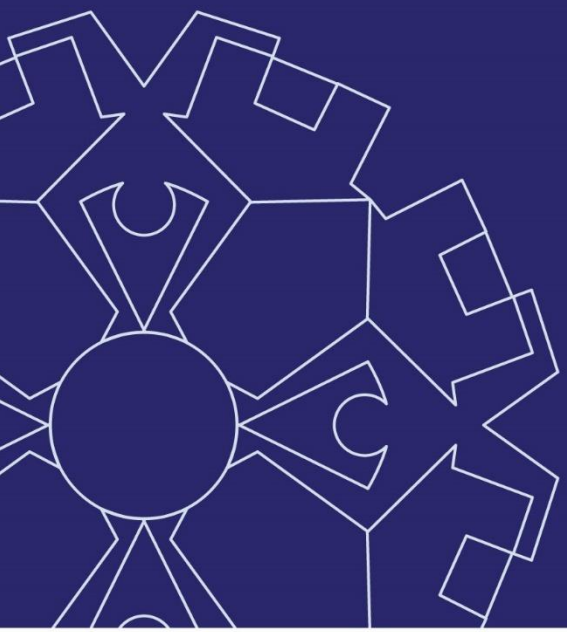
STATEMENT OF ENVIRONMENTAL EFFECTS
WAGGA WAGGA SOLAR FARM

PREPARED FOR
TERRAIN SOLAR

NOVEMBER 2017



• Civil, Environmental & Structural Engineering • Surveying • Environmental • Planning • Architecture

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ABBREVIATIONS

Acronyms

AC	Alternating Current
AER	Australian Energy Regulator
AHIP	Aboriginal Heritage Impact Permit
ANL	Acceptable Noise Levels
ARENA	Australian Renewable Energy Agency
ARPNSA	Australian Radiation Protection and Nuclear Safety Agency
APZ	Asset Protection Zone
BA	Biodiversity Assessment
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CEMP	Construction Environmental Management Plan
CO_2e	Carbon Dioxide Equivalent
CRTN	Calculation of Road Traffic Noise
DA	Development Application
DC	Direct Current
DCP	Development Control Plan
DMP	Decommissioning Management Plan
DoE	Department of Environment
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
EMF	Electric and Magnetic Field
EPA	Environment Protection Authority
EPC	Engineering Procurement Construction
ESD	Ecologically Sustainable Development
FTE	Full Time Equivalent
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
HV	High Voltage
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
LEP	Local Environmental Plan
LGA	Local Government Area
LGC	Large Generation Certificates
LLS	Local Land Service
LV	Low Voltage
NEM	National Electricity Market
NERR	National Energy Retail Rules
NHMRC	National Health and Medical Research Council
OEH	Office Environment and Heritage
OEMP	Operations Environmental Management Plan
OHTL	Overhead Transmission Line
PCT	Plant Community Type
PV	Photovoltaic
REAP	Renewable Energy Action Plan
RET	Renewable Energy Target
RFS	Rural Fire Service
RMS	Roads and Maritime Service
RNP	Road Noise Policy
SAT	Single-Axis Tracking System
SEPP	State Environmental Planning Policy
SJRPP	Southern Joint Regional Planning Panel
WAL	Water Access Licence
WBZ	Water Bearing Zone
WSP	Water Sharing Plan
WWCC	Wagga Wagga City Council
WWSF	Wagga Wagga Solar Farm

Units of measure

dB(A)	A-weighted decibel
GW	Gigawatt
GWh	Gigawatt Hour
Ha	Hectare
Km	Kilometre
kV	Kilovolt
kV/m	kilo Volts per metre
kW	Kilowatt
kWh	Kilowatt hour
m	Metre
mAHD	Metres Australian Height Datum
m/s	Metres per second
ML	Megalitre
MW	Megawatt
MWh	Megawatt Hour
MWp	Megawatt Peak
µT	micro Teslas

Executive Summary

The proposed Wagga Wagga Solar Farm (WWSF) is a 26 MW_{AC} electricity generation works that will be comprised of solar photovoltaic modules, steel racking and piled supports, electrical transformers and inverters, electrical cabling, telecommunications equipment, an operations and maintenance building, site substation and perimeter fencing. Infrastructure will occupy a footprint of approximately 70 hectares. The generated electricity will be exported into the network by a connection into the TransGrid substation located adjacent to the development site.

The development is consistent with the Commonwealth's Renewable Energy Target (RET) and both the NSW Government's *Renewable Energy Action Plan* and *Climate Change Policy Framework*. At a regional level the development complements the objectives of diversified energy production, promoting energy supply through renewable energy generation and encouraging renewable energy projects at locations with renewable energy potential and ready access to connect with the electricity network.

At a local level the WWSF, at the location proposed, is compatible with the strategic land use planning objectives that underpin the City of Wagga Wagga's *Bomen Strategic Master Plan (2010)* and *Spatial Plan 2013 – 2043*.

Once built the WWSF will generate 67,500 MWh of clean electricity a year, enough to power 11,600 households and displace 56,025 tonnes of greenhouse gas emissions annually. During the estimated twelve (12) month construction effort it will require a peak workforce of up to approximately 100 workers and will provide economic opportunities in the Wagga Wagga district.

The capacity and development footprint of the farm has been refined through the identification of constraints and opportunities mapped through the environmental impact assessment process. Stands of native vegetation on site will be retained and the farm layout provides a buffer for the majority of the 2nd order drainage line that traverses the site. Consultation with Aboriginal stakeholders has established in-principle support for the development and no objection to securing an Aboriginal Heritage Impact Permit for the sites recorded. Significantly, the archaeologist and the Registered Aboriginal Parties argue that establishment of the solar farm will have a net beneficial effect on the conservation of the integrity of Aboriginal heritage objects by breaking the cycle of cultivation and halting processes that incrementally degrade the integrity of the archaeological resource.

At the location proposed, the WWSF is not an incompatible land use with the potential to create land use conflicts for existing neighbours, or the industrialisation planned for the Bomen Urban Release Area immediately to the north of the site. It is not a threat to continued primary production activities for any neighbour. There would be no impact to any groundwater resource nor any fundamental change to surface hydrology in terms of peak discharge or the velocity of flows leaving the property. The development site is not flood prone.

Traffic, noise and vibration impacts associated with the proposed WWSF have been assessed as compliant with applicable guidelines. The potential for traffic impacts are restricted to the construction phase only and these impacts will be temporary, manageable and easily monitored. Adverse amenity impacts resulting from noise and vibration during the construction phase of the project are considered unlikely for receptors not associated with the development. Whilst the solar farm will be visible, the infrastructure associated with the farm is relatively low to the ground with the maximum module height approximately 2.6 m and farm infrastructure can essentially hug the site landform whilst preserving stands of native vegetation and maintaining a vegetated groundcover over the vast bulk of the site.

Harvesting sunlight is a passive land use and effectively constitutes an extended fallow that would provide benefits to soil health and water quality. The WWSF represents an ecologically sustainable development. There is no risk of serious or irreversible environmental damage; biological diversity and ecological integrity is being protected; the health, diversity and productivity of the environment is being maintained and enhanced for future generations; and producing carbon free electricity embodies the principle of improved valuation of a natural resource, solar energy.

Introduction

1.1 BACKGROUND

Terrain Solar is an Australian owned and operated business that is developing innovative and strategically located solar farms across regional Australia.

The company brings together industry leaders with a strong track record in the development of large-scale renewable energy projects. The team have collectively developed over 2,000 megawatts of renewable energy projects across Australia, South Africa and the Pacific Region and are specialists in the land use, planning, engineering, energy and finance sectors.

Terrain Solar is the development proponent of the Wagga Wagga Solar Farm (WWSF).

1.2 DEVELOPMENT OVERVIEW

The WWSF will generate electrical energy by converting solar radiation into electricity through the use of solar PV panels. The farm will operate year-round to generate electricity during daylight hours when electricity demand in NSW is at its peak. The farm will be monitored remotely with a limited on-site presence, apart from routine maintenance.

The farm will consist of solar panels, steel racking and piled supports, inverter stations, electrical cabling, telecommunications equipment, an Operations and Maintenance Building, site substation and perimeter security fencing.

The solar panels will be similar to those used for domestic purposes and will operate as a single axis tracking system (SAT) which follows the sun during the course of the day to ensure optimal energy generation. The farm will consist of linear strings of mounted panels organised into blocks. Each block will connect to an inverter station that will convert the direct current (DC) energy into grid compatible alternating current (AC) energy.

The farm will include a site sub-station comprising a transformer, switch gear and protection equipment. The generated electricity will be exported into the network by an overhead 66 kV transmission line into TransGrid's substation adjacent to the development site.

With the exception of TransGrid the grid connection does not entail infrastructure on any other third party's landholding.

The farm will have a generation capacity of 26 MWac and infrastructure will occupy a footprint of approximately 70 ha.

1.3 DEVELOPMENT LOCATION

The development site is located approximately 7 km north east of Wagga Wagga (refer **Figure 1**).

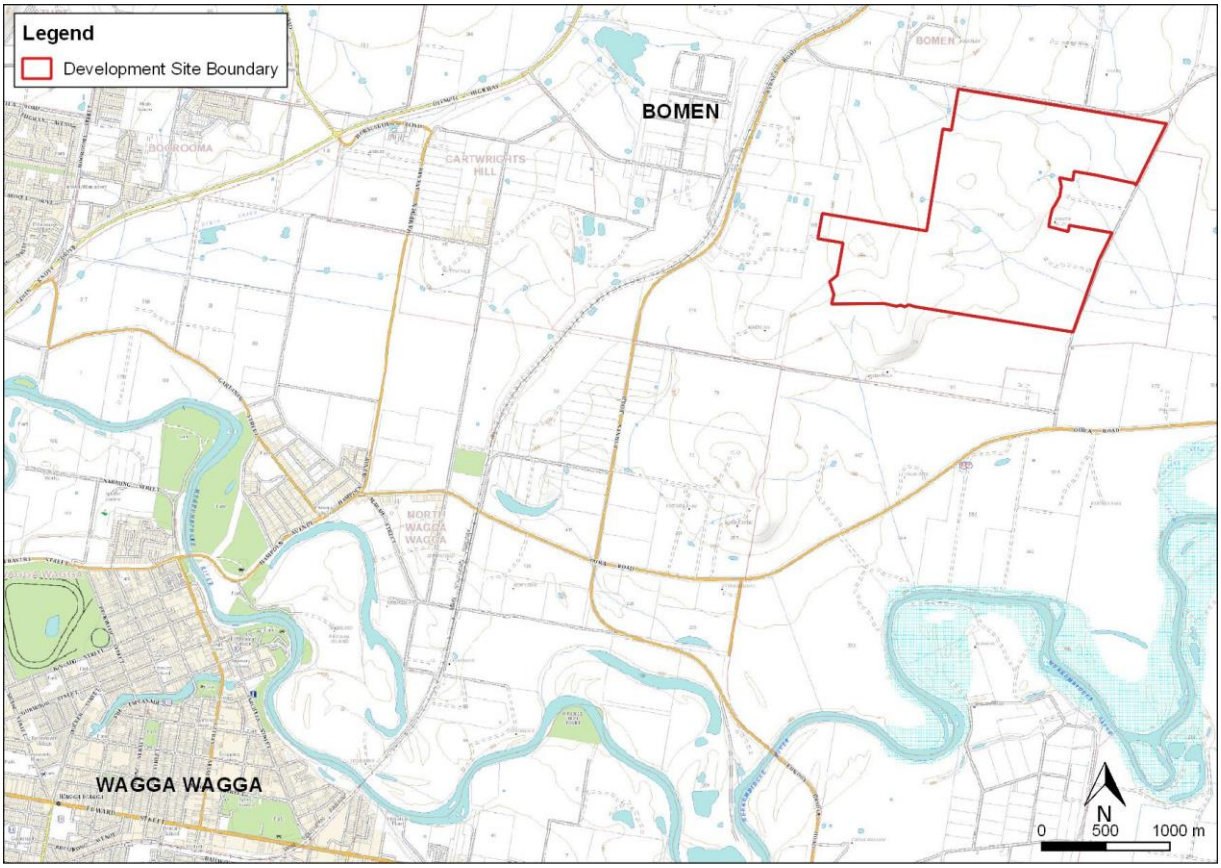

Figure 1: Development Location

1.4 STATEMENT PURPOSE

The construction and operation of the WWSF requires development approval under NSW planning legislation. This Statement of Environmental Effects (SEE) has been prepared to support a Development Application (DA) lodged with Wagga Wagga City Council (WWCC).

1.5 STATEMENT SCOPE

This SEE identifies and assesses the environmental impacts associated with the construction, operation, upgrading and decommissioning of the proposed WWSF.

1.6 STATEMENT STRUCTURE

This SEE has been structured to address those matters for consideration that a consent authority is to take into consideration general in determining a DA pursuant to s.79(c) of the *Environmental Planning and Assessment Act 1979*.

Section 2 describes the proposed development, including a description of associated infrastructure, and the solar farm's construction and operation.

Section 3 identifies the statutory planning context.

Section 4 identifies the process of identifying environmental issues associated with the solar farm.

Sections 5 – 16 identifies the receiving environment and assesses potential impacts associated with the solar farm's construction and operation.

Section 17 collates all environmental safeguards and mitigation measures that form part of the development proposal and the proponent's statements of commitment.

Section 18 provides a development justification.

Section 19 provides a checklist against relevant *Wagga Wagga Local Environmental Plan 2010* provisions and s.79(c) matters for consideration.

Appendix A – provides an Aboriginal Cultural Heritage Assessment.

Appendix B – provides a Biodiversity Assessment Report.

Appendix C – provides a Noise and Vibration Assessment.

Appendix D – provides a compliance assessment against relevant Development Control Plan (DCP) provisions.

The Development

2.1 DEVELOPMENT OBJECTIVE

The objective of the WWSF is to use solar PV panels to convert sunlight into carbon free electricity which will be sold in the National Electricity Market (NEM), create Large Generation Certificates (LGC) which will be sold to liable entities under the *Renewable Energy Act 2000* and produce electricity that will contribute to the Federal Government's RET of 33,000 gigawatt hours (GWh) by 2020.

2.2 DEVELOPMENT PROPOSAL

The development proposal includes the construction, operation, upgrading and potential future decommissioning of a 26 MW_{AC} PV electricity generating works and associated infrastructure, including grid connection to the TransGrid zone substation.

2.3 FARM CAPACITY

The WWSF will have a maximum capacity of 26 MW_{AC} and once operational will generate approximately 67,500 megawatt hours (MWh) of carbon free electricity annually.

The Australian Energy Regulator (AER) provides electricity benchmarks and in December 2011, as part of the National Energy Retail Rules (NERR), energy retailers have been required to publish consumption benchmarks on a residential customer's bill. In March 2015 the AER reported that the average annual household electricity usage in Australia in 2014 was 5,817 kilowatt hours (kWh) (ACIL, 2015).

Based on the above, the energy generated from the WWSF will be sufficient to service approximately 11,600 homes annually during the life of the farm. Census data on the number of households by Local Government Area (LGA) from 2016 reported a total of 22,397 households in the Wagga Wagga LGA, with an average household size of 2.5 persons.

The WWSF would supply approximately half of the electricity demand for all households in the Wagga Wagga LGA.

2.4 FARM DESIGN

2.4.1 CONCEPT DESIGN PRINCIPLES

The development footprint of the WWSF has been refined through consideration of the results of site investigations, including consideration of potential constraints and opportunities identified during the environmental impact assessment process, consultation with Wagga Wagga City Council, neighbours and liaison with TransGrid about network connection and Riverina Water.

Through this process a ~70 ha buildable development footprint has been identified. This development footprint would accommodate all electricity generating infrastructure and facilities associated with the development.

The Schedule of Drawings identify the development footprint, environmental features in the locality, the location of neighbouring dwellings, site access, the alignment of the grid connection and the farm layout and infrastructure. The layout as shown is indicative and may be subject to minor changes following detailed design and final equipment selection. Notwithstanding, the location, form and extent of infrastructure is accurate.

2.4.2 DETAILED DESIGN PROCESS

Contingent on securing planning approval the next step in the WWSF project would be to progress to detailed design. Terrain Solar will undertake this through awarding an Engineering Procurement and Construction (EPC) contract. An EPC contract is the most common form of contract used to undertake construction works for utility scale solar farms in New South Wales.

Under an EPC contract a contractor is appointed to deliver a complete project for a fixed price by a fixed date. The EPC contractor carries out the detailed engineering design of the project, procures all the equipment and materials necessary, and then constructs to deliver a functioning facility to their client.

For the WWSF Terrain Solar will have an EPC contractor design most elements of the farm and other elements will be designed by Terrain Solar.

As part of the detailed design a suite of very specific and targeted additional site investigations would be completed. These investigations are undertaken to 'lock-in' a final farm layout and inform the need for or extent of any preparatory earthworks around the solar arrays as required to meet structural tolerances for the tracker equipment, or site specific construction methodologies that may be required to mitigate potential impacts.

Development consent is a standard and logical 'hold-point' on projects before progressing to detailed design. It not only defers some project expenditure until there is greater project certainty, it also ensures all relevant consent conditions can be incorporated into the detailed design process.

The need to secure approval on a Construction Environmental Management Plan (CEMP), before works can commence, provides the regulatory check and mechanism for ensuring that what is built, and how, is consistent with the development consent and complies with all consent conditions.

2.5 FARM LAYOUT

2.5.1 ELECTRICAL GENERATION EQUIPMENT

The solar PV panel technology will be either crystalline silicone or Cadmium Telluride thin film. The panel modules will be connected together via a DC collection system consisting of cables mounted on the module support structure. The racking system will be Single Axis Tracking (SAT).

Fixed tilt systems hold the modules in a fixed orientation in relation to the sun and have no moving parts. A SAT system tracks the daily movement of the sun and motorised linkages rotate the modules from the east in the morning to the west in the afternoon; constantly aligning towards the sun to maximise energy output performance.

The modules are laid out in rows or strings, typically 5-6 m apart, depending on the technology used. The relative flatness of the WWSF site will lead to optimal spacing without output being affected by shading of adjacent strings. The racking system will be supported by steel piles. These are either hollow or C-sections or I beams which are either driven into the ground, screw piled or pre-drilled and driven into place.

Inverters convert the DC current to AC current and medium voltage transformers increase the voltage to the collection system rating. Contingent on detailed design and procurement, the WWSF will have up to 12 inverter stations. These inverter stations will be positioned throughout the module arrays with each power block of the solar farm corresponding to the capacity of the inverter station.

The AC collection system will consist of cabling at 22 kilovolt (kV) or 33 kV which will connect to each inverter station and deliver the electricity to a site substation. This substation will transform the voltage from the collection system to 66 kV grid compliant energy. The site substation will consist of a secure enclosure (up to 50 m x 30 m) with several items of electrical equipment and supporting structures. This will include a transformer to increase the voltage to 66 kV as well as essential switch gear, protection equipment and a small control room. The equipment and structures will be installed on concrete foundations and the substation yard will be kept free of vegetation. The site substation will be monitored remotely via a security system.

2.5.2 GRID CONNECTION

Grid compliant energy will be delivered to the network by a 66 kV overhead transmission line (OHTL) from the WWSF's substation connecting to TransGrid's substation located immediately west of the farm. The WWSF has been sized to take advantage of available capacity in the network. Studies are currently underway to design the connection and to identify the technical requirements for the operation of the farm.

Consultation has also commenced with Riverina Water with regards to erecting the 66 kV OHTL over a 5 m wide easement that exists near the substation (refer **Drawing EV06**).

2.5.3 ANCILLARY INFRASTRUCTURE

An Operations and Maintenance (O&M) building will be located in the north eastern corner of the farm. Staff will utilise this building during commissioning in order to advance the farm to its operational readiness. Once the farm is operational staff will occasionally visit the building as needed to monitor the performance of the farm and to diagnose faults. From the building there will be communications connections to the electricity market operator, TransGrid and the operation's team.

The building will provide basic amenities (sink and toilet), with a rainwater tank providing the water supply and a proprietary sewage treatment system for the minor volumes of domestic grade effluent that will be generated.

2.5.4 SECURITY FENCE

A security fence will be installed around the solar farm perimeter. This fence will be up to 2.1 m chain link with three barbs on top, for a total height of up to 2.4 m.

Outside this fence a 10 m wide asset protection zone (APZ) will be maintained to provide for bush fire control and tanker access.

2.5.5 LANDSCAPE PLANTINGS

The development as proposed includes the establishment of landscape screen plantings in the south east corner of the farm. The species used in this planting will include those listed in *Wagga Wagga Development Control Plan (Section 5, Table 5.2.2)* as native species of conservation significance.

The plantings will be at least 5 metres deep, and be comprised of at least 2 rows of staggered trees and shrubs. The location and extent of these planting is shown on **Drawing EV05**.

2.6 FARM CONSTRUCTION

2.6.1 DEVELOPMENT PROGRAM

Construction is estimated to take up to 12 months with an indicative scheduled program of activities provided below.

WAGGA WAGGA SOLAR FARM INDICATIVE PROJECT SCHEDULE																		
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Detailed Design																		
Civil Design																		
Strucural and Mechanical Design																		
Electrical Design																		
Grid Connection Design																		
Procurement																		
Piling																		
Modules																		
Inverters																		
Cabling																		
Substation																		
Construction																		
Mobilisation																		
Site Preparations, survey and set-out																		
Civil Works																		
Trenching and Conduits																		
Piling																		
Module / Tracker Installation																		
Inverters and Cabling																		
Grid connection Works																		
Commissioning																		

Figure 2: Indicative Construction Program

2.6.2 SITE ACCESS

The first task will be establishing a dedicated access off East Bomen Road.

2.6.3 SITE PREPARATION

Site facilities and construction laydown areas will be established within the development footprint and construction equipment will then be mobilised to the site. The security fence will then be erected.

The internal roads will then be formed and any site levelling completed to provide for the necessary PV panel ground clearance tolerances.

The extent of earthworks proposed is expected to be modest and the extent of these is ultimately dependent on the tracker technology employed. The driver for land forming is the requirement to provide ground clearance for the panels. The shorter the length of the tracker units, the less earthworks required.

2.6.4 SUBSTATION

The site substation will also be commenced at this phase. Civil works will be required to prepare the base including establishment of slab foundations and cable trenches. Concrete slab foundations will be poured and a gravel base will be laid down to create an all-weather compound. The transformer, switch gear and protection equipment will be installed on the slab foundations.

The site preparation and substation construction will require the use of plant such as bulldozers, water trucks, graders, flatbed trucks, skid steers, front end loaders, roller compactors, trenchers, backhoes, gravel trucks, cranes and aerial lifts.

2.6.5 SOLAR PV MODULES

Following site preparation the supporting structures and the solar modules will be installed. The site will be surveyed and locations of all the major equipment will be pegged or marked on the ground. The hollow sections or flanged sectioned steel piles which support the racking system will be driven into the ground pneumatically or alternatively, holes will be screwed or bored and the piles will be either driven or grouted in position.

Piles may be cut off to height and the steel racking assembly will be attached according to the manufacturer's proprietary system. The solar PV modules will then be installed on the racking and secured in position to withstand wind loading. Once the modules have been installed the DC collection cables will be laid on the structure and terminated to the modules.

This phase will require the use of equipment including all-terrain plant like telehandlers, pile drivers, augers, forklifts, welders, oxy acetylene, trenchers, excavators, pickup trucks, water trucks, flatbed trucks and cranes.

2.6.6 INVERTER STATIONS AND ELECTRICAL COLLECTION SYSTEM

Once the PV modules have been installed, or in parallel with the post installation, cable trenches will be excavated and AC and DC cables will be laid. Trenches will be backfilled with excavated material or imported thermal fill and cables will be terminated to the modules. Trench details are determined by *Australian Standards* and voltage specifications.

The medium voltage cables will be terminated to the inverter stations. Testing and quality assurance will be carried out as connections are made.

2.6.7 GRID CONNECTION

Grid connection will involve erection of a 66 kV OHTL from the WWSF's substation into TransGrid's substation.

2.6.8 COMMISSIONING

Once all the inverter stations and electrical collection system has been installed commissioning of equipment will be undertaken. Commissioning will include terminations, testing, calibration and troubleshooting. The inverters, transformers, collection system, solar PV array and substation will be tested prior to commencement of commercial operations to ensure any system issues are rectified. Upon completion of successful pre-functional testing the solar farm can be connected to the TransGrid substation and it will be ready to export electricity.

2.6.9 CONSTRUCTION COMPOUND

To facilitate construction there will be a construction compound containing site offices and amenities, vehicle parking and equipment laydown areas.

2.6.10 CONSTRUCTION WORKFORCE

Over the twelve (12) month construction effort the demand for labour will vary depending on the site activities being undertaken. Installation and commissioning of modules is labour intensive and employment is expected to peak at approximately 100 on-site workers involved directly in project construction. This peak period is expected to extend over a six (6) month period. Outside this peak the workforce is expected to drop to 20 or less.

These jobs will include construction managers, electricians, fitters, various plant operators, mechanics and other skilled and semi-skilled labour, including general labourers.

Terrain Solar's intent is to award a contract to an Engineering, Procurement and Construction (EPC) contractor that has a commitment to maximise local employment opportunities.

2.6.11 MATERIALS AND RESOURCES

2.6.11.1 Water

Water demand during construction will be limited to that required for dust mitigation and/or moisture conditioning of material, as well as a potable supply for construction staff. The former will be sourced from a legal supply point and trucked to the site in a bulk tanker. The potable supply will be provided through bottled water.

Dry port-a-loos will be provided for amenities throughout construction negating the need for on-site domestic sewage treatment.

2.6.11.2 Sand and Gravel

The establishment of internal access roads and compacted hardstand areas around the construction compound will require gravel. Sand will be required for the bedding of cabling in the trenches before backfilling. These materials will be sourced from local suppliers.

2.6.12 HOURS OF WORK

Construction activity is proposed to be undertaken in accordance with the Environment Protection Authority's (EPA) recommended standard hours for construction; these being:

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm on Saturday
- No works on Sunday's or Public Holidays.

2.7 FARM OPERATION

2.7.1 MAINTENANCE ACTIVITIES

Following commissioning the WWSF will begin operating with the production of electricity fed into the electricity grid. The solar modules will operate during daylight hours, seven days per week, 365 days a year.

The farm will also be monitored remotely from an off-site location and apart from a routine maintenance program, specialist operators will only visit the farm when responding to any performance issues (i.e. where actual output measured by the monitoring system deviates from generation forecasts and other key performance metrics).

The farm will generate up to three (3) full time equivalent employees.

Activities at the farm that will be part of a routine maintenance program will generally be limited to:

- Equipment, cabling, substation and communications system inspection, maintenance and testing, and repair and replacement as required.
- Fence, access and internal road, and control room maintenance and management.
- Vegetation (fuel load), weed and pest management.
- Possible solar PV module washing on an as-needed basis.
- Security monitoring.

2.7.2 SOLAR PV MODULE WASHING

Water use for regular washing of modules is not expected to be required. In the event of an abnormal soiling event (e.g. due to a particularly severe dust storm) water would be trucked to the site and the modules cleaned with a portable pressure washer without the use of any detergent or cleaning agent.

2.7.3 FUEL MANAGEMENT

Fuel management will be a key ongoing activity targeting bushfire risk prevention. Groundcover within the solar farm will be proactively managed to avoid excessive fuel loads (which would also compromise the solar farm's performance) and prevent the proliferation of any noxious weeds.

2.8 FARM UPGRADING

Upgrading of the farm would include the augmentation and/or replacement of solar panels and ancillary infrastructure within the development footprint.

2.9 FARM DECOMMISSIONING

It is proposed that no later than 12 months before the intent to decommission the WWSF the owner of the WWSF will provide a Decommissioning Management Plan (DMP) to WWCC for approval.

The DMP would detail what decommissioning would entail and how it would be conducted. All above ground infrastructure would be removed from the site and sold as scrap metal, recycled or otherwise disposed of at approved facilities."

The primary objective of the DMP would be to restore the land capability to its pre-existing agricultural value and use.

Statutory Planning

3.1 DEVELOPMENT SITE

Infrastructure associated with the solar farm, inclusive of the grid connection, will be located on lands as described in **Table 3.1**.

Table 3.1 – Development Land

Development Component	Lot/Deposited Plan
Solar Farm	Lot 15 DP 1108798
Grid Connection	Lot 15 DP 1108798 and Lot 1 DP 1115229

3.2 PERMISSIBILITY

Pursuant to *State Environmental Planning Policy (Infrastructure) 2007:*

- an electricity generating works means a building or place used for the purpose of making or generating electricity; and
- a solar energy system means, amongst other things, a PV electricity generating system.

The WWSF will be both a place used for the making of electricity and a PV electricity generating system. The WWSF is therefore both an electricity generating works and a solar energy system.

Development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural zone. The development site, zoned RU1 – Primary Production under the *Wagga Wagga Local Environmental Plan 2010* (Wagga LEP), is a prescribed rural zone.

A solar energy system is permitted with consent on any land.[1]

The WWSF is a permissible development subject to securing development consent.

3.3 REGIONAL PLANNING PANEL

The WWSF is an electricity generating works with a capital investment value of more than $5 million and pursuant to Schedule 4A of the *Environmental Planning and Assessment Act 1979* constitutes a regional development. As such, the responsibility for determining the DA is conferred upon the Southern Joint Regional Planning Panel (SJRPP). The WWSF does not have a capital investment value >$30 million and is not a state significant development.

3.4 INTEGRATED DEVELOPMENT

The WWSF is also integrated development, pursuant to s.91 of the *Environmental Planning and Assessment Act 1979*, as it will require:

- an Aboriginal Heritage Impact Permit under s.90 of the *National Parks and Wildlife Act 1974*;
- a controlled activity approval under s. 92(2) of the *Water Management Act 2000*; and
- a consent under s.138 of the *Roads Act 1993*.

The basis for these integrated triggers is described below.

[1] The exception to this is a system > 100 kW on residential land – which is not the case for the WWSF project.

3.5 STATE LEGISLATION

3.5.1 BIODIVERSITY CONSERVATION ACT 2016

The *Biodiversity Conservation Act 2016* (BC Act) and *Local Land Services Act 2013* (LLS Act) commenced on the 25th August 2017 and has replaced the *Threatened Species Conservation Act 1995*.

Under Part 7 (1 e) of the *Biodiversity Conservation (Savings and transitional) Regulation 2017* projects assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* are permitted to be assessed under the old legislation if the DA is lodged within 3 months of the commencement of the new Act.

3.5.2 THREATENED SPECIES CONSERVATION ACT 1995

The *Threatened Species Conservation Act 1995* aims to conserve biological diversity, promote ecologically sustainable development, prevent extinctions and promote recovery of threatened entities, protect critical habitat, assess the impacts of actions on, and encourage the conservation of threatened entities. The Act contains lists of critically endangered, endangered, and vulnerable species, populations and ecological communities, as well as a list of key threatening processes in NSW. Where a significant impact is likely to occur a Species Impact Statement (SIS) must be prepared for projects assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*. The Biodiversity Assessment undertaken for the WWSF has determined that a significant impact is not likely to occur.

3.5.3 NATIVE VEGETATION ACT 2003

The *Native Vegetation Act 2003* was repealed as of the 25th of August 2017. Consultation with the Murrumbidgee Local Land Services (LLS) has confirmed that removal of vegetation for the WWSF does not require consent from the LLS.

3.5.4 NATIONAL PARKS AND WILDLIFE ACT 1974

The Aboriginal Cultural Heritage Assessment undertaken as part of site investigations and consultation with Aboriginal stakeholders (refer **Appendix A**) has established that an Aboriginal Heritage Impact Permit (AHIP) is required pursuant to the *National Parks and Wildlife Act 1974*.

3.5.5 WATER MANAGEMENT ACT 2000

The development does entail the upgrade/construction of two internal road crossings on a mapped waterway, and the erection of infrastructure within 40 m of this waterway.

Pursuant to the *Water Management Act 2000* a controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land.

Waterfront land means the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river. The prescribed distance is 40 m. The Act defines a river as including any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved.

A controlled activity means:

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

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

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

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

Based on the above the development requires a controlled activity approval under s. 92(2) of the *Water Management Act 2000*. However, pursuant to the *Water Management (General) Regulation 2011* any activity carried out in connection with the construction or use of fencing, or of a vehicular crossing or an access track, that does not impound water, being an activity carried out in, on or under waterfront land relating to a minor stream, and within a rural zone (other than a rural village) under an environmental planning instrument, is exempt. A minor stream includes a second order stream. The mapped waterway on the development site is a second order stream and is therefore exempt.

Notwithstanding, solar farm infrastructure, including panels and tracker assemblies, will be constructed on waterfront land and as such, will a controlled activity approval.

The development does not involve the penetration of an aquifer, the interference with water in an aquifer, the obstruction of the flow of water in an aquifer, or the taking of water from an aquifer. An aquifer interference approval is not required.

3.5.6 FISHERIES MANAGEMENT ACT 1994

While a drainage line does exist within the development site, this landscape feature is dominated by exotic pasture species, does not support aquatic vegetation or experience regular inundation of water and does not constitute aquatic habitat. None of the drainage lines within the development site are mapped as Key Fish Habitat.

The objects of Division 3 of the Fisheries Management Act 1994 are to conserve the biodiversity of fish and aquatic vegetation and to protect fish habitat by providing for the management of dredging and reclamation work, consistent with the objectives of ecologically sustainable development.

Dredging work means any work that involves excavating water land, or any work that involves the removal of material from water land that is prescribed by the regulations as being dredging work to which this Division applies. Reclamation work means any work that involves: using any material to fill in or reclaim water land, or depositing any such material on water land for the purpose of constructing anything over water land. Water land includes land submerged by water, whether permanently or intermittently.

The drainage line within the development site satisfies the definition of water land and the development does entail the upgrade/construction of two internal road crossings and solar infrastructure (PV panels and tracker assemblies) on this water land. Notwithstanding, this watercourse does not fit the definition of Key Fish Habitat (KFH) and is not mapped as KFH and a permit for dredging, reclamation or obstructing fish passage is not required under s.201 of the *Fisheries Management Act 1994*.

3.5.7 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

The development is not a scheduled premise and does not require licensing under s.48 of the *Protection of the Environment Operations Act 1997*.

3.5.8 ROADS ACT 1993

Under the *Roads Act 1993* a person must not carry out a work in, on or over a public road without the consent of the appropriate roads authority. East Bomen Road is a local road for which WWCC is the appropriate road authority. Works to establish a new access to the solar farm off East Bomen Road will require a consent under s.138 of the *Roads Act 1993*.

3.6 STATE PLANNING POLICIES

3.6.1 SEPP 55 - REMEDIATION OF LAND

A search of the NSW EPA *List of NSW contaminated sites notified to EPA* and the *Contaminated Land Record* did not identify contaminated sites at or near the site. Pursuant to Clause 7 of *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land to be disturbed by the proposed development would be contaminated.

WWCC confirmed during the pre-lodgement meeting that there are no contamination records for the development site. However, as directed by WWCC, a GIPA search was undertaken to check historical records relating to the development site. These records did not identify any contamination records or information to suggest that contaminating land uses have occurred at the site.

3.6.2 SEPP – RURAL LANDS 2008

Pursuant to clause 2 of the Rural Lands SEPP the aims of the policy include:

(a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,

(b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State,

(c) to implement measures designed to reduce land use conflicts,

(d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,

(e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The site is not identified as being state significant agricultural land under the Rural Lands SEPP.

The WWSF will not compromise the orderly and economic use and development of rural lands for rural and related purposes, compromise the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State, increase land use conflicts or impact significantly on state significant agricultural land.

3.6.3 SEPP 44 – KOALA HABITAT PROTECTION

SEPP 44 encourages the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure that permanent free living populations will be maintained over their present range. Wagga Wagga LGA (Wagga LGA) is listed as a Local Government Area to which the SEPP applies.

White Box (*Eucalyptus albens*) is a primary feed tree however minimal White Box trees occur in the study area. The dominant eucalypt in the area is Yellow Box (*Eucalyptus melliodora*) which is considered a secondary feed tree for Koalas. Given the Koala was not recorded during the field survey undertaken as part of the ecological investigations, and no records occur within 10km of the study area, it was concluded that due to the highly fragmented and cleared landscape, the development site does not support a resident population of Koalas.

3.6.4 SEPP 33 – HAZARDOUS AND OFFENSIVE DEVELOPMENT

The proposed WWSF does not pose a significant risk in relation to the locality to human health, life or property, or to the biophysical environment. It is not a potentially hazardous industry. Similarly, the WWSF would not emit a polluting discharge which would have a significant adverse impact in the locality or on the existing or likely future development on other land. The proposed WWSF is neither a hazardous nor offensive industry.

3.7 COMMONWEALTH LEGISLATION

3.7.1 ENVIRONMENT PROTECTION BIODIVERSITY CONSERVATION ACT

Referral to the Australian Government Minister for the Environment under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* is not required (refer **Appendix B**).

3.7.2 RENEWABLE ENERGY ACT 2000

The *Renewable Energy Act 2000* establishes solar as an eligible energy source under the Commonwealth's RET. Creating LGC's from the WWSF, which can then be sold to liable entities, is subject to the approval of the Clean Energy Regulator pursuant to the *Renewable Energy Act 2000.*

Environmental Issues

4.1 IDENTIFYING POTENTIAL CONSTRAINTS

The process of identifying key potential environmental issues associated with the construction and operation of the WWSF commenced with a preliminary desktop risk assessment that identified the likely planning and environmental issues associated with the development and discussions with WWCC in a Pre-Lodgement Meeting.

Site inspections and specialist surveys were then completed to ground truth the biophysical data sourced from the desktop assessment and inspect the features in and around the development site.

Targeted consultation with the closest adjoining neighbours was then undertaken with respect to specific issues. The purpose of this consultation was to provide details of the development, explain the approvals process and the associated opportunity for input as a result of public exhibition, answer questions and understand issues of concern or interest to these neighbours.

The objective has been to accurately identify and map features of the development site and its surrounds that could represent a design constraint and to inform the impact assessment methodologies.

4.2 ENVIRONMENTAL ISSUES

The following have been identified as the key potential environmental issues associated with the WWSF:

- Land Use
- Aboriginal Heritage
- Biodiversity
- Amenity values for neighbours (visual and noise impacts)
- Hydrology

Other environmental issues include:

- Water quality
- Traffic
- Air quality
- Waste management
- Electromagnetic Interference

Land Use

5.1 ZONE OBJECTIVES

The development site is located on land zoned RU1 – Primary Production under the *Wagga Wagga Local Environmental Plan 2010* (Wagga LEP). The objectives of this zoning 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 foster strong, sustainable rural community lifestyles.
- To maintain the rural landscape character of the land.
- To allow tourist and visitor accommodation only where it is in association with agricultural activities.

A solar farm is not inconsistent with these objectives.

It will not diminish or degrade the natural resource base. To the contrary, as a passive land use harvesting sunlight a solar farm provides a capacity to reduce impacts on soil and water resources compared to farming and grazing, and have no off-site impact that would compromise the use of neighbouring lands for primary production purposes.

It will not fragment or alienate resource lands, nor create conflicts between land uses within this zone and/or existing and future planned industrial land uses within adjoining zones.

Whilst the WWSF will impact on the existing rural landscape character of this land, as detailed below, the landscape character in the immediate vicinity of the WWSF is destined for significant change with the Bomen Urban Release Area (BURA).

As shown in **Figure 3** lands to the north and west are zoned IN1 - General Industrial, with the objectives of this zone:

- To provide a wide range of industrial and warehouse land uses.
- To encourage employment opportunities.
- To minimise any adverse effect of industry on other land uses.
- To support and protect industrial land for industrial uses.

The types of development permitted in this zoning, contingent on securing development consent, include depots; freight transport facilities; general industries; industrial training facilities; light industries and warehouse or distribution centres.

An area of land to the west is also zoned RE1 Public Recreation, with the objectives of this zone:

- To enable land to be used for public open space or recreational purposes.
- To provide a range of recreational settings and activities and compatible land uses.
- To protect and enhance the natural environment for recreational purposes.
- To protect and enhance the natural environment generally and to assist in ensuring that areas of high ecological, scientific, cultural or aesthetic values are maintained or improved.

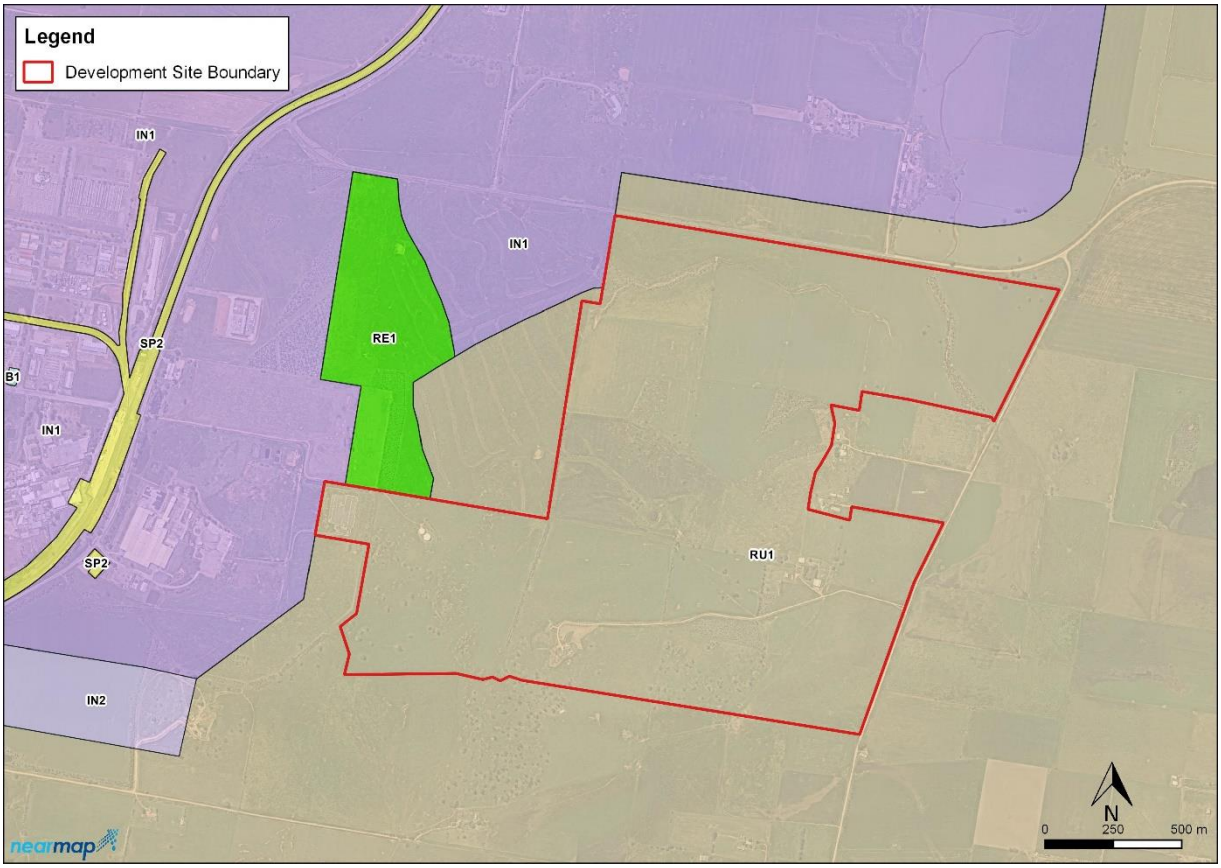

Figure 3: Land use zoning

As noted in **Section 19.1** public exhibition of a planning proposal closed in mid-October 2017 for the rezoning of part of the land to the west of the development site from RE1 to E2. This land relates to the Bomen axe quarry reserve and will not be impacted by the proposed solar farm.

5.2 STRATEGIC SUITABILITY

5.2.1 BOMEN INDUSTRIAL AREA

The development site is located adjacent to lands mapped as the Bomen Urban Release Area (BURA) (refer **Figure 4**). The development of land within the BURA is regulated through Clause 6.3 of the *Wagga Wagga Local Environmental Plan (LEP) 2010* and the *Wagga Wagga Development Control Plan 2010 (WWDCP).*

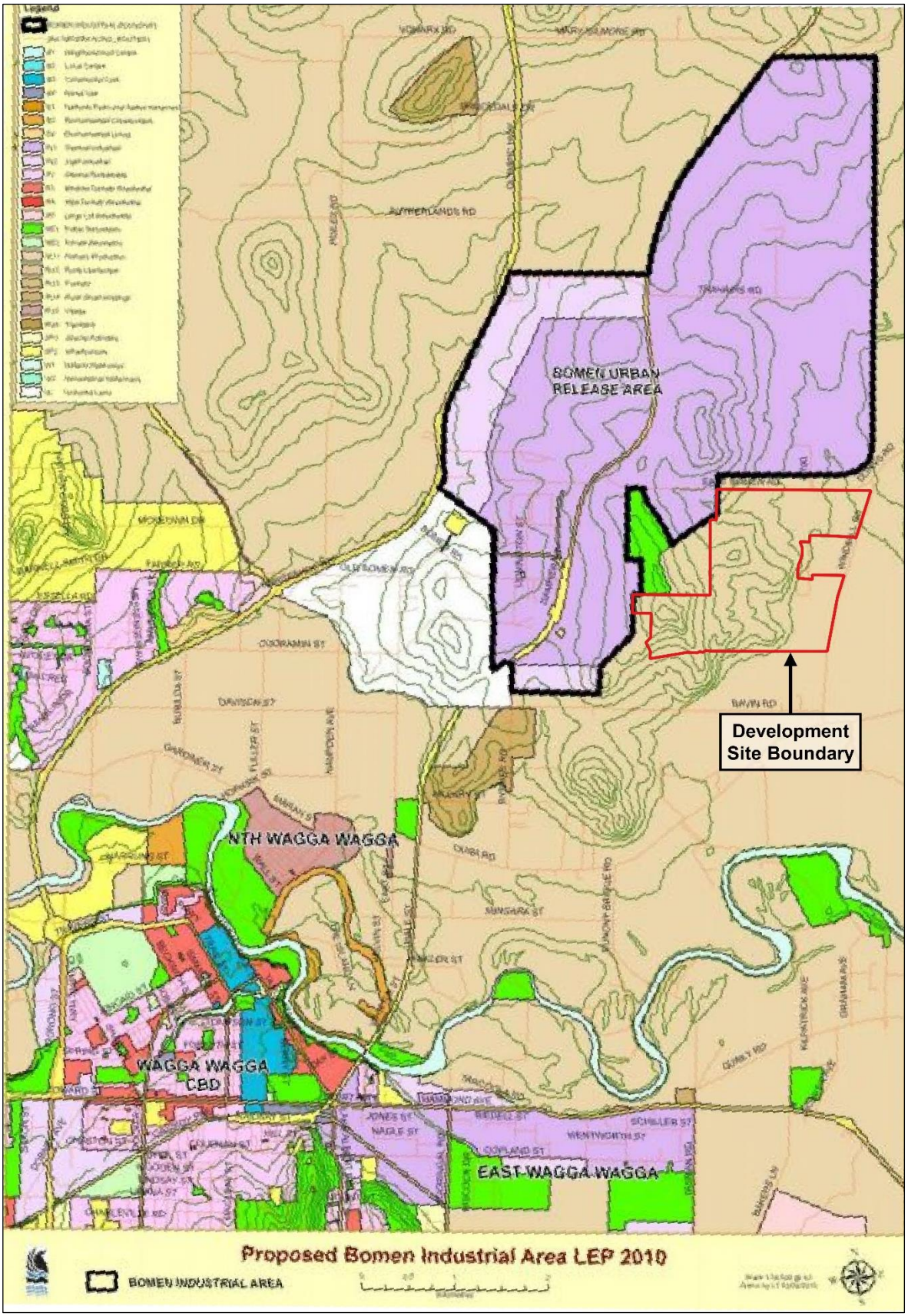

Figure 4: Bomen Urban Release Area (WWDCP)

Land use developments within the BURA are managed strategically, and within the context of complementing Council's *Bomen Strategic Master Plan (2010)* (BSMP).

The BSMP states that the vision for Bomen's future is:

> *In 2030, the Southeast Australian Logistics hub (SEAL) is:*
> *1 The intermodal transport terminal of choice for industries and transport businesses across southeastern Australia.*
> *2 A well planned place of industry that takes full advantage of its location, accessibility and infrastructure; and an internationally renowned exemplar of ecologically sustainable development through deployment of the principles of industrial ecology.*
> *3 One of the most resource and energy efficient places of business nationally.*
> *4 Fully serviced by support businesses, providing services that foster economic development and sustained business and jobs growth.*
> *5 Supplied with infrastructure for transport, energy, communications and resource and materials sharing that is economically and environmentally effective.*

The WWDCD states that:

> *The vision for Bomen is for the Bomen Industrial Area to be a high-quality and nationally renowned place for transport and logistics based enterprises, well designed and integrated with existing industry that meets the requirements of a targeted range of businesses and supporting activities to complement and nurture a more sustainable City of Wagga Wagga and Riverina Region.*

The WWDCP notes that more than 4,000 employees are expected to work in Bomen once development is complete.

Based on the above, two considerations are noted.

First, that land use to the north and west of the proposed WWSF, as a direct consequence of WWCC's long term land use planning, will change to industrial use with associated subdivisions and a variety of permissible building footprints and scales.

Second, notwithstanding that the proposed WWSF development site sits outside the BURA, its proximity warrants consideration of the principles that guide land use planning decisions and development within the BURA. Specifically, consideration that the WWSF does not compromise the opportunities for the strategically targeted industrialization of the neighbouring landscape.

To this end, the WWDCP establishes preferred land use patterns within the BURA to ensure that access to transport infrastructure (primarily the rail corridor) is optimised by directing those enterprises and activities that must be adjacent to the rail corridor to a delineated 'rail enterprise area', and directing those enterprises not requiring direct rail access to other sites within the BURA. The WWSF will have no impact on the rail enterprise area or jeopardise WWCC's vision for the Bomen Industrial Area.

The WWSF does not encroach into the BURA and would not limit future industrial development within the BURA. Further, the development control principles that are to guide the industrialization of the Bomen landscape have been incorporated into the selection of the development site and the proposed solar farm layout. Vegetated drainage lines and stands of native vegetation within the development site are being retained and strategically located landscape plantings form part of the proposed development.

The solar farm, consistent with the WWDCP, also constitutes a 'cleaner' development best positioned, as it is proposed, on the eastern side of Byrnes Road and on a larger lot (>5ha). With a large building footprint, the development site is also located on relatively flat land (<10%) such that preparatory civil works will not require excessive cut and fill.

5.2.2 URBAN GROWTH

The prospect of future residential encroachment and the diminution of existing buffers between the WWSF and residential receptors is highly unlikely.

The *Wagga Wagga Spatial Plan 2013 – 2043* provides clear strategic indicators for development of Wagga Wagga over the next 30 years and beyond. It is the key strategic document for directing and managing urban growth and change in the city, villages and rural areas over the next 25 years. The Plan documents the pressures for growth and identifies current and future opportunities for sustainable growth across the Local Government Area.

The Plan identifies a number of Potential Urban Areas and the closest of these (Potential Urban Area 1) to the development site is land located north of Charles Sturt University and on the western side of the Highway (refer **Figure 5**); approximately 4.5 km from the proposed WWSF.

The WWSF, at the site proposed, will not compromise future opportunities for accommodating the planned urban growth in Wagga Wagga.

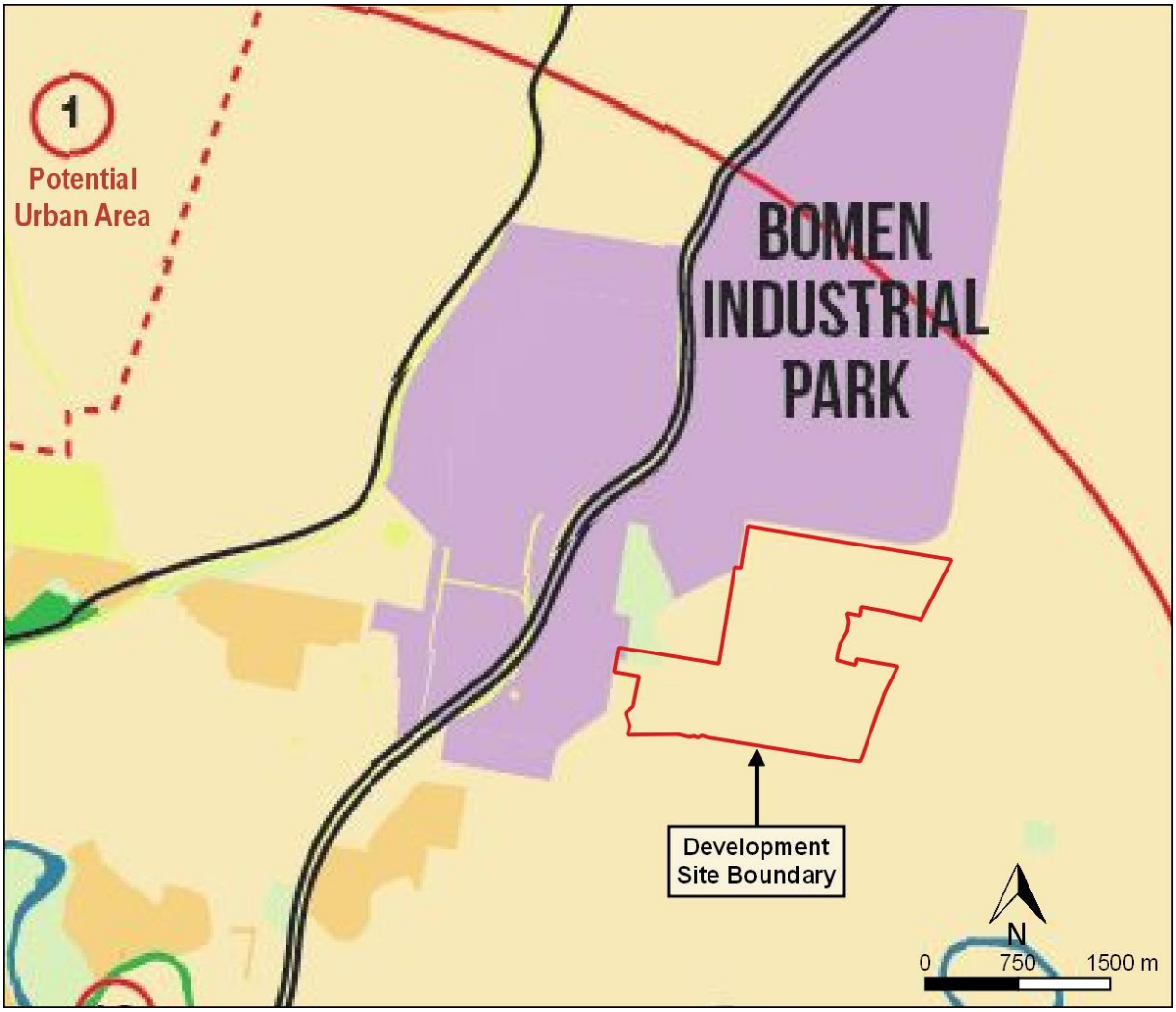

Figure 5: Potential Urban Areas (Wagga Wagga Spatial Plan 2013-2043)

5.2.3 FUTURE ROAD INFRASTRUCTURE

The *WWDCP* identifies a preferred location of collector and local roads within the BURA. The Proposed Road Location and Hierarchy diagram (refer **Figure 6**) identifies a three-level hierarchy of proposed roads, with one being the major arterial proposed as the future east-west link to areas beyond Bomen.

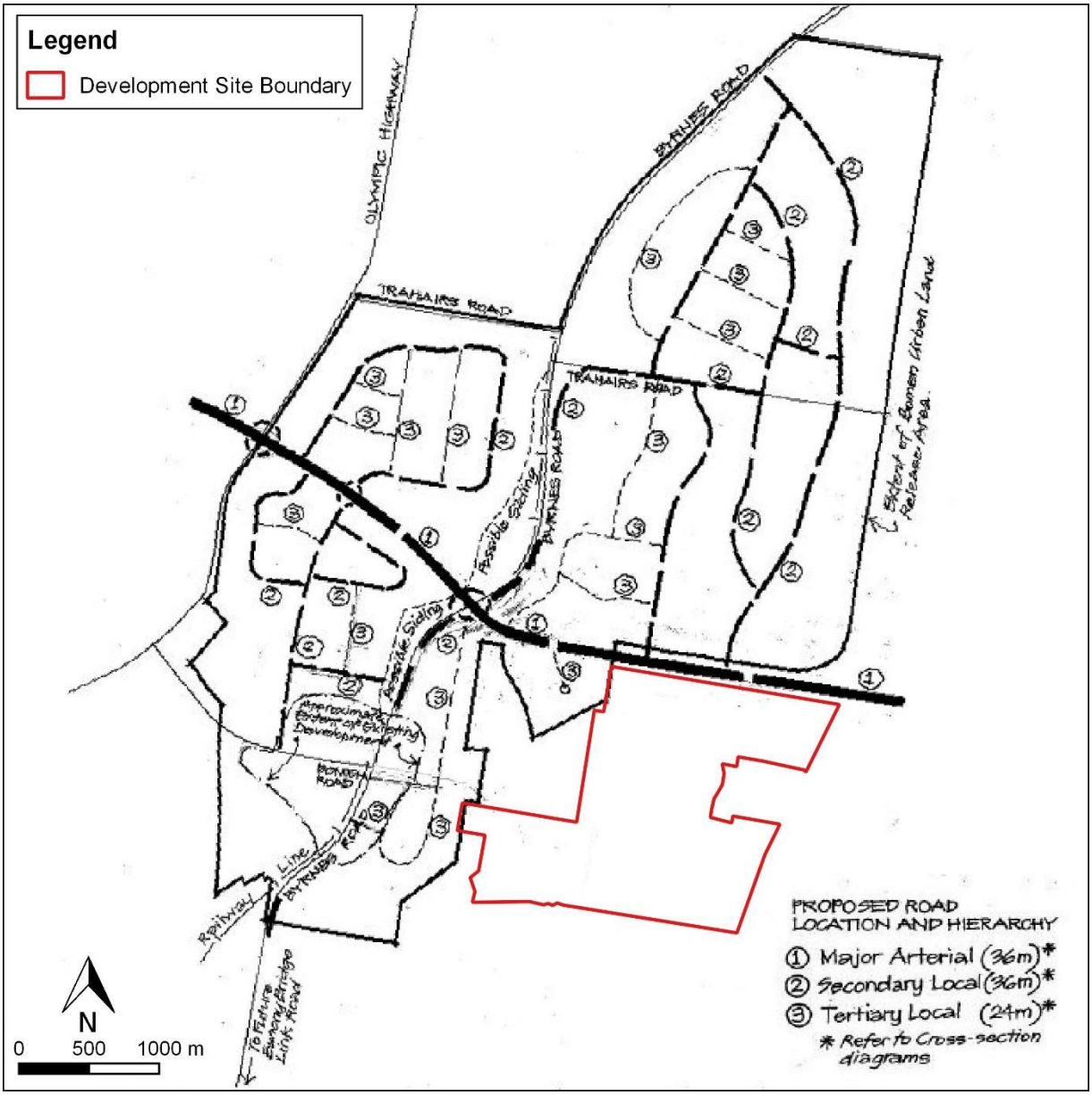

Figure 6: Proposed Road Location and Hierarchy Diagram (WWDCP)

The *Spatial Plan 2013-2043* also identifies a possible future extension/connection to this major arterial road. The Spatial Plan identifies this as Connection 5 (refer **Figure 7**), where this potential road connection crosses the Murrumbidgee River and provides a more direct connection to Bomen and the Olympic and Sturt Highways.

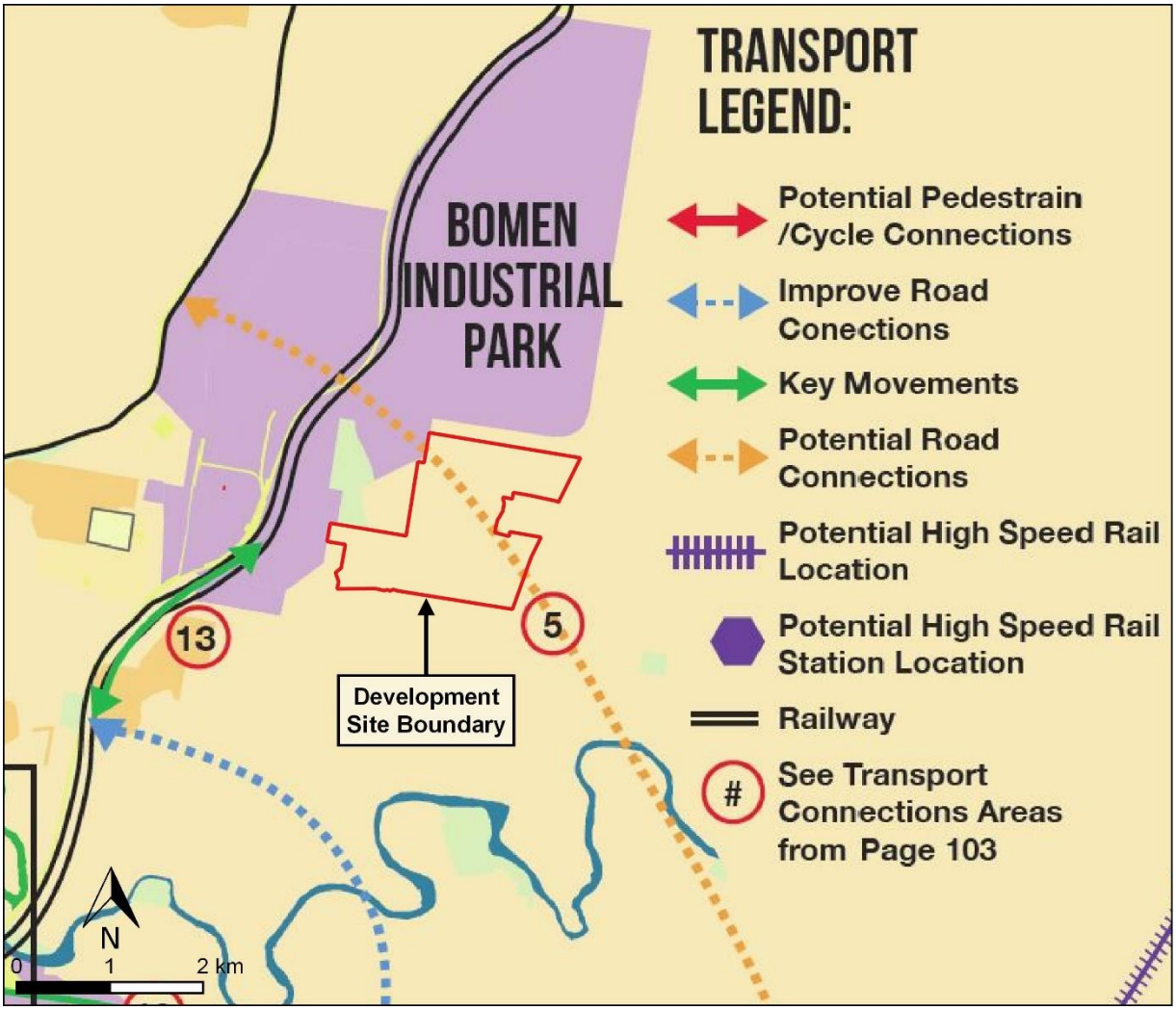

Figure 7: Potential road connections (Wagga Wagga Spatial Plan 2013-2043)

Whilst the mapping shows this connection bisecting the development site, the following considerations should be noted.

- The mapping of this connection indicates links only and does not reflect an actual alignment. Constraints, including flooding, potential Aboriginal heritage, the APA pipeline, property vegetation plans and biodiversity will all need to be addressed during investigations for selecting the appropriate location of any future alignment.
- The Major Arterial connection shown in the WWDCP is located to the north and extending east of the WWSF site boundary.

5.3 POTENTIAL IMPACTS

Potential land use impacts associated with the construction, operation and (possible) future de-commissioning of the solar farm in 30 years include the following:

- loss of agricultural land;
- creating land use conflicts through compromising the continued use of adjoining lands for primary production purposes by neighbours;
- creating land use conflicts through compromising the future industrial use of lands to the north and west of the development site; and
- restricting access to mineral resources.

Each of these potential impacts is discussed below.

5.3.1 LOSS OF AGRICULTURAL LAND

5.3.1.1 Biophysical Strategic Agricultural Land

A small part of the land to be occupied by the WWSF (0.3 ha) is mapped as Biophysical Strategic Agricultural Land (BSAL) (refer **Figure 8**). The site is not identified as being state significant agricultural land under the Rural Lands SEPP.

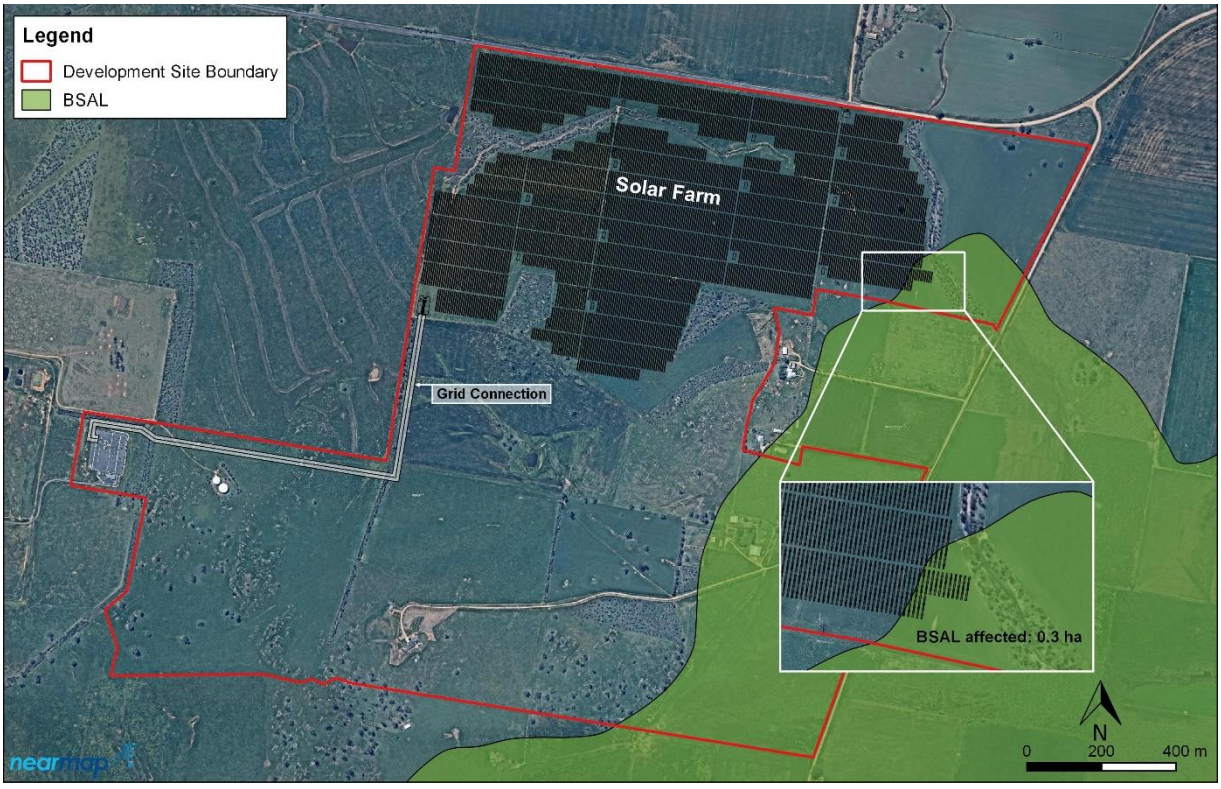

Figure 8: Biophysical Strategic Agricultural Land

The total land area for the Wagga Wagga LGA statistical area is 482,448.9 ha (as at 2016), 93.5% (450,945.4 ha) of which is land zoned for rural purposes (including RU1 – Primary Production, RU2 Rural Landscape and RU4 – Primary Production Small Lots). The development footprint of the solar farm (70 ha) impacts 0.015% of land zoned for rural purposes in the LGA.

Similarly, there is 17,762.7 ha of Biophysical Strategic Agricultural Land (BSAL) in the Wagga Wagga LGA The WWSF will occupy 0.3 ha of BSAL; representing 0.002% of all BSAL in Wagga Wagga LGA.

The use of approximately 70 ha of the development site for a solar farm does not compromise or significantly diminish the availability of land for primary production purposes in the Bomen district and wider Wagga LGA.

The land will only be permanently utilised for the purposes of electricity generation if a decision to extend the life of the facility is continuously made. In this unlikely scenario, the net effect of the WWSF will be to lose 70 ha of land for agricultural use: representing 0.015% of land zoned for rural purposes in the Wagga LGA.

The *Wagga Wagga Spatial Plan 2013 – 2043*, which is the key strategic document for directing and managing urban growth and change in the city, villages and rural areas over the next 25 years, delineates an 'urban containment line' which, amongst other things, is to guide development to prevent the fragmentation of rural land. The WWSF is located within the containment line and as such is consistent with this objective.

5.3.1.2 Restoration

If in 30 years the owner of the WWSF determines that it will decommission the solar farm and the land reverted to agricultural use then the land needs to be 'fit-for-purpose'. Decommissioning would entail the following:

- Disconnection from the TransGrid substation and removal of interconnecting infrastructure.
- Removal of solar farm substation.
- Removal of inverter stations, modules, racking system and posts.
- Removal of the operations and maintenance building, and foundations.
- Removal of security fencing.
- Rehabilitation of access tracks.

The extent of these possible future restoration works would be relatively modest given the benign use of the land during this 30 year period. Harvesting sunlight is a passive land use.

With the financial return on the land linked to solar generation rather than grazing or cropping, there will be an enhanced capacity to retain groundcover at all times. The 30 year use of the 70 ha as a solar farm would effectively provide an extended fallow which would, in a relative sense, provide benefits to the land in terms of soil health (ie. less disturbance associated with farming, less soil compaction as a result of lighter grazing, enhanced ability to retain a groundcover, etc).

Again, in a relative sense, compared to continued cropping over the next 30 years there would be a reduction in herbicide/insecticide applications, less recurring ground disturbance and with an enhanced capacity to retain groundcover, an improvement to organic carbon levels in the soil can be realistically expected. A solar farm compared to dryland broad-acre farming and grazing is a passive land use that would effectively rest the soil resource.

5.3.2 COMPATIBILITY

The proposed WWSF would not compromise the capacity for neighbours to continue existing or future primary production land uses. Infrastructure is low to the ground and would not compromise aerial agricultural spraying: noting that existing overhead power lines currently traverse the site.

Terrain Solar do not envisage any unacceptable risk to the solar panels from activities on adjacent farm land such as aerial spraying or dust generation, nor as a consequence of industrial development to the north and west.

The existing surrounding agricultural land uses and expected future industrial land uses are known and the WWSF is not an incompatible land use with a potential to create land use conflicts. The WWSF is not a threat to continued primary production activities by neighbours or industrial activities by future neighbours.

As an owner of land in a rural environment, the owners of the WWSF will, like their neighbours, have responsibilities to manage the land appropriately. In particular this will include obligations to manage any noxious weeds and to control fuel loads. Standard and proven management techniques for ensuring these outcomes can be implemented include slashing and/or crash grazing, and treatment (spot spraying) of any noxious weeds.

5.3.3 LOSS OF MINERAL RESOURCES LAND

Review of the DP&E online MinView database confirms that there are no mining or exploration titles or applications affecting the development site.

5.3.4 WATER SUPPLY LINE

A private water supply line that traverses the site to service neighbours (R1 and R2) will not impacted by the development. The indicative location of this private supply line is shown on **Drawing EV04**.

5.3.5 WATER SUPPLY EASEMENT

A section of the proposed overhead transmission line to provide for grid connection into TransGrid's substation will pass over a 5 m wide easement for water supply (refer **Drawing EV06**).

Consultation with Riverina Water County Council has established no in-principle conflict, noting that further detail will be required (when available) showing placement of poles, earth wires, etc. to validate there is no impact on this water main.

Heritage

6.1 ABORIGINAL HERITAGE

6.1.1 ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Access Archaeology and Heritage (AAH) was engaged to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) for the proposed WWSF. This report documents the assessment of Aboriginal heritage in a manner consistent with:

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*
- *Code of Practice for Archaeological Investigations;* and
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW.*

A full copy of the ACHAR is provided in **Appendix A**.

The objectives of the ACHAR were to:

- Undertake a search of the OEH Aboriginal Heritage Management System (AHIMS) database to determine if there had been any archaeological material recorded in the study area
- Consult the local Aboriginal community consistent with the intent of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*
- To undertake an archaeological survey to determine if there are landforms with a high potential to contain Aboriginal objects and whether Aboriginal object occur within the study area.
- Assess the nature and level of disturbance of these landforms and the integrity of any Aboriginal objects.
- Complete a report on assessment and present recommendations for management of Aboriginal heritage in the study area.

6.1.2 CONSULTATION

A four step process of consultation with Aboriginal stakeholders was undertaken in accordance with clause 80C of the *National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010*. The consultation steps, listed below, are outlined in the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (ACHCRP 2010) guide.

Consultation Step 1 – Notification

Notification letters were sent to the relevant bodies/agencies requesting details of any parties with a known interest, or who hold knowledge related to the development area. Notification of the Aboriginal heritage project was undertaken via the placement of a newspaper notice in the Daily Advertiser on Saturday 29 July 2017. Following receipt of a list of potential Aboriginal stakeholders from the OEH, notification letters were sent to these organisations and individuals on the 4th of August 2017.

The notification phase resulted in the four groups/individuals expressing interest in the project (ie. Registered Aboriginal Parties).

Consultation Step 2 – Information to RAPs

A *Project Proposal Information* document for the assessment was forwarded to respondents. The document provided details of the project and the proposed heritage assessment methodology and invited comments from the RAPs. The document also sought any information regarding known Aboriginal cultural significance values associated with the subject area and/or any Aboriginal objects contained therein.

Consultation Step 3 – Information Gathering

A field inspection was attended by a RAP. General discussion was had regarding local Aboriginal heritage and the potential cultural significance of the area. No particular or immediate concerns were raised regarding the study area from the perspective of non-tangible cultural heritage. Test excavations were undertaken under the Code of Practice for Archaeological Investigations and was attended by RAP representatives.

Consultation Step - Review

The draft ACHAR was provided to the RAPs on 13 October 2016. The one response received was that the report was good, and that the RAP would be happy to assist in selecting an on-site location for protection of collected and excavated stone artefacts, and assist with any collection.

6.1.3 REGISTER AND FIELD SURVEY

6.1.3.1 AHIMS Search

A detailed search of the AHIMS register showed 49 Aboriginal sites and 2 Aboriginal places recorded within ~10km of the subject area and within ~1.5 km of the boundary there are 18 previously recorded sites and one Aboriginal place.

6.1.3.2 Field Survey

Two archaeological sites and two isolated artefacts were recorded during the field survey. In addition, two areas of Potential Archaeological Deposit (PD) were also identified and subsequent test excavations were completed.

The results of these investigations identified five Aboriginal sites across the development site. Four of these are artefact scatters, and one an isolated artefact. The location of these are shown on **Drawing EV05**.

6.1.4 CULTURAL HERITAGE VALUES AND SIGNIFICANCE

Research Potential

All archaeological sites have the potential to contribute something to the record of human activity, however small, but the ability to contribute significantly to current and potential research questions is highly variable. The ability of the archaeological resources in the study area to significantly contribute to local or regional studies is high.

In terms of integrity and condition, the study area has undergone modification through land clearing and agriculture. Artefacts found in the soil profile do not show a high degree of disturbance, and there are spatially identifiable patterns. The archaeology of the subject has moderate to good integrity.

In terms of complexity, the archaeological resources of the study area show a moderate to high degree of complexity for their type of site. The assemblage is predominantly one stone material, but overall has a wide range and displays a wider range of stone artefacts than solely flaked artefacts.

Archaeological Potential

There is high potential for further stone artefacts to be found in the study area in considerable density. Research that concentrates on stone artefact technology and/or distribution could obtain a reasonable numbers of stone artefacts with relatively minimal effort, in comparison to most other known sites nearby.

Connectedness

The cultural material of the study area is connected to the cultural material of the broader Wagga Wagga area by being small part of a much wider scatter of Aboriginal objects that share similarities, such as the dominance of quartz. The nearby location of an important hatchet quarry has potential to directly connect the two sites through artefacts from the quarry occurring in the study area.

Representativeness

The archaeological material on the study area is broadly representative of the archaeological material of the Wagga Wagga area.

Rarity

While in general the types of artefacts found in the study area are not rare, their occurrence in the concentration found is uncommon in the local area, particularly in association with less common artefacts types such as the grinding/anvil implements.

Education potential

The archaeological remains of the subject area have moderate educational potential if retained in situ, but only if ground cover is sparse/absent. There is a surface expression of the site that is informative with regard to site content and extent.

Archaeological Landscapes

The study area is certainly part of a broader cultural landscape that contains a range of site types. This archaeological landscape will not be significantly altered if the study area is developed.

Aesthetic Value

The occupation sites recorded during this study have low aesthetic value within the meaning attributed in a heritage assessment.

Historic Value

The study area is not directly associated with an important individual or identifiable historic event. Objects in the study area will not have 'historic value' within the meaning attributed by a heritage assessment

Statement of Scientific Heritage Significance

The objects recorded, and potentially occurring, in the study area have moderate scientific heritage significance, forming a small part of the wider archaeology of the Wagga Wagga area. The artefacts are broadly typical of the assemblage recorded in the local area, and occur in a poorly stratified, fairly thin soil profile. The information contained in these objects will be readily available in the broader local landscape. Areas of particular concentration are less common, and are an indicator that topographic anomalies such as the sandy rise where one of the sites is located may have served to focus Aboriginal occupation.

Social or Cultural Value

Local Aboriginal people value evidence of their ancestors' occupation of the land extremely highly. Any evidence of occupation activity is afforded high cultural value. More complex or rare artefacts tend to be highly regarded.

6.1.5 ASSESSMENT OF HARM

The establishment of the proposed Wagga Wagga Solar Farm will have a relatively low impact on the archaeological resources of the study area.

Construction will require only modest preparatory civil works to ensure ground and structural tolerances for the array supports are met. The installation of the framework to support the panels does not require substantial ground disturbing works and the vast majority of the land surface will remain undisturbed, and as a consequence there is low potential to cause significant harm to a widespread scatter. There is potential for the development to harm objects through the installation of roads and tracks and other infrastructure, but it is to be noted that the entirety of the subject area has been subject to similar disturbance regimes through agricultural land use over more than a century.

Significantly, the Access Archaeology and Heritage and the RAPs argue that establishment of the Wagga Wagga Solar Farm will have a net beneficial effect on the conservation of the integrity of Aboriginal heritage objects by breaking the semi-annual cycle of cultivation.

6.1.6 IMPACTS ON VALUES

6.1.6.1 Social and Cultural Values

The proposed development will not diminish social or cultural values of any site located wholly or partially on the study area. Local Aboriginal people will continue to hold any evidence in the study area in high value.

6.1.6.2 Scientific (Archaeological) Values

The proposed development would not significantly diminish the scientific value of the archaeology of the landscape. As noted above, it is suggested that the change of land use, accompanied by disturbance to a small proportion of the area, halts agricultural processes that incrementally degrade the integrity of the archaeological resource.

6.1.7 CONCLUSION

The development proposal should proceed with no further archaeological assessment. No material was identified that would warrant salvage excavation or exclusion from development. Monitoring of ground disturbing activities is not a warranted mitigation strategy as the widespread sparse scatter is unlikely to be observed during the proposed development activities, and there is low potential for human burials to occur.

6.1.8 MITIGATION MEASURES

6.1.8.1 General

In the event development footprint is extended beyond the area currently assessed, the additional area should be subject to further archaeological survey by a qualified archaeologist in association with the Registered Aboriginal Parties.

6.1.8.2 Management of Known Sites

- The proponent must apply for an Aboriginal Heritage Impact Permit (AHIP) that covers the development area.
- A condition of the AHIP should include the collection of complex Aboriginal artefacts such as anvil/grindstones and hatchet preforms in order that they are not damaged by the proposed works. They should be collected by the field team that recorded the site and securely stored until development is completed and then returned to a protected location on the site.
- A condition of the AHIP should be that the grindstone/anvil should be subject to residue analysis to investigate possibility it retains evidence of its use.

- The collection of flaked stone artefacts from within the development footprint is unnecessary as they are common and the development will not cause a high level of disturbance.
- In cooperation with the RAPs a location on site must be identified for the repatriation of archaeological material (reburial).

6.1.8.3 Chance Finds Protocol

Section 89A of the *National Parks and Wildlife (NSW) 1974* requires that any person who is aware of the existence of an Aboriginal Object is required to notify the Chief Executive of the NSW Office of Environment and Heritage. To ensure compliance with Section 89A the proponent should undertake the following outside of the site areas currently recorded.

- Prepare an information poster for site staff that describes the most likely site occurrences that might be observed and how to recognise them. A face to face heritage induction may be considered.
- Where a flaked isolated artefact is discovered:
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefact with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, 'looking north' or 'looking east' etc)
    - Move the artefact during work that may harm it and return it to the location immediately the work has concluded.
- Where an isolated implement (eg, hammer, hatchet, grindstone, etc) is discovered:
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefact with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, 'looking north' or 'looking east' etc)
    - Collect the artefact and store securely on site along with labelling that includes the Eastings and Northings.
- Where any other form or cluster of Aboriginal Objects is discovered,
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefacts with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, 'looking north' or 'looking east' etc)
    - Isolate the area with a ~50m buffer and contact a qualified archaeologist for further information/advice on the most appropriate strategy
- Within three months of making a discovery the development proponent should inform OEH of its existence though a qualified archaeologist submitting an AHIMS recording form for each discovery. The person submitting the information will need to be supplied with the information recorded at the time of field recoding and/or collection.
- Although very unlikely, if any object is found suspected to be human remains work at the location must cease and the following must be contacted immediately:
    - NSW Police – Wagga Wagga Police Station
    - NSW OEH

  The location is to be made secure to prevent unauthorised access. Work on the WWSF project may continue at a suitable distance from the potential human remains – not closer than 100 m.

6.2 HISTORIC HERITAGE

6.2.1 DATA REVIEW

A search of the NSW State Heritage Inventory (including the State Heritage Register, Interim Heritage Orders, State Agency Heritage Registers and Wagga LEP heritage items) did not identify any heritage items at the development site.

The closest heritage item listed under the NSW State Heritage Inventory is the 'Bomen Axe Quarry', listed as an Aboriginal Place under the *National Parks and Wildlife Act 1974*. The location provided by the NSW State Heritage Inventory is Lat: -35.069813 Long: 147.424007. This is approximately 670 m north of the TransGrid substation and 750 m west of the proposed solar farm.

A search of the Australian Heritage Database (including items on the National Heritage List, World Heritage List, Commonwealth Heritage List and the Register of National Estate Non-Statutory archive) did not identify any recorded heritage items at or near the site.

No historic buildings or sheds were observed within the development footprint.

6.2.2 MITIGATION MEASURE

Should any object or item of historic heritage be uncovered during construction, work in that area will cease and the item cordoned off.

A qualified heritage specialist will attend the site to determine the nature of the find and determine the required course of action; including consultation with WWCC.

Biodiversity

7.1 INTRODUCTION

A specialist Biodiversity Assessment (BA) for the WWSF has been undertaken by NGH Environmental and is provided in **Appendix B**. A summary of this assessment follows.

7.2 SCOPE AND AIMS

The scope and aims of the BA are to:

- Address the requirements of the relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Determine the biodiversity values of the study area including identifying protected and threatened flora and fauna species, populations and ecological communities and their habitats.
- Identify the ecological constraints of the proposal.
- Identify the potential impacts of the proposed activity on threatened flora and fauna species, populations, ecological communities and critical habitat.
- Assess the significance of the impact of the proposed activities on species, ecological communities and populations listed under the TSC Act and EPBC Act.
- Propose environmental management measures to minimise, mitigate and, if necessary, offset residual impacts.

7.3 FLORA

7.3.1 EXISTING ENVIRONMENT

Remnant vegetation remaining in the locality is comprised of scattered paddock trees and disturbed grasslands. Narrow linear plantings occur along paddock boundaries, ridge lines, creek lines and areas with a history of erosion. The native vegetation communities remaining are isolated patches of open grassy woodlands. This vegetation type largely reflects the underlying geology and land use of the region. Open, grassy woodlands occur across a diversity of geologies however are usually found on the slopes or valleys of more deep and fertile soils.

The study area occurs in an undulating terrain which has been heavily cleared for agricultural purposes. Generally, native vegetation has been retained in the largely inaccessible and unproductive areas.

The proposal area has been largely cultivated or has experienced pasture improvement (**Figure 9** and **Figure 10**). The dominant vegetation is exotic pastures with planted vegetation occurring along the central drainage line, rocky ridge line, around the wetland area and along the eastern boundary. No remnant native vegetation communities remain in the proposal area.

Figure 9: Cultivated Paddocks (looking east)

Figure 10: Heavily grazed exotic pastures (looking south)

Figure 11: Planted vegetation (looking north)

7.3.2 SPECIES RECORDED

A total of 72 flora species were recorded during the flora surveys comprising 29 native and 43 exotic species. 12 of the native species are shrubs occurring in the planted vegetation areas. A complete list of all species recorded according to specific plot location is provided in **Appendix B**.

7.3.3 WEEDS AND DISTURBANCE

The proposal area has been subject to historical disturbance, mostly associated with large scale clearing, cultivation and pasture improvement for agriculture. The groundcover within the study area is predominantly exotic.

Of the exotic species recorded two 'Priority Weeds' were identified. These include Silver Leaf Nightshade (*Solanum elaeagnifolium*) and African Boxthorn (*Lyceum ferocissimum*). Both these species are classed as Mandatory Measure and 'must not be imported into the State or sold'.

7.3.4 VEGETATION COMMUNITIES

No remnant native vegetation communities were identified within the study area. 14 isolated paddock trees occur in the proposal area. The trees were identified as White box (*Eucalyptus albens*), Yellow box (*Eucalyptus melliodora*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Grey Box (*Eucalyptus microcarpa*). The presence of these species suggests that historically *White Box Yellow Box Blakely Red Gum Woodland* (Box Gum Woodland) would have occurred naturally in the study area. The only native vegetation remaining in the study area is the planted vegetation in Areas A, B and C (**Figure 12**).

A wide variety of native species (locally occurring and not) occupy the planting areas. This vegetation would be avoided by the development footprint.

Due to the historic clearing of native understorey and groundcover in the proposal area, the vegetation types within the proposal area were determined to be 'Exotic Vegetation' and 'Planted Vegetation'. The extent of these vegetation types can be seen in **Figure 12**.

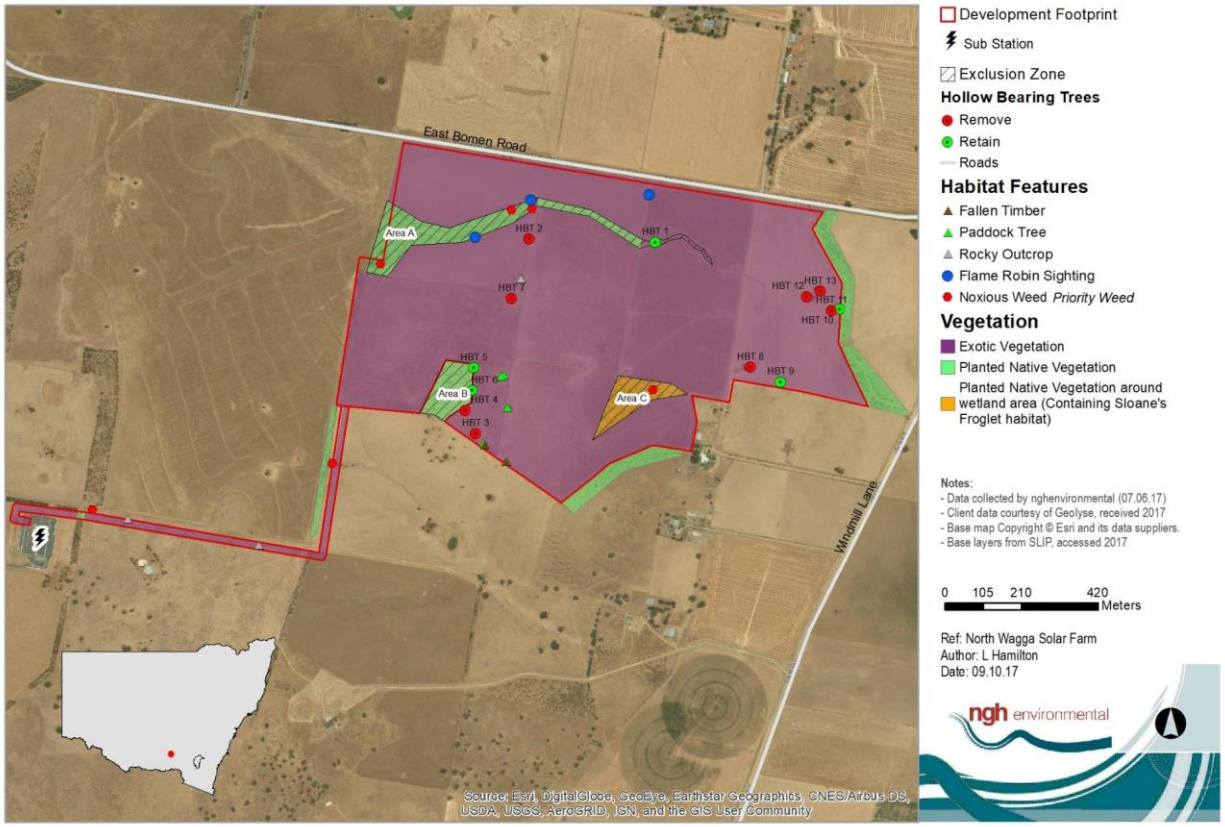

Figure 12: Biodiversity Constraints

7.3.5 SPECIES AND COMMUNITIES OF CONSERVATION SIGNIFICANCE

7.3.5.1 Endangered Ecological Communities

No endangered ecological communities were identified within the proposal area, or are considered likely to occur.

7.3.5.2 Endangered Populations

No endangered fauna populations were identified within the proposal area, or are considered likely to occur.

7.3.5.3 Listed Threatened Species

No listed threatened flora species were observed during the field surveys or are known to occur in the study area.

The Atlas of NSW Wildlife database search produced no identified records of threatened plant species within 10km of the proposal area. A threatened species profile search was also undertaken (OEH) which indicated that 7 species could occur within the locality. A search of the EPBC Act Protected Matters Search Tool highlighted 1 flora species with the potential to occur within a 10km radius of the proposal area. Based on the habitat evaluation habitat within the study area was considered to be suitable for:

- Yass Daisy (*Ammobium craspedioides*)
- Small Scurf-pea (*Cullen parvum*)
- Austral Pillwort (*Pilularia novae-hollandiae*)

- Cotoneaster pomaderris (*Pomaderris cotoneaster*)
- Green comb spider orchid (*Caledenia tensa*)
- Crimson Spider orchid (*Caledenia concolor*)
- Tumut grevillea (*Grevillea wilkinsonii*)
- Woolly Ragwort (*Senecio garlandii*)

Targeted searches failed to detect any of these species in the study area, although it is acknowledged that some of these species would not have been detectable at the time of the surveys. Notwithstanding this, these species are unlikely to be present due to the high disturbance and cultivation of the proposal area.

7.4 FAUNA

7.4.1 SPECIES RECORDED

21 bird species, 1 reptile, and 3 mammals were recorded during the field surveys. A complete fauna list is proved in **Appendix B**.

7.4.2 FAUNA HABITAT

7.4.2.1 Terrestrial

The majority of the study area consists of exotic pastures dominated by rye grass, clover and bromes and fescue. A number of paddocks have been sown with cereal crops or pastures. The proposal area has been highly modified and minimal native groundcover is present. These habitat types provide limited resources for fauna. However, Red capped robins (*Petrioca goodenovii*) and the Flame robins (*Petroica phoenicea*) were seen utilising the open areas of the agricultural pastures. These species often sally from fence-posts or thistles and other prominent perches in open habitats in their autumn and winter ranges (OEH,2017). Black Shouldered kites *(Elanus axillaris)* and nankeen kestrels (*Falco cenchroides*) were recorded in mature Eucalypts in the study area.

The planted vegetation in the study area provides moderate to good habitat quality. The plantings are approximately 10 years old and provide a dense shrub layer for protection, food and breeding habitat for birds. The plantings have limited connectivity values due to the heavily cleared landscape and have likely been undertaken to control erosion.

The lone paddock trees identified within the proposal area also provide moderate to good quality habitat in a heavily cleared landscape. These trees provide roosting, foraging and breeding habitat for a number of fauna.

Fallen timber is uncommon in the proposal area. As a routine agricultural activity, timber which accumulates under paddock trees is placed into large piles. One pile of timber exists in the proposal area. Timber which is stockpiled can be a haven for pest species including foxes and rabbits. There was evidence that livestock have used the timber for shelter resulting in soil disturbance and weed encroachment. This has significantly reduced the habitat value of the timber pile. Fallen timber also exists in Planting Area B which has a number of remnant trees (**Figure 12**). This timber provides habitat for a range of fauna, including skinks, snakes, birds, and ground-dwelling mammals.

A rocky outcrop exists in the centre of the proposal area. The exposed rocks experience high disturbance from livestock and are surrounded by heavily grazed exotic pasture. It is unlikely that these rocks provide suitable habitat for threatened reptiles. No species were identified during the survey.

In general, fauna habitat in the planting areas are considered moderate to good quality. The cleared pasture and cropping paddocks, while providing opportunistic foraging habitat for a number of species, provide only limited habitat value due to the ongoing agricultural activities.

7.4.2.2 Hollow Bearing Trees

13 hollow-bearing trees were identified within the study area which provide roosting, nesting and sheltering habitat for birds and a range of nocturnal species.

7.4.2.3 Declared Critical Habitat

The study area does not contain any areas that have been declared as critical habitat under either the TSC Act or EPBC Act.

7.4.3 THREATENED SPECIES

The EPBC Act Protected Matters Search Tool listed 9 birds, 2 reptiles, 3 mammals, 1 frog, 3 fish, and 10 migratory bird species with the potential to occur within 10km of the study area. The NSW Wildlife Atlas database search for threatened species revealed 9 species of birds and 2 mammals recorded as occurring within 10km of the study area.

All threatened species were evaluated for their potential to occur in the study area. Species considered to have the potential to occur are discussed further below.

7.4.3.1 Woodland Birds

The Flame Robin (*Petroica phoenicea*) was observed in the study area. This species is listed as vulnerable under the *NSW TSC Act*. The Flame Robin breeds in upland areas and tends to move inland to the slopes and plains during the winter months. It prefers open habitat where it will sally from fence posts or thistles and other prominent perches when foraging. The species is wide ranging and occupies cleared and disturbed land around Wagga Wagga in winter. It is highly mobile.

No other threatened bird species were observed during the survey. Based on the threatened species evaluation the following birds have potential to occur in the study area:

- Spotted Harrier (*Circus assimilis*)
- Superb Parrot (*Polytelis swainsonii*)
- Turquoise Parrot (*Neophema pulchella)*
- Little Lorikeet (*Glossopsitta pusilla*)
- Barking Owl (*Ninox connivens*)
- Hooded Robin (*Melanodryas cucullate*)
- Flame robin (*Petroica phoenicea*)
- Scarlet Robin (*Petroica boodang*)
- Dusky Woodswallow (*Artamus cyanopterus*)

There are 13 recorded sightings of the Superb Parrot (*Polytelis swainsonii*) within 10km of the proposal area. The closest sighting was recorded 460m from the substation. It is likely that the Superb Parrot is a vagrant visitor within the proposal area, however due to its high mobility it was not detected during the field surveys. The proposal site supports only limited foraging habitat for this species, which is abundant in the locality.

The proposal area provides foraging habitat for the listed woodland birds in the form of open grasslands, flowering tree canopies and understorey vegetation in the planted habitats. Breeding and roosting habitat for non-hollow bearing dependant species exists in the planted vegetation. These habitats are abundant in the study area and locality. Raptors including the Spotted Harrier and Barking Owl would forage on pest and native prey species in the proposal area. All these species are highly mobile and the proposal area does not support habitat critical to their survival.

7.4.3.2 Koala

The Koala was not observed during the field surveys and has not been recorded within 10km of the study area.

White Box (*Eucalyptus albens*) is a primary feed tree however minimal White Box trees occur in the study area. The dominant eucalypt in the proposal area was Yellow Box (*Eucalyptus melliodora*) which is considered a secondary feed tree for Koalas. Given the Koala was not recorded during the field survey, and no records occur within 10km of the study area, it can be concluded that due to the highly fragmented and cleared landscape, the study area does not support a resident population of Koalas.

7.4.3.3 Microbats

The database searches indicated that 3 threatened bat species have the potential to occur in the study area. These include Corbens Long-eared bat (*Nyctophilus corbeni*), Yellow-bellied Sheath-tail bat (*Saccolaimus flaviventris*) and the Eastern Bentwing-bat (*Miniopterus schreibersii*). The Eastern Bentwing-bat has been recorded 3.8km south of the study area near the Murrumbidgee River.

The threatened species evaluations determined that Yellow-bellied Sheathtail bat could potentially occur in the study area. This species forages in most habitats across its very wide range, occurring in landscapes with and without trees. In treeless landscapes it is known to utilise mammal burrows for roosting. The study area supports foraging habitat for this species.

The other two species may, from time to time, traverse the study area. However, no habitat important to their lifecycle is present.

7.5 AQUATIC HABITAT

7.5.1 EXISTING ENVIRONMENT

Aquatic habitat was identified within Planting Area C (**Figure 13** and **Figure 14**). The area was identified as potential Sloane's Froglet (*Crinia sloanei*) habitat. Sloane's Froglet is listed as Vulnerable under the NSW TSC Act. The species is known to occur in periodically inundated grasslands, woodlands and disturbed habitats. It shelters in any vegetation, ground debris or cracks in the soil. Aerial images from 2016 showed the aquatic habitat inundated with water. During the field surveys, no pooling water was present and vegetation was identified as predominantly exotic with minimal aquatic flora present.

The aquatic habitat identified was not deemed suitable for the Southern Bell Frog (*Litoria raniformis*) which has potential to occur in the locality. This species requires vegetation such as Typha, Phragmites and Eleocharis. This species also requires more permanent water bodies including, lagoons, swamps, ponds and dams. The Southern Bell Frog is considered unlikely to occur in the proposal area, therefore was not targeted in the surveys.

The drainage line which runs through Planting Area A is ephemeral. This landscape feature is dominated by exotic pasture species, does not support aquatic vegetation or experience regular inundation of water. Hence, for the purpose of this report the drainage line is not considered aquatic habitat.

Figure 13: Potential Sloane's Froglet habitat (looking west)

Figure 14: Sloane's Froglet habitat (looking south west)

7.5.2 SPECIES RECORDED

No amphibian species were identified during the surveys. Recent surveys in the Wagga Wagga area have been unsuccessful in detecting Sloane's Froglet (*Crinia sloanie*). The low number of sites where the population exists, low recorded individuals per site, and low proportion of records suggest a low number of mature individuals exist. Despite the survey conditions being relatively dry, it is unlikely that Sloane's Froglet occurs in the study area.

7.6 MATTERS OF NATIONAL SIGNIFICANCE

The following matters of national significance relevant to biodiversity are considered to apply to the proposal.

7.6.1 ENDANGERED ECOLOGICAL COMMUNITIES

No endangered ecological communities were identified within the proposal area, or are considered likely to occur.

7.6.2 THREATENED SPECIES

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable under the EPBC Act. The EPBC Act assessment tool has determined that no further assessment of this species is required.

Yellow-bellied sheathtail- bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the TSC Act. There is potential for this species to be found within the proposal area.

No threatened flora species were identified within the proposal area, or are considered likely to occur.

7.6.3 MIGRATORY SPECIES

10 species listed as Migratory under the EPBC Act are considered to have potential to occur within the study area. Based on a habitat assessment none of these species are considered likely to be impacted by the proposal.

7.7 ASSESSMENT OF IMPACTS

7.7.1 FLORA IMPACTS

7.7.1.1 Vegetation Loss

No native vegetation communities were identified in the study area and therefore none would be impacted by the proposal. The proposed works would involve the removal of up to 8 hollow bearing trees (HBTs) and 3 mature non-hollow bearing trees. All areas of planted vegetation would be retained and avoided by the proposal.

It is also noted that the development as proposed includes establishment of landscape screen plantings in the south east corner of the farm. The species used in this planting will include those listed in *Wagga Wagga Development Control Plan (Section 5, Table 5.2.2)* as native species of conservation significance.

The plantings will be at least 5 metres deep, and be comprised of at least 2 rows of staggered trees and shrubs.

The location and extent of these planting is shown on **Drawing EV05**, and will provide for approximately 0.3 ha of compensatory/replacement plantings of native vegetation of conservation significance.

7.7.1.2 Threatened Species

No threatened flora species were identified within the proposal area, or are considered likely to occur. No impact to threatened flora species is likely to occur as a result of the proposal.

7.7.1.3 Weeds

The spread of priority weeds may occur during the construction of the proposal. Two priority weeds were identified during the field surveys including Silverleaf Nightshade (*Solanum elaeagnifolium*) and African Boxthorn (*Lyceum ferocissimum*). African boxthorn was identified in Planting Area C and would not be disturbed as a result of the proposal. Silverleaf nightshade has the potential to be spread through moving plant and equipment. Each species requires particular treatment to be successfully managed, and detailed information on managing each species can be sought from the *Noxious and Environmental Weed Control Handbook* (DPI 2011).

7.7.2 FAUNA IMPACTS

7.7.2.1 Construction Impacts

During construction, the proposal has potential to impact on fauna in the study area. An assessment of these impacts is provided below.

Removal of Fauna Habitat

The proposal would remove fauna habitat including grassland foraging habitat, one pile of fallen timber and a rocky outcrop. Grassland foraging habitat is abundant in the locality. Following the installation of the solar farm, grasses would re-establish across the proposal area and continue to provide foraging habitat.

The fallen timber and rocky outcrops have limited habitat value. The removal of this habitat is not expected to impact any native species. The planted areas provide medium to good quality habitat including fallen timer and rocky outcrops for birds and reptiles. Given this habitat would not be impacted by the proposal, fauna would be able to utilise these areas of habitat and the adjoining agricultural matrix.

Removal of Hollow Bearing Trees

The proposal would involve the removal of up to 8 hollow-bearing trees and 3 mature non-hollow bearing tree. 5 hollow-bearing trees would be retained within the proposal area. The number of hollows which would be removed by size class is documented in **Appendix B**.

The removal of up to 8 hollow-bearing trees represents the loss of habitat for arboreal mammals, reptiles, birds and microbats. These are expected to be common and widespread species such as Common Brushtail Possum (*Trichosurus vulpecula*), Rosellas (*Platycercus spp*.) and Galahs (*Eolophus roseicapilla*). Threatened species which have the potential to utilise hollows within the proposal area include the Superb Parrot (*Polytelis swainsonii),* Turquoise Parrot *(Neophema pulchella),* Little Lorikeet *(Glossopsitta pusilla*) and Barking Owl *(Ninox connivens).* The loss of hollows for these species has been considered in the assessment of significance.

The distribution and abundance of hollow bearing trees has been reduced and fragmented by extensive clearing during the past two centuries, primarily for agriculture. This is the case for the study area with only scattered paddock trees remaining. In this context, hollow bearing trees are considered a valuable resource in the locality. The proposal has aimed to minimise impact by reducing the felling of as many hollow bearing trees as possible. Due to the highly fragmented nature of the study area, and its isolation from major watercourses, it is unlikely that any native species are reliant on these hollow bearing trees.

Impacts to Threatened Species

Detailed assessments of significance for species with the potential to occur and be impacted by the proposal are provided in **Appendix B**. These assessments are summarised below.

Threatened ground/understory birds (Flame Robin and Scarlet Robin)

Potential impacts to threatened ground/understory birds including the Flame Robin and Scarlet Robin may occur as the result of the proposal including construction disturbance, habitat removal and land use change. Both these species utilise open pastures for foraging in areas close to dense vegetation for protection. Both

species are likely to continue to forage in the proposal area once grasses re-establish in between the solar panels.

An Assessment of Significance was carried out to determine if any potential impacts are likely to be significant. The assessment concluded that there is unlikely to be a significant impact on the Flame Robin and Scarlet Robin because:

- Similar quality habitat (agricultural matrix) is widespread in the locality.
- Important habitat (Planted vegetation) for these species would be retained.
- The solar panels are likely to provide similar groundcover foraging habitat from beneath the panels once operational.

Threatened canopy birds (Superb Parrot, Turquoise Parrot, Little Lorikeet, and Barking Owl,)

Impacts to threatened canopy birds including the Superb Parrot, Turquoise Parrot, Little Lorikeet, and Barking Owl may occur as the result of the proposal including construction disturbance, habitat removal and land use change. These birds utilise tree hollows for breeding and canopy for foraging.

An Assessment of Significance was carried out to determine if any potential impacts are likely to be significant. The assessment concluded that there is unlikely to be a significant impact on the Superb Parrot, Turquoise Parrot, Little Lorikeet, and Barking Owl because:

- The habitat quality is poor in the proposal area.
- The species are highly mobile and would utilise surrounding habitat of similar quality.
- At least 5 hollow bearing trees would be retained in the proposal area.
- Habitat is heavily fragmented, with no woodland patches or watercourses within 2km.

Threatened Bats (Yellow- bellied Sheathtail- bat)

There are potential impacts to microbats due to the loss of potential nesting and foraging resources. Approximately 8 hollow bearing trees that may provide suitable roosting sites for the microbats would be removed as a result of the proposal, although 5 would be retained.

An Assessment of Significance was carried out for this species and concluded that there is unlikely to be a significant impact on the Yellow- bellied Sheathtail- bat because:

- Breeding resources would be retained in the study area and similar habitats are widespread in the locality.
- A significant area of foraging resources would be retained within the study area (Planted vegetation) (approximately 18ha).
- This species is highly mobile and occupies a large range of habitat types over large areas, therefore would not be restricted to the habitats in the proposal area.

7.7.2.2 Operational Impacts

No impacts to threatened species are expected to occur as a result of the operational phase of the proposal. Fauna in the study area are expected to utilise remaining habitat. Groundcover would be maintained beneath the solar panels which would provide foraging habitat for a number of woodland bird species including the Flame Robin (*Petroica phoenicea*) and Hooded Robin (*Melanodryas cucullate*).

7.7.3 AQUATIC IMPACTS

7.7.3.1 Construction Impacts

No impacts to threatened aquatic species is expected to occur as a result of the construction phase of the proposal. The proposal would not impact on the aquatic habitat identified in Planting Area C.

The proposal would involve the construction of a crossing over the central drainage line. The drainage line does not constitute aquatic habitat, therefore no impacts to aquatic habitat are expected as a result of these works.

There is potential for sediment laden run off to impact Planting Area A and C during construction. Groundcover in these areas is predominantly exotic however could have the potential to be smothered with sediment laden run off. These impacts can be avoided with the implementation of appropriate erosion and sediment controls and standard construction safeguards.

Threatened amphibians (Sloane's Froglet)

No impacts to threatened frog species would occur as a result of the proposal. Field surveys were unsuccessful in detecting the presence of Sloane's Froglet (*Crinia sloanei*). The habitat identified as potential Sloane's Froglet habitat in Planting Area C would be retained and other common species of frogs would utilise this habitat during seasonal episodes of inundation.

7.7.3.2 Operational Impacts

No impacts to threatened aquatic species is expected to occur as a result of the operational phase of the proposal. The proposal would not impact on any aquatic habitat, reducing any potential risks of erosion in the gully areas and retaining threatened species habitat. Fauna including potential amphibian species are expected to utilise the remaining habitat.

7.7.4 REGIONAL AND CUMULATIVE IMPACTS

The loss of large habitat trees or hollow-bearing trees is a long-term cost of projects such as these, because these features of the environment can take well over 100 years to form (Mackowski 1984; Wormington & Lamb 1999). The landscape surrounding the proposal area is largely cleared and already contains a reduced density of mature trees that may be hollow-bearing. Many of the mature trees occur as scattered paddock trees which are susceptible to dieback and occur in actively grazed or cropped situations where ongoing recruitment of trees is inhibited. Despite this, there are still likely to be a number of hollows present in the vegetation within the locality of similar overstorey composition to that within the project area.

The proposal would not reduce the overall landscape connectivity at the local or regional scale, as connectivity is already poor in the study area.

7.8 MITIGATION MEASURES

The safeguards below will assist with minimising the impacts on biodiversity during vegetation removal and maintenance works.

Table 7.1 – Safeguards for the Protection of Flora and Fauna

Impact	Safeguard	Timing
Disruption to the breeding cycle of threatened birds	Pre-clearing surveys should be undertaken for hollow-bearing trees and would include surveys for threatened birds and the presence of active nests in the proposal area. If nests for any of these species are detected the host tree should be avoided and no works should occur within 100 metres until the eggs have hatched and the chicks fledged. If this cannot be achieved it may be appropriate for species other than threatened species for an ecologist or wildlife carer to remove the nest and to take the eggs/chicks to a wildlife care facility. Whether or not this is appropriate should be at the discretion of the project ecologist.	Pre-construction and clearing
Loss of hollow bearing trees	Pre-clearing surveys should be undertaken for the presence of bats that are likely to occur in the area. Staged removal of hollow-bearing trees should be adopted as described in Guides 1 and 4 of the Roads and Maritime Biodiversity Guidelines (RTA 2011) Details of local WIRES contact to be kept readily available in the case of fauna being discovered or injured during tree felling. Hollow bearing trees to be retained will be protected by a physical barrier or fence or similar in accordance with AS 4970-2009. 10 nest boxes for displaced fauna (including non-threatened species) should be installed within the planted vegetation (Area A,B and C) on site. The type of nest boxes and final location would be selected in consultation with an ecologist. Nest boxes should be installed up to one month before the start of any tree removal to provide alternative shelter for hollow-dependent fauna displaced during clearing. Nest box monitoring and maintenance, including replacement, would be carried out for the life of the solar farm, in consultation with an ecologist. Damaged nest boxes would be replaced. Pests, such as non-native bees, would be eradicated. Where practical, hollowed limbs removed from trees being felled will be placed in areas outside the proposal footprint or in the planted areas where they will in time form habitat for ground dwelling fauna. They should not be stacked into windrows, but scattered sparsely.	Pre-construction and clearing
Introduction and spread of priority weeds	Declared priority weeds should be managed according to the requirements stipulated by the Biosecurity Act, and recommendations made by the local control authority (MLLS) and the Noxious and Environmental Weed Handbook (DPI, 2011), which contains details as to the management of specific noxious weeds. Regular targeted control of priority weeds should take place for at least 24 months following rehabilitation of disturbed areas. All weed material containing seed heads, weeds that contain toxins, and weeds that are able to reproduce vegetatively should be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth. All herbicides should be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application should be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	Construction and post-construction
Disturbance to fallen timber, dead wood and bush rock	Any fallen timber, dead wood and bush rock encountered in the impact area should be relocated to within the planted vegetation areas (Areas A, B, and C).	Construction

Table 7.1 – Safeguards for the Protection of Flora and Fauna

Impact	Safeguard	Timing
Unexpected threatened species finds	The site induction should include measures to make employees aware of potential threatened flora and fauna during works and understand the procedures if threatened fauna are detected, this will be recorded as a part of the induction procedure and toolbox talks: • Stop work, • Alert Ecologist for assessment and possible re-location during works.	Construction and post construction

7.9 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

7.9.1 PRECAUTIONARY PRINCIPLE

Namely that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. The Biodiversity assessment has been prepared utilising the precautionary principle. That is, if threats are perceived as possibly leading to serious or irreversible environmental damage, then either the non-development of the proposal would occur, or the development modified to ensure that such threats do not exist. This has been the approach in relation to mitigation measures.

7.9.2 INTERGENERATIONAL EQUITY

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The proposed works would not impact on natural features to a level that would compromise the health, diversity or productivity of the environment to a level that would impact on future generations.

7.9.3 BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

The proposed works would potentially disturb fauna habitat including the removal of 8 hollow bearing trees and 3 non-hollow bearing trees. The quality of potential habitat is low, being largely cleared, dominated by exotic grasses, lacking structural complexity, and disturbed by agricultural activities. The planted vegetation contains moderate to good quality habitat which would be retained. The assessment has identified that the works would not impact significantly on the biological diversity and ecological integrity of the locality. Furthermore, safeguards have been developed that would assist in protecting valuable habitat resources.

7.9.4 IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS

This principle relates to giving monetary values to environmental resources. The proposal involves the generation of renewable energy an important sustainable resource. With minimal environmental impact this factor ensures that the development would conform to the principles of ecologically sustainable development.

Noise and Vibration

8.1 INTRODUCTION

A noise study has been undertaken to assess the potential impacts of the construction and operation of the proposed solar farm on nearby sensitive receptors in accordance with the following NSW policies and guidelines:

- *NSW Environment Protection Authority Industrial Noise Policy* (EPA, 2000)
- *NSW Assessing Vibration: a technical guideline* (DEC, 2006);
- *NSW Road Noise Policy* (DECCW, 2011); and
- *Interim Construction Noise Guideline* (DECCW, 2009)

In accordance with the requirements of the above guidelines, computational modelling and first principle calculations have been undertaken to support the assessment of the potential for adverse amenity impacts as a result of the development.

A full copy of this study is provided in **Appendix A**. Provided below is a summary of the methodology, results and conclusions of the noise and vibration impact assessment.

8.2 SENSITIVE RECEPTORS

The nearest residential receptors to the proposed solar farm include 17 single existing dwellings located within 1.7 km of the development. Of these, one receptor is located within the proposed development lot boundary. Receptor R18 is a commercial receptor.

Table 8.1 and **Figure 15** provide a summary of the nearest receptors considered in the noise assessment.

Table 8.1 – Potentially Sensitive Receptors

Receptor	Description	Distance to Development Site Boundary
R1	Existing Dwelling	40 m
R2	Existing Dwelling	40 m
R3	Existing Dwelling	300 m
R4	Existing Dwelling	440 m
R5 (associated with the development)	Existing Dwelling	800 m
R6	Existing Dwelling	560 m
R7	Existing Dwelling	450 m
R8	Existing Dwelling	970 m
R9	Existing Dwelling	960 m
R10	Existing Dwelling	1,320 m
R11	Existing Dwelling	1,370 m
R12	Existing Dwelling	1,450 m
R13	Existing Dwelling	1,000 m
R14	Existing Dwelling	1,250 m
R15	Existing Dwelling	1,410 m
R16	Existing Dwelling	1,690 m

Table 8.1 – Potentially Sensitive Receptors

Receptor	Description	Distance to Development Site Boundary
R17	Existing Dwelling	1,160 m
R18	Commercial Premise	390 m

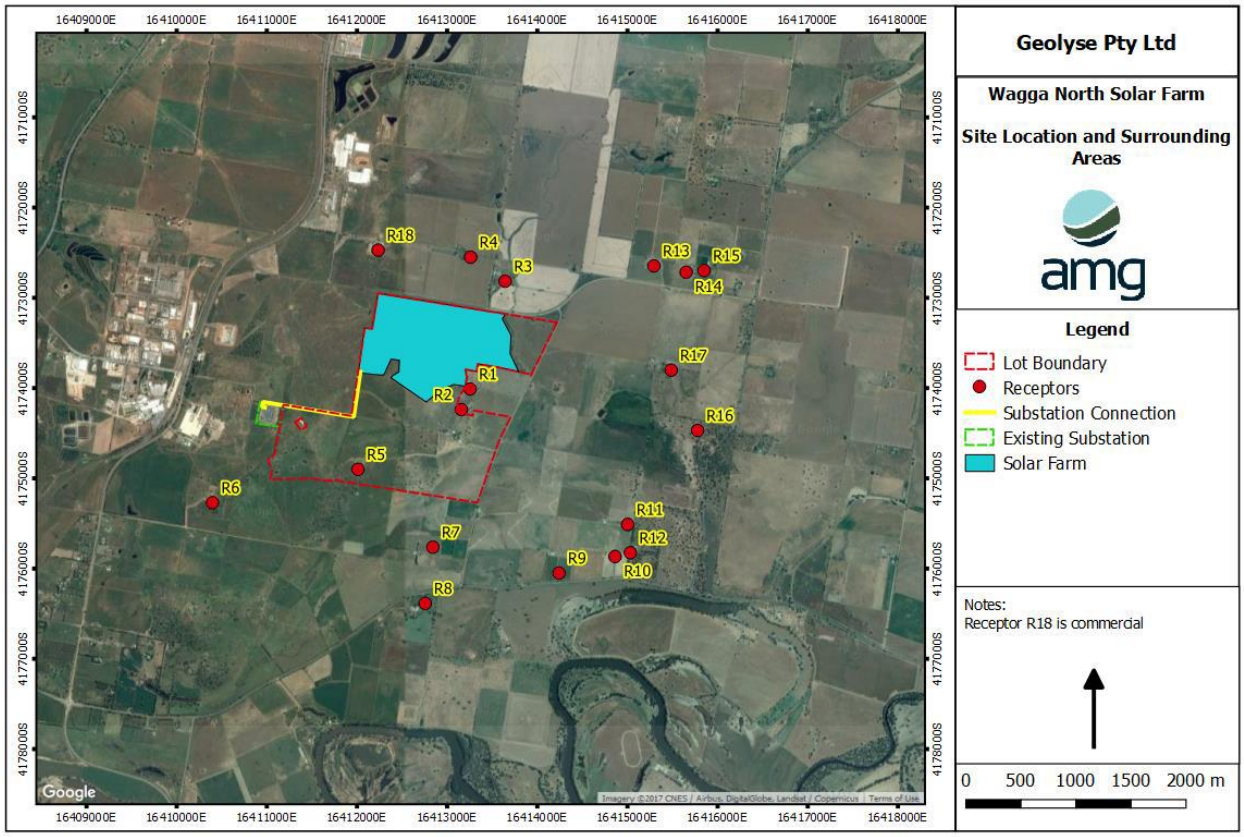

Figure 15: Sensitive Receptors

8.3 CONSTRUCTION NOISE ASSESSMENT

8.3.1 DURATION OF CONSTRUCTION WORKS

The construction of the WWSF is expected to take approximately 12 months with a number of different activities undertaken over that time.

Table 8.2 below presents an overview of each of the construction tasks along with their expected duration. It is noted that some of these tasks are likely to occur concurrently. Activities such as civil works, trenching, piling and installation may occur concurrently, and site preparation and construction of the substation is likely to be undertaken at the same time as installation of the solar PV modules and cabling.

Table 8.2 – Construction Phases and Expected Duration

Construction Phase	Duration
Site clearing and preparation	3 months
Piling – installation of module mounting structures	3 months
Installation of solar PV modules & inverter assemblies	5 months
Commissioning	3 months

Given the rural location and the relatively large separation distances between the development and the majority of nearby sensitive receptors, the assessment has also considered the potential for adverse amenity impacts associated with construction outside recommended standard hours.

The assessment has therefore considered the potential for adverse amenity impacts associated with construction outside what the EPA term 'normal construction hours': which are between 7 am and 6 pm Monday to Friday and 8 am to 1 pm Saturday, with no works on Sundays or Public Holidays.

8.3.2 INTERIM CONSTRUCTION NOISE GUIDELINES

Guidance on the assessment and management of construction noise in NSW is provided in the *Interim Construction Noise Guideline 2009* (ICNG) published by the EPA.

The main objectives of the Guideline are to:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours, unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage;
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts; and
- Provide guidelines for assessing noise generated during the construction phase of developments.

In achieving these objectives, the guideline provides a framework for the qualitative and quantitative assessment of potential construction noise impacts noting that, for major projects, a quantitative assessment is the preferred approach.

Table 8.3 presents construction noise criteria outlined in the guideline. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 8.3 – NSW EPA Construction Noise Criteria – Residential Receivers

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

Where nearby sensitive uses are predicted to be noise affected, the proponent is required to apply reasonable and feasible noise mitigation measures. A noise mitigation measure is feasible if it is capable of being put into practice, and is practical given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

For construction noise, the assessment criteria have been determined based on the RBL determined through background noise monitoring as detailed in Appendix B. For standard construction hours, the RBL at the representative monitoring location was 35 dB(A), resulting in a noise affected limit of 45 dB(A) for construction during standard hours.

For construction outside standard hours, the background noise monitoring data indicates a representative RBL of 29 dB(A) during night periods. It is noted that the minimum allowable RBL according to the INP is 30 dB(A) for night periods thereby resulting in a noise affected limit of 35 dB(A) for construction outside standard hours.

8.3.3 CONSTRUCTION NOISE SOURCES

In terms of noise emissions, the site preparation activities and installation of the solar PV modules (specifically driving the support posts into the ground) are expected to represent those with the most significant potential for adverse impacts. The indicative project schedule has determined these two activities may occur concurrently. Therefore, for the purposes of the assessment, the impacts associated with these two elements have been assessed cumulatively.

It is noted that construction works are expected to progress across the site such that plant and equipment would only be in a single area for a short period of time. For example, each post takes approximately 25-30 seconds to drive into the ground thereby providing the ability to install a new pile approximately every 2.5 minutes. Given this, the potential for adverse impacts at any one receptor is expected to only occur for a short period of time.

Table 8.4 presents a summary of the plant and equipment likely to be required to complete the on-site construction works. The sound power levels presented have been sourced from published noise emission datasets and the library of source noise levels maintained by Assured Monitoring Group.

Table 8.4 – Construction Phases and Expected Duration

Construction Phase	Plant Item	Number Assume	Sound Power Level, dB(A)	Acoustical Usage Factor, %
Site preparation and construction of site substation [a)]	Truck and Dog	2	110	40
	Compactor	2	103	20
	Bulldozer	3	109	40
	Excavator	1	106	40
	Mulcher	2	116	20
	Grader [c)]	2	108	40
	Water Cart (as required)	2	103	40
	Vibratory Roller	2	103	20
Installation of solar PV modules & inverter assemblies	Piling Drill Rig [f)]	3	105	20
	Franna Crane	2	107	16
	Trencher	3	97	40
	Loader	2	107	40
	Generator	1	73	50
	Powered Hand Tools		95	50

a) Construction plant used intermittently as required. Continuous use not expected.
b) Truck movements associated with deliveries assumed to move through site at 10 km per hour as a moving point source.
c) Grader required for construction of access tracks, substation, maintenance building, construction offices car park, minor earthworks and grading around the solar array area as required to meet structural tolerances for the tracker equipment.
d) Deliveries to site only to occur during standard construction hours.
e) The 'Acoustical Usage Factor' represents the percentage of time that a particular item of equipment is assumed to be running at full power while working on site.
f) Includes a correction for tonality

8.3.4 ASSESSMENT OF IMPACTS

For the purposes of predicting impacts associated with noise emissions from the development site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software Cadna. Cadna incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with ISO Standard 9613 (1996) *Acoustics - Attenuation of sound during propagation outdoors*.

The model is utilised to assess the potential noise emissions from the site under a range of operating scenarios and meteorological conditions. In the event that non-compliance with the assessment criterion is predicted, the noise modelling also allows investigation of possible noise management solutions.

8.3.4.1 Site Clearance Activities

For the site clearance activities during the construction phase of the proposed project, predictive noise modelling has considered the range of potential impacts likely noting that noise generating activities will progressively move across the site over the duration of construction. As such, the highest noise levels would not be expected to be experienced at a single receptor for more than one day while construction equipment is at the closest point to the receptor.

Table 8.5 presents predicted receptor noise levels for site clearance activities during the construction phase of the proposed solar farm.

Table 8.5 – Predicted Receptor Noise Levels – Construction Phase (Preparatory Works), dB(A)

Receptor	Predicted Construction Noise Levels, LAeq 15min	Noise Management Level		Comply (Y/N)
		Standard Hours	Outside Standard Hours	
R1	40	45	35	Standard Hours only
R2	38	45	35	Standard hours only
R3	36	45	35	Standard hours only
R4	34	45	35	Y
R5	33	45	35	Y
R6	19	45	35	Y
R7	24	45	35	Y
R8	<10	45	35	Y
R9	<10	45	35	Y
R10	<10	45	35	Y
R11	<10	45	35	Y
R12	<10	45		Y
R13	24	45		Y
R14	17	45		Y
R15	13	45		Y
R16	<10	45		Y
R17	27	45		Y
R18	31			NA

Review of the predicted noise levels confirms that compliance with the noise management level provided in the ICNG for all receptors for normal construction hours. For construction outside standard hours, the results of the modelling indicate exceedances of the noise limits could occur at Receptors R1, R2 and R3.

It should be noted that ICNG does not provide criteria for commercial receptors, however the predicted noise levels at R18 show compliance with the residential criteria.

8.3.4.2 Installation Activities

For the installation activities (including piling) during the construction phase of the proposed project, predictive noise modelling has considered the range of potential impacts likely noting that noise generating activities will progressively move across the site over the duration of construction. As such, the highest noise levels from piling activities would not be expected to be experienced at a single receptor for more than one day while construction equipment is at the closest point to the receptor.

Table 8.6 presents predicted receptor noise levels for installation activities during the construction phase of the proposed solar farm.

Table 8.6 – Predicted Receptor Noise Levels – Construction Phase (Installation) dB(A)

Receptor	Predicted Construction Noise Levels, LAeq 15min	Noise Management Level		Comply (Y/N)
		Standard Hours	Outside Standard Hours	
R1	40	45	35	Standard Hours only
R2	37	45	35	Standard hours only
R3	35	45	35	Y
R4	31	45	35	Y
R5	31	45	35	Y
R6	<10	45	35	Y
R7	25	45	35	Y
R8	<10	45	35	Y
R9	<10	45	35	Y
R10	<10	45	35	Y
R11	<10	45	35	Y
R12	<10	45	35	Y
R13	20	45	35	Y
R14	17	45	35	Y
R15	16	45	35	Y
R16	<10	45	35	Y
R17	27	45	34	Y
R18	26			NA

Review of the predicted noise levels confirms that compliance with the noise management level provided in the ICNG is predicted to be achieved for all receptors for construction during standard hours. For construction outside standard hours, the results of the modelling indicate exceedances of the noise limits could occur at Receptors R1 and R2.

Receptor R3 has a higher predicted noise level during preparatory civil works due to the proximity to the site access road.

8.3.5 MITIGATION OF CONSTRUCTION NOISE LEVELS

Receptor R1 is located approximately 40 m from the development boundary. As noted previously, the piling activities during the installation phase of the construction works are expected to generate the highest noise levels. For the purposes of this assessment, the sound power level used for the piling activities is 107 dB(A) excluding a tonality correction.

Due to the proximity of receptors R1 and R2, prior to piling activities being undertaken, it is recommended that the following approach is considered:

- Stage 1: Undertake consultation with the residents;
- Stage 2: If possible procure piling rigs with a maximum SWL of 107 dB(A);
- Stage 3: Where quieter piling rigs are unable to be sourced and consultation with Receptors 1 and 2 confirms unacceptable noise levels, piling activities should be managed such that when piling within 500 m of the boundary, only one rig is operational at any one time and piling must not occur for more than three (3) hours at any one time, with a minimum of one (1) hour break.

Given the variable and mobile nature of the construction works, the use of permanent or temporary acoustic barriers is not considered feasible. Potential controls available to the construction contractor to minimise potential impacts on Receptor R1 and R2 for construction works could include:

- Limiting noise generating construction activities to standard construction hours except where an acceptable acoustic solution can be identified to minimise adverse amenity impacts on Receptors R1, R2 and R3;
- Consultation with R1 and R2 landholders throughout the construction process to inform them on the duration and timing of potentially noisy activities;
- Using broad-band reversing alarms on all mobile plant and equipment;
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine;
- Select quieter items of plant and equipment where feasible and reasonable;
- Operating plant in a quiet and efficient manner;
- Reduce throttle setting and turn off equipment when not being used; and
- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers.

Overall, given the size of the subject site, there is potential for limited quiet construction works to be undertaken outside standard hours subject to the effective implementation of the above reasonable and feasible mitigation measures. Further, given the tendency for agricultural activities to be undertaken during evening and night periods (e.g. during harvest season etc.), construction during these periods, when undertaken concurrently with these agricultural activities is unlikely to represent a significant amenity impact for residences in the area.

8.4 OPERATIONS NOISE ASSESSMENT

8.4.1 OPERATIONAL NOISE CRITERIA

8.4.1.1 Overview

The acoustic assessment has been completed in accordance with the procedure identified in the NSW *Industrial Noise Policy* (INP). The INP establishes two separate noise criteria to meet environmental noise objectives: one to account for intrusive noise and the other to protect the amenity of particular land uses.

The derivation of the two sets of criteria are presented below. For residential dwellings the noise criteria are assessed at the most-affected point (i.e. highest noise level) on or within the property boundary. Where the property boundary is more than 30 m from the house, then the criteria applies at the most affected point within 30 m of the house.

8.4.1.2 Intrusiveness Criteria

In accordance with the INP, intrusive noise refers to noise that exceeds background noise levels (as defined by the Rating Background Level) by more than 5 dB. Given the remote location of the development site and the lack of any significant activity in the area, the impact assessment has used background noise monitoring data reported by Atkins Acoustic (2008). This data was collected near to the development site at a location considered representative of the acoustic environment expected to be experienced by the nearest sensitive receptors to the proposed solar farm.

Therefore, **Table 8.7** presents the derivation of the intrusiveness criteria based on the minimum background noise level established by the INP.

Table 8.7 – Derived Intrusiveness Noise Criteria

Receptor	Intrusiveness $L_{Aeq,15\text{-}minute}$ Criteria		
	Day	Evening	Night
All nearby residential receptors [a)]	40 [b)]	37 [b)]	35 [b)]

a) Receptor noise limit applies at a location 30 m from the dwelling façade.
b) Based on background monitoring (refer Appendix C). Night period background noise level established by the INP minimum allowable level (30 dB(A)) + 5 dB.

8.4.1.3 Amenity Criteria

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels (ANL) specified in the INP. The ANL is dependent on the type of area being considered. **Table 8.8** presents ANL values for residential receivers in rural areas.

Table 8.8 – INP Acceptable Noise Levels for Residential Receivers

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Noise Management Level Comply (Y/N)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Commercial	All	When in use	65	70

When the existing industrial noise levels approach the ANL, then the noise level from a new source must be controlled to preserve the amenity of the area. In the absence of the proposed solar farm, no other industrial noise sources have been identified in the area.

Equally, it is also noted that noise emissions from the proposed solar farm would not be expected to limit the future potential for development of the adjacent Bomen Urban Release Area.

In view of this, the assessment has considered the compliance of noise emissions during the operational phase of the project against the (limiting) intrusiveness criteria presented above.

8.4.1.4 Sleep Disturbance

NSW EPA have identified the potential for noise emissions from developments to impact on the sleep of residents living in the area. To assist in the reducing the potential for these impacts the EPA released a policy statement in relation to the assessment of the potential for sleep disturbance effects. The following presents an excerpt from this policy statement:

> *"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development."*

For the operational phase of the WWSF, loud impact noises associated with sleep disturbance are considered unlikely with all plant and equipment continuous or semi-continuous in its operations. Furthermore, the operation of plant and equipment on-site is expected to only occur during daylight hours where solar energy is available with peak operations.

Given the lack of short-term impact noise sources on site consideration of sleep disturbance impacts for the operational phase of this project is considered unnecessary. Rather, where compliance can be demonstrated with the intrusive noise criteria established for the development, compliance with the sleep disturbance provisions would also be expected.

8.4.2 NOISE SOURCES

The WWSF is to consist of solar photovoltaic (PV) plant and associated infrastructure producing up to 26 MW of electricity for supply into the grid. It is expected that, at completion, infrastructure installed on site will incorporate:

- a total of 101,562 solar panels;
- 12 solar inverters with integrated transformers; and
- a high-voltage step-up transformer.

The PV panels are expected to be single axis tracking panels which track the sun's movement across the day through the use of small motors which rotate the panel arc of the sun to maximise the solar effect. Up to 1,295 NexTracker tracking motors will be installed. For the purposes of the assessment it is assumed that these tracking motors would be evenly distributed across the farm.

The inverters required for the development will be placed to optimise cabling and maintenance and for the purposes of this assessment, the inverters required have been located at approximately even spacing across the site.

A single transformer is required for the proposed solar farm to allow connection of the solar farm to the power grid and will be located at the south west corner of the development site.

Table 8.9 presents a summary of the source noise levels considered in the assessment.

Table 8.9 – Source Noise Levels

Source	Sound Power Level (dB(A))
NexTracker	60 (each)
Inverter [a)]	92 (each)
Transformer	75
Light Vehicle	88

a) Based on previous experience with similar sources there is potential for tonal influences associated with this source. Therefore, in accordance with the INP, a +5 dB penalty has been applied to this source.

8.4.3 NOISE MODELLING METHODOLOGY

For the purposes of predicting impacts associated with noise emissions from the development site on nearby sensitive receptors, noise modelling of the sources was completed using the proprietary software Cadna. Cadna incorporates the influence of meteorology, terrain, ground type and air absorption in addition to source characteristics to predict noise impacts at receptor locations. All predictions have been undertaken in accordance with ISO Standard 9613 (1996) *Acoustics - Attenuation of sound during propagation outdoors*.

The model is utilised to assess the potential noise emissions from the site under a range of operating scenarios and meteorological conditions. The noise modelling also allows investigation of possible noise management solutions, in the event that non-compliance with the assessment criterion is predicted.

8.4.4 METEOROLOGY

The INP presents guidelines for the consideration of meteorological effects on noise propagation. Specifically, temperature inversions and/or gradient winds should be modelled if each factor is a feature of the local environment. The following conditions for modelling temperature inversions or gradients winds are provided:

- Temperature inversions:
  - use default parameters for temperature inversions and drainage-flow wind speed where inversions are present for at least 30 percent of the total night time during winter as specified; or
  - use parameters determined by direct measurement. Wind data should be collected at a 10 m height.
- Gradient winds:
  - where there is 30 percent or more occurrence of wind speeds below 3 m/s (source-to-receiver component), then the highest wind speed (below 3 m/s) is used instead of the default.
  - where there is less than 30 percent occurrence of wind speeds of up to 3 m/s (source-to-receiver component), wind is not included in the noise prediction calculation.

Given the location of the site, the presence of temperature inversions is considered possible for night-periods. Therefore, in accordance with the requirements of the INP the following scenarios have been considered:

- Day Periods - Source to receptor wind at 3 m/s representing a worst-case assessment of potential impacts for day-periods; and
- Night Periods - Moderate temperature inversion with light source to receptor winds representing a worst-case assessment of potential impacts for night periods.

8.4.5 PREDICTED NOISE LEVELS

Table 8.10 presents predicted receptor noise levels during the operational phase of the WWSF. Review of the predicted noise levels confirms that compliance with the intrusive noise criteria established in accordance with the INP can be achieved for all receptors for daytime operational hours under worst-case meteorological conditions.

Table 8.10 – Predicted Receptor Noise Levels – Operational Phase, dB(A)

Receptor	Predicted Operational Noise Levels, $L_{Aeq, 15min}$	Intrusive Noise Criteria [a)]	Comply (Y/N)
R1	35	40	Y
R2	32	40	Y
R3	24	40	Y
R4	24	40	Y
R5	27	40	Y
R6	<10	40	Y
R7	21	40	Y
R8	<10	40	Y
R9	<10	40	Y
R10	<10	40	Y
R11	<10	40	Y
R12	<10	40	Y
R13	13	40	Y
R14	<10	40	Y
R15	<10	40	Y
R16	<10	40	Y
R17	12	40	Y
R18	22	65	Y

a) Intrusive noise criteria for day, evening and night periods
b) Acceptable noise criteria for when in use

8.5 ROAD TRAFFIC NOISE ASSESSMENT

8.5.1 INTRODUCTION

Noise impacts associated with vehicle movements during the operational phase of the Wagga Wagga Solar Farm project are expected to be negligible given the small number of movements expected (maximum of six per day for three permanent staff). During the construction phase of the project however, significantly higher traffic volumes are expected for the duration of the construction works.

Construction is expected to be completed over a 12-month period with an expected peak period of six months during which a range of construction tasks are concurrently undertaken. During this peak, it is anticipated that up to 100 workers would be on-site daily, dropping to 20 workers for the six-month shoulder periods.

While it is expected that the contractor would provide a shuttle bus service, for assessment purposes it is assumed that only 30% of the 100 workers would participate in some form of carpooling. Therefore, the modelling has assumed an estimated maximum of 70 private light vehicles travelling to and from the site daily for this peak period.

The infrastructure will be delivered to the site via Byrnes Road and East Bomen Road.

The maximum number of heavy vehicles accessing the site during the peak of the construction period is not expected to exceed 20 (i.e. generating a total of 40 heavy vehicle movements in a day).

Given this, the assessment has considered the potential impacts associated with noise emissions from the maximum expected 140 light and 40 heavy vehicle movements from the site entry along East Bomen Road and Byrnes Road.

Table 8.11 – Construction Phase Traffic Generation

Road	Vehicle Type	Vehicle Speed	Number of Movements	
			Day (7.00 am – 10 pm)	Night (Peak 1 hour)
Byrnes Road	Light	100 km/hr [b)]	140	70
	Heavy	100 km/hr [b)]	40	0
East Bomen Road	Light	60 km/hr	140	70
	Heavy	40 km/hr	40	0

a) Assumes all truck deliveries to site occur during the hours of 7 am to 10 pm.

8.5.2 ASSESSMENT CRITERIA

Based on the NSW *Road Noise Policy* (RNP) and road type, **Table 8.12** presents the applicable road traffic noise criteria for existing residences affected by traffic on existing roadways generated by land use developments.

Table 8.12 – Applicable Road Traffic Noise Criteria

Road Category	Type of Project & Land Use	Assessment Criteria (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments.	Day: LAeq,1 hour 55 dB(A) Night: LAeq,1 hour 50 dB(A)
Freeway / arterial / sub-arterial road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	Day: LAeq,15 hour 60 dB(A) Night: LAeq,9 hour 55 dB(A)

8.5.3 NOISE MODELLING METHODOLOGY

Predicting impacts associated with road traffic noise was completed using the proprietary software Cadna with all predictions undertaken in accordance with Calculation of Road Traffic Noise (CRTN) methodology developed by the UK Department of Transport. In accordance with the requirements of the RNP the predictive noise modelling incorporated the following assumptions:

- L_{Aeq} values were calculated from the L_{A10} values predicted by the CRTN methodology using the approximation $L_{Aeq,1\ hour} = L_{A10,1\ hour} – 3$.
- Noise source heights were set at 0.5 m above road level for cars, 1.5 m for heavy vehicle engines and 3.6 m for heavily vehicle exhausts.
- Noise from heavy vehicle exhausts is 8 dB lower than the steady continuous engine noise; and
- Corrections established for Australian conditions applied through a negative correction to the CRTN predations of -1.7 dB for façade-corrected levels (Samuels and Sauders, 1982).

Table 8.13 below presents predicted noise levels for the nearest potential receptor to Byrnes Road assuming a minimum setback distance of 20 m. It should be noted that this is considered to represent a conservative assumption. **Table 8.13** also presents predicted noise levels for the nearest potential receptor to East Bomen Road assuming a minimum setback distance of 360 m.

Review of the predicted noise levels confirms that compliance with the RNP is predicted by a considerable margin. Adverse amenity impacts due to peak traffic levels generated by the proposed construction works is considered unlikely.

Table 8.13 – Predicted Noise Levels – Road Traffic Noise

Receptor	Setback from Roadway	Period	Parameter	Criteria	Predicted Noise Level	Comply (Y/N)
Nearest to Byrnes Road (R6)	20 m	Day Night	L_{Aeq}, 15 hour L_{Aeq}, 9 hour	60 dB(A) 55 dB(A)	57 54	Y Y
Nearest to East Bomen Road (R7)	360 m	Day Night	L_{Aeq}, 1 hour L_{Aeq}, 1 hour	55 d B(A) 50 dB(A)	31 26	Y Y

8.6 VIBRATION ASSESSMENT

8.6.1 INTRODUCTION

There is potential for impacts as a result of vibration generated by plant and equipment during the construction phase. The assessment undertaken considered the potential for impacts on both human comfort and structural damage for the nearest residence to the construction works.

8.6.2 ASSESSMENT CRITERIA

The vibration criteria presented in the *Environmental Noise Management – Assessing Vibration: A Technical Guide* (2006) published by the NSW Department of Environment Climate Change and Water (DECCW) have been adopted for the assessment. The technical guide provides vibration criteria associated with amenity impacts (human annoyance) for the three categories of vibration:

- Continuous vibration (e.g. road traffic, continuous construction activity);
- Impulsive vibration includes less than 3 distinct vibration events in an assessment period (e.g. occasional dropping of heavy equipment); and
- Intermittent vibration includes interrupted periods of continuous vibration (e.g. drilling), repeated periods of impulsive vibration (e.g. pile driving) or continuous vibration that varies significantly in amplitude.

Table 8.14 and **Table 8.15** present the criteria for continuous and impulsive vibration and intermittent vibration respectively.

Table 8.14 – Continuous & Impulsive Vibration Criteria – Peak Velocity

Location	Vibration Type	Preferred Limit (mm/s)	Maximum Limit (mm/s)
Residences	Continuous	0.28	0.56
Residences	Impulsive	8.6	17

Table 8.15 – Intermittent Vibration Criteria for Residences

Location	Assessment Period	Preferred Value ($m/s^{1.75}$)	Maximum Value ($m/s^{1.75}$)
Residences	Day-time	0.20	0.40

The above criteria are suitable for assessing human annoyance in response to vibration levels. In order to assess potential damage to buildings, reference has been made to British Standard BS 7385-2: 1993

Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration. **Table 8.16** presents vibration criteria for assessing the potential for building damage.

Table 8.16 – Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Particle Velocity (mm/s)	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures – residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

8.6.3 POTENTIAL VIBRATION SOURCES

Table 8.17 identifies the vibration source levels for the equipment likely to be used for the construction of the solar farm.

Table 8.17 – Vibration Source Levels – Peak Particle Velocity

Equipment Item	PPV at 10 m (mm/s)	Sources
Piling	1 – 2	Rockhill D.J et. al. [b]
Roller	5 - 6	DECCW
7 tonne compactor	5 - 7	DECCW
Loaded trucks (rough surface)	5	USA DT [a]
Loaded trucks (smooth surface)	1 – 2	USA DT [a]
Excavator	2.5 – 4	DECCW

a) Transit Noise and Vibration Impact Assessment, US Department of Transportation, May 2006.
b) Rockhill, D.J., Bolton, M.D. & White, D.J. (2003) 'Ground-borne vibrations due to press-in piling operations'

8.6.4 ASSESSMENT OF POTENTIAL IMPACTS

Based on the vibration source levels at 10 m peak particle velocities have been predicted at various separation distances.

Table 8.18 – Predicted Peak Particle Velocity at Sensitive Receptors (mm/s)

Distance from Source (m)	Predicted Peak Particle Velocity (mm/s)					
	Roller	7 tonne compactor	Excavator	Piling	Loaded trucks (rough surfaces)	Loaded trucks (smooth surfaces)
10	6.00	7.00	4.00	0.35-0.71	5.00	1-2
20	2.12	2.47	1.41	0.19-0.38	1.77	0.35-0.71
30	1.15	1.35	0.77	0.13-0.25	0.96	0.19-0.38
40	0.75	0.88	0.50	0.09-0.18	0.63	0.13-0.25
50	0.54	0.63	0.36	0.07-0.14	0.45	0.09-0.18
60	0.41	0.48	0.27	0.02-0.11	0.34	0.07-0.14
70	0.32	0.38	0.22	0.04-0.09	0.27	0.06-0.11
80	0.27	0.31	0.18	0.07-0.07	0.22	0.05-0.09
90	0.22	0.26	0.15	0.03-0.06	0.19	0.04-0.07
100	0.19	0.22	0.13	0.02-0.03	0.16	0.03-0.06
150	0.1	0.12	0.07	0.35-0.71	0.09	0.02-0.03
Type	Continuous	Continuous	Continuous	Intermittent	Intermittent	Intermittent
Nuisance Criteria	Residential 0.28 (preferred)/0.56 (max) School 0.56 (preferred)/1.1 (max)					
Building Criteria	Residential 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above					

The predicted vibration levels presented in **Table 8.18** indicate compliance with the continuous preferred vibration nuisance criteria for locations at a separation distance of 50-60 m. Compliance with the building damage criteria is predicted at 10 m from construction for each source.

For intermittent vibration associated with haul vehicles and piling, it is difficult to provide an appropriate comparison with the relevant criteria (which is presented as a Vibration Dose Value (VDV) in $m/s^{1.75}$). The calculation of a VDV requires both the overall weighted RMS (root mean square) acceleration (m/s^2) typically obtained from on-site measurements and the estimated time period for vibration events.

It is noted, however, that the piling PPV at distances of 260 m (the distance to the nearest sensitive receptor from potential piling) is predicted to be within the maximum continuous criteria of 0.56 mm/s. This comparison with the continuous criteria (as a conservative approach) indicates that vibration levels associated with piling are not considered to be significant (which is expected given the significant separation distances).

8.7 CONCLUSION

The impact assessment has considered the potential for adverse impacts resulting from noise (construction, road traffic and operational) and vibration (construction) emissions on neighbours.

Overall, based on the results of the assessment, the risk of adverse impacts as a result of the proposed WWSF is considered to be low and complies with all applicable criteria. Hence, from an acoustic perspective, the proposed development site is considered acceptable for the proposed use.

Visual Impact

9.1 LANDSCAPE CHARACTER

Section 13 of the *Wagga Wagga Development Control Plan* for the Bomen Urban Release Area (BURA) notes that natural features within the Bomen area provide an important setting for new development. The varying topography, creek lines and vegetation are significant elements of the landscape, which is currently dominated by agricultural pasture and some remnants of indigenous ecology. As a whole the Bomen landscape is characterised by undulating ground with sparse tree cover.

A significant ridge is located west of the development site, with the railway line and Byrnes Road located predominantly along this ridgeline. The development site, as with a large extent of the BURA, lies on the eastern slope of this ridge.

Important landscape features associated with the BURA, and the spatial relationship between the BURA and the WWSF is shown in the DCP's Site Topography and Landscape Character diagram below.

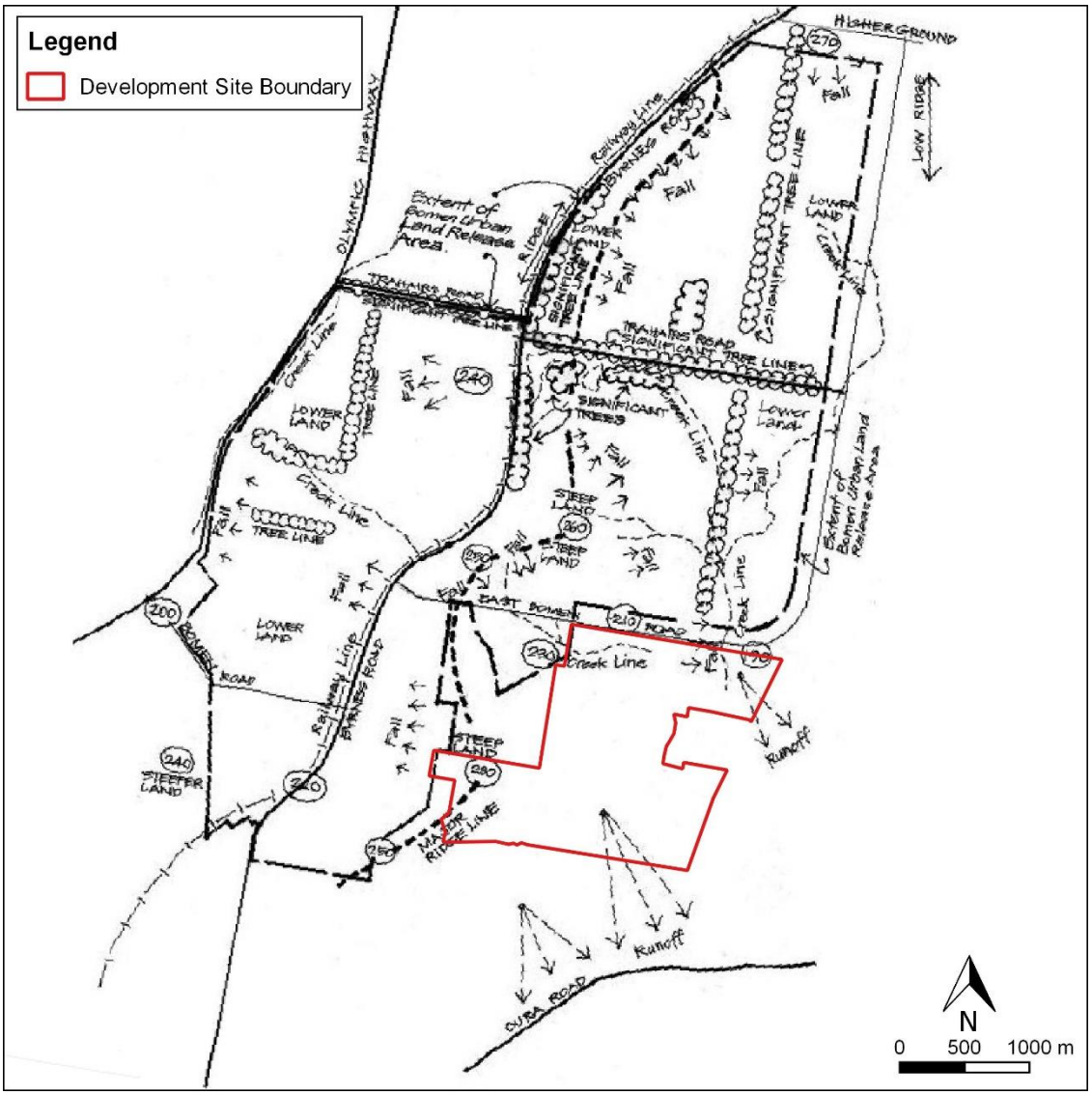

Figure 16: Site Topography and Landscape Character (WWDCP)

While the visual qualities of the existing Bomen landscape is characterised by undulating ground with sparse tree cover, the future landscape associated with the BURA immediately to the north and west will be significantly different. The types of development permitted in this Industrial zoned, contingent on securing development consent, include, but are not restricted to, depots; freight transport facilities; general industries; industrial training facilities; light industries and warehouse and distribution centres. Similarly, the Wagga Wagga Development Control Plan allows for a diversity of building forms and sizes within the BURA.

Whilst the WWSF will impact on the existing rural landscape, the landscape character in the immediate vicinity of the WWSF is destined for significant change.

9.2 FARM INFRASTRUCTURE

Above ground infrastructure associated with the solar farm will include a perimeter security fence, modules (including the supporting piles and tracking mounts), an operations and maintenance building, the inverter stations and the site substation. The grid connection will be an OHTL.

Modules

The solar PV panel technology will be either crystalline silicone or Cadmium Telluride thin film. The panel modules will be connected together via a DC collection system consisting of cables mounted on the module support structure. The racking system will be SAT, which tracks the daily movement of the sun and motorised linkages rotate the modules from the east in the morning to the west in the afternoon. The maximum height of the module infrastructure will be 2.6 m above ground level.

The modules are laid out in rows or strings, typically 5 to 7 m apart, depending on the technology used. The gentle slopes of the WWSF site will lead to optimal spacing without output being affected by shading of adjacent strings. The racking system will be supported by steel piles. The module arrays occupy the bulk of the 70 ha solar farm footprint.

Plate 1: Indicative Single Axis Tracking

Inverter Stations

Contingent on detailed design and procurement the WWSF will have up to 13 (2 MW) inverter stations. Dimensions are typically 2.59 m high, 6.05 m long and 2.43 m wide. These inverter stations will be positioned throughout the module arrays with each power block of the solar farm corresponding to the capacity of the inverter station.

The inverter stations are self-contained units comparable in appearance to a shipping container or open skid type structures on elevated platforms up to 3.5 m in total height. The location of these will be determined during detailed design but will essentially be evenly distributed throughout the arrays.

Plate 2: Typical Container Type Inverter Station

Substation

The site substation will consist of a secure enclosure (up to 50 m x 30 m) with several items of electrical equipment and supporting structures. This will include a transformer to increase the voltage to 66 kV as well as essential switch gear, protection equipment and a small control room.

The equipment and structures will be installed on concrete foundations and the substation yard will be kept free of vegetation.

The substation will be positioned in the south western corner of the solar farm.

Plate 3: Typical Substation Arrangement

Grid connection

The grid connection will be an OHTL from the WWSF's substation connecting to TransGrid's substation located immediately west of the farm.

Security fence

A security fence will be installed around the solar farm perimeter. This fence will be up to 2.1 m chain link with three barbs on top, for a total height of up to 2.4 m.

Operations and Maintenance Building

An Operations and Maintenance (O&M) Building will be located on the northern side of the farm. The building proposed is a modular Ausco/Stratco type building with colorbond roof and exterior finish. A storage facility will also be included as part of the O&M building (or separate to the O&M building) and will generally be of the same type of construction.

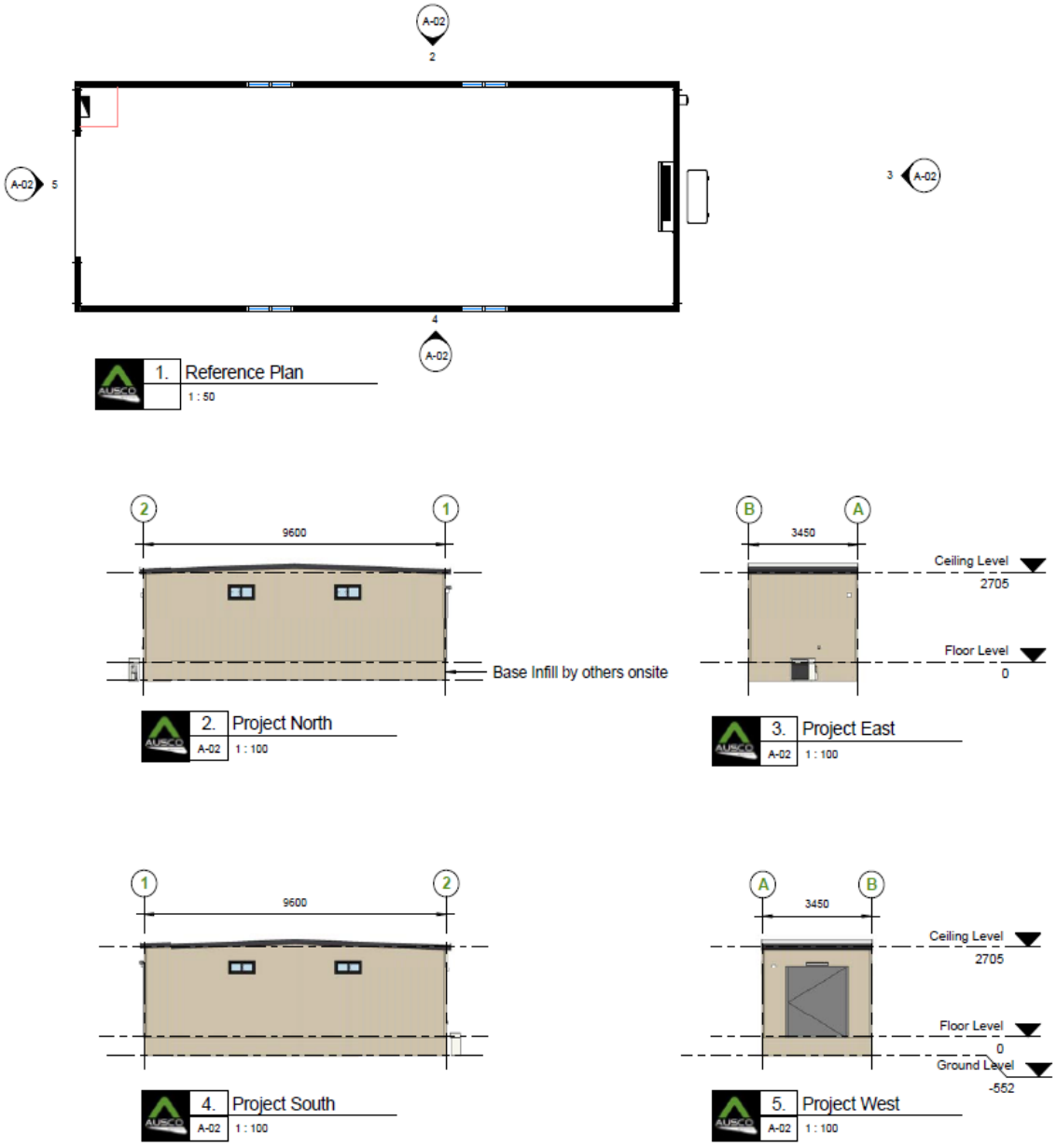

Plate 4: Typical Operations and Maintenance Building

The Operations and Maintenance Building will provide basic amenities (toilet and hand basin) for the three staff and the septic system will comply with requisite Council guidelines

9.3 IMPACTS

9.3.1 LANDSCAPE

Drawings EV07 and **EV08** show aerial view montages of how and where the 70 ha WWSF will sit within the landscape.

9.3.2 AMENITY FOR NEIGHBOURS

The receptors assessed by viewshed analysis are shown in **Figure 17**.

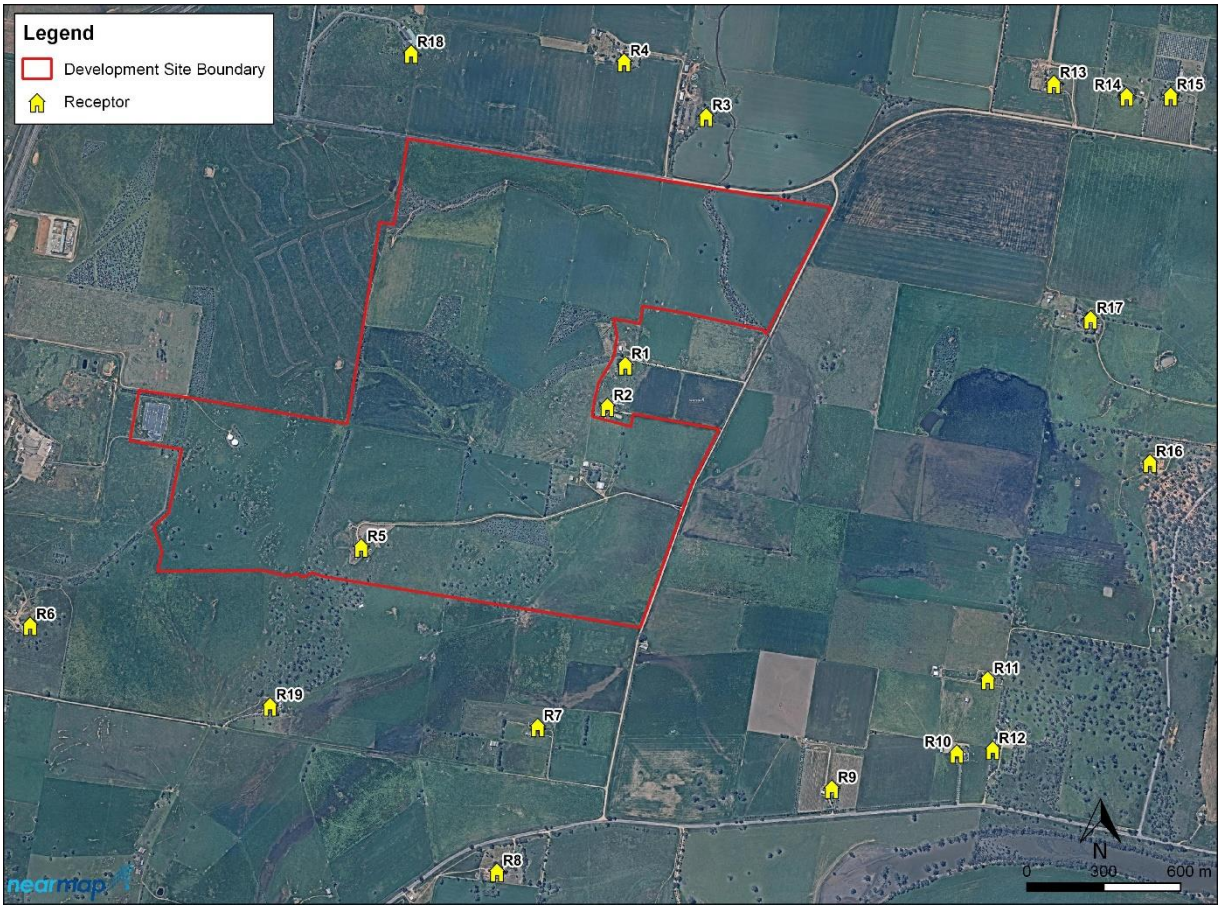

Figure 17: Receptors assessed by Viewshed Analysis

To appreciate what parts of the WWSF may be visible from these homes (and business), the Quantum GIS (QGIS) analysis plugin tool 'r.viewshed' was used to compute the viewshed from each receptor. The viewshed analysis was undertaken using elevation raster data available via Geoscience Australia's ELVIS - Elevation Information System.

Data was extracted from Geoscience Australia's Elevation Information System (ELVIS) for the development site and surrounding area. Data was extracted from the ELVIS Digital Elevation Model (DEM) 5 Metre Grid of Australia, derived from the LiDAR model representing a National 5 metre (bare earth) DEM which has been derived from individual LiDAR surveys. The DEM dataset includes ground topography and obstructing features such as vegetation and buildings. However, it is noted that the 5 metre resolution of the DEM may not capture all obstructing features (i.e. features less than 5 metres wide). Therefore, in addition to obstructing features present in the 5 metre DEM, there may be other obstructing features present in the landscape that would restrict views towards the solar farm.

Parameters used for each viewshed analysis included:

- A viewing position height above the ground of 1.75 m (height of resident observation).
- An offset target elevation above the ground of 2.6 m (height of solar farm infrastructure).

The results of the viewshed analysis are provided in **Figure 18 – Figure 34**. The yellow shaded areas in each figure are the areas of the solar farm infrastructure that are visible from that residence, based on a resident viewing position height of 1.75 m and the elevation of solar farm infrastructure at 2.6 m.

It is noted that this analysis makes no provision for the aspect of the residence, or garden plantings that may obstruct views of the solar farm.

The viewshed analysis shows the following.

- Residents to the south will either see none of the solar farm (ie. R 6 and R19) or very little of the solar farm (ie. R 7 and R8), and at distances in excess of 1.8 km and 2 km respectively.
- Residents to the south east (ie. R9, R10, R11 and R12) will be able to see nearly all the solar farm, but in the distance and with a buffer in excess of 2 km, 2 km, 1.8 km and 2 km respectively.
- Residents to the east (ie. R16 and R17) will see some of the solar farm, but in the distance with a buffer in excess of 2.2 km and 2.1 km respectively.
- Residents to the north east (ie. R13, R14 and R15) will see most of the solar farm, but in the distance with a buffer in excess of 1.5 km, 2 km and 2.3 km respectively.
- Residents to the north (ie. R3 and R4) will see most of the solar farm, with a buffer of 300 m and 460 m respectively. The following is noted. Both these residences are located on land zoned Industrial and sit within the Bomen Urban Release Area.
- R18 is a business located on land zoned Industrial and within the Bomen Urban Release Area.
- R1 is a neighbour and while only part of the solar farm will be visible, the residence is located only 200 m from the nearest part of the solar farm. Consultation with this neighbour has resulted in refining the locvation and extent of screen plantings designed to mitigate impacts.
- R2 is also a neighbour, although only a very small part of the solar farm will be visible.

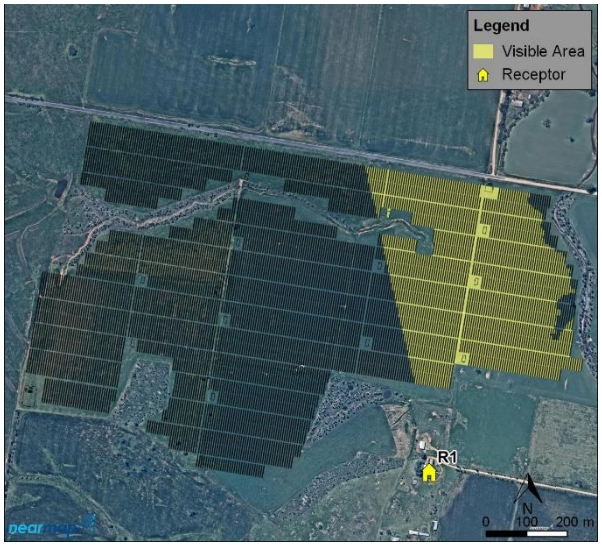

Figure 18: R1 Viewshed (200 m)

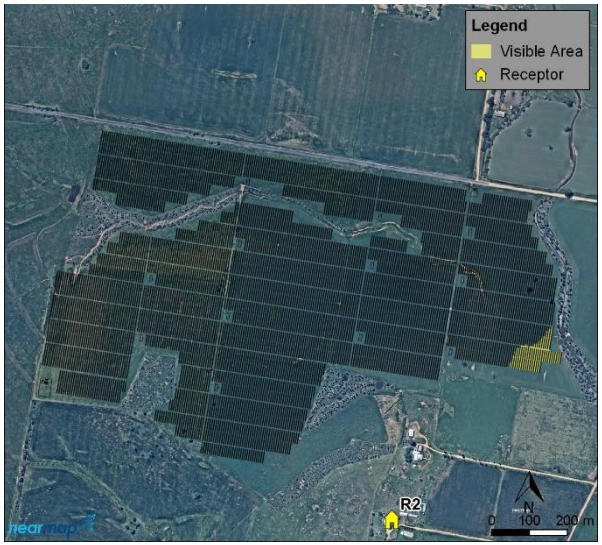

Figure 19: R2 Viewshed (510 m)

Figure 20: R3 Viewshed (300 m)

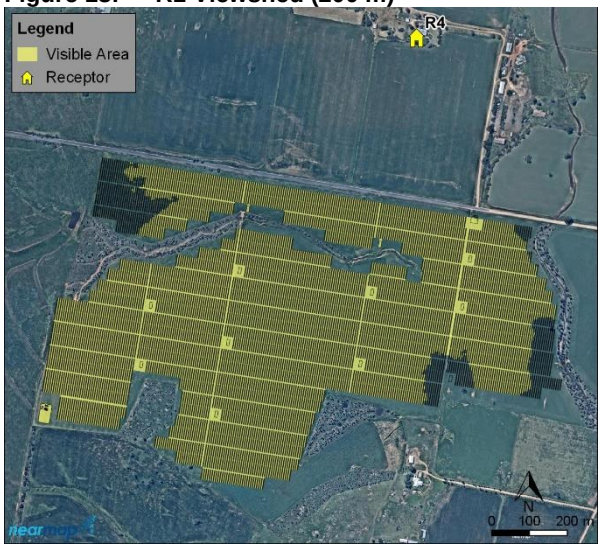

Figure 21: R4 Viewshed (460 m)

Figure 22: R5 Viewshed (850 m)

Figure 23: R7 Viewshed (1.8km)

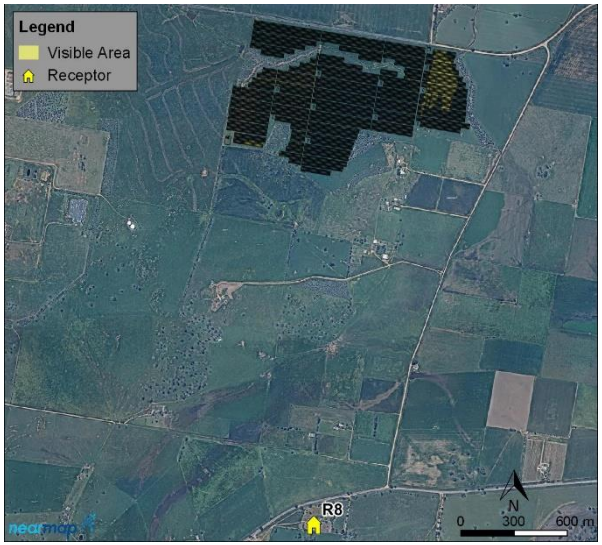

Figure 24: R8 Viewshed (2 km)

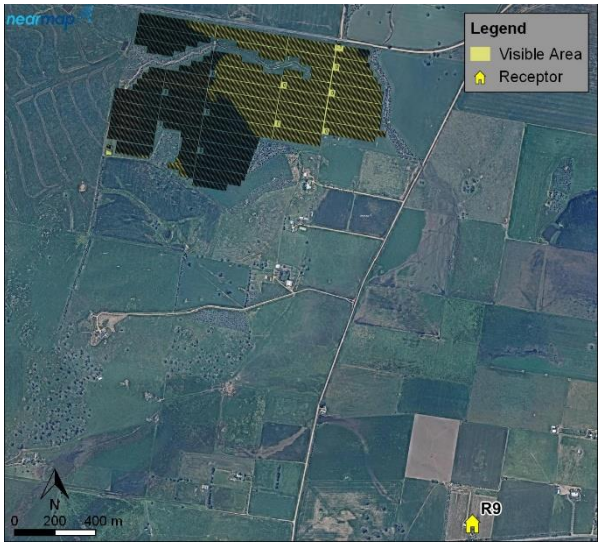

Figure 25: R9 Viewshed (2 km)

Figure 26: R10 Viewshed (2 km)

Figure 27: R11 Viewshed (1.8 km)

Figure 28: R12 Viewshed (2 km)

Figure 29: R13 Viewshed (1.5 km)

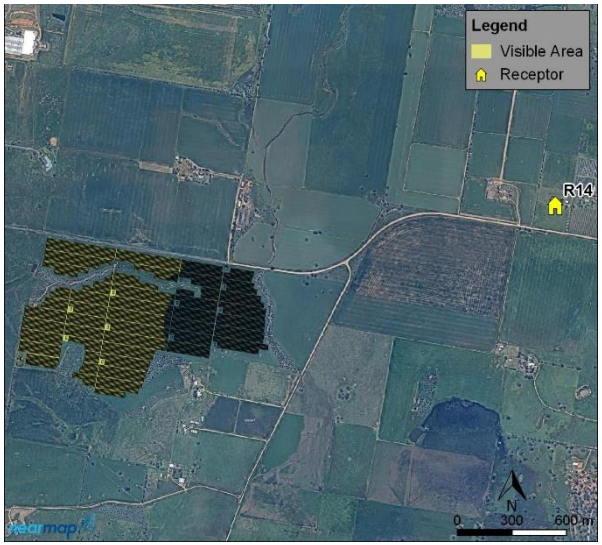

Figure 30: R14 Viewshed (2 km)

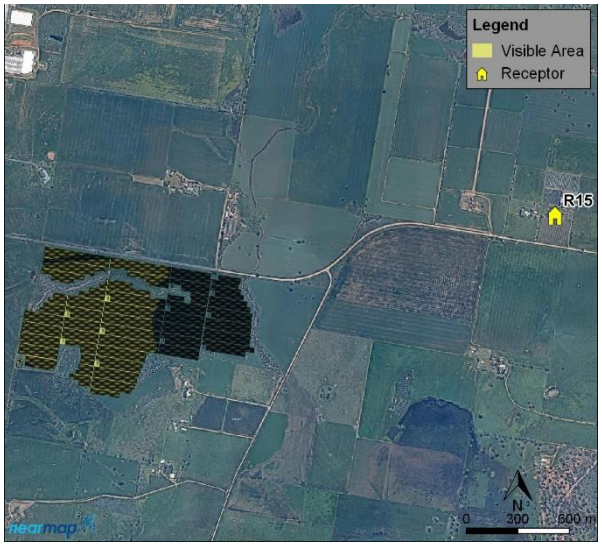

Figure 31: R15 Viewshed (2.3 km)

Figure 32: R16 Viewshed (2.2 km)

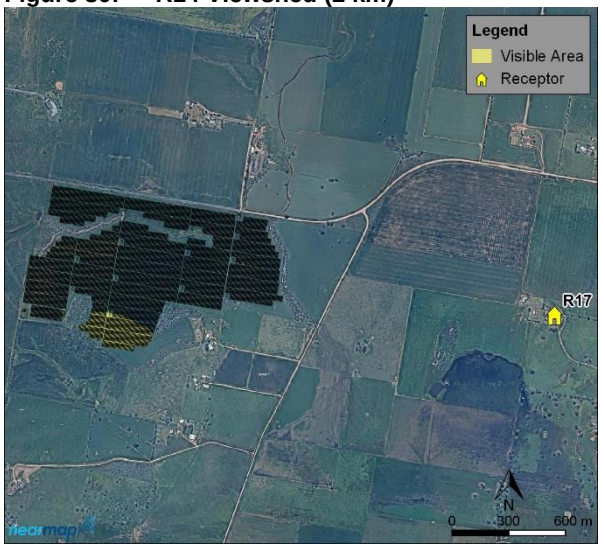

Figure 33: R17 Viewshed (2.1 km)

Figure 34: R18 Viewshed (365 m)

9.3.3 GLARE

Glare is a continuous source of excessive brightness relative to ambient lighting (Ho, 2009). Solar PV panels are specifically designed to absorb not reflect solar energy. Reflected sunlight is lost energy and represents lost revenue. For this reason the glass used in solar PV systems can reflect just 2% of the light received (Spaven, 2012). In comparative terms this is significantly lower than the reflectivity of other materials (refer **Figure 35**).

Glare will be minimised by the use of a single-axis tracking modules which track east to west with the sun. This means the angle of incident (AOI) sunlight onto the solar panel is generally perpendicular, resulting in more energy hitting the module and less reflection than a fixed-axis module which has a greater AOI as the sun moves. Fixed-axis modules do not move so the angle that the sun hits the fixed panels earlier and later in the day is much greater, and more likely to result in glare.

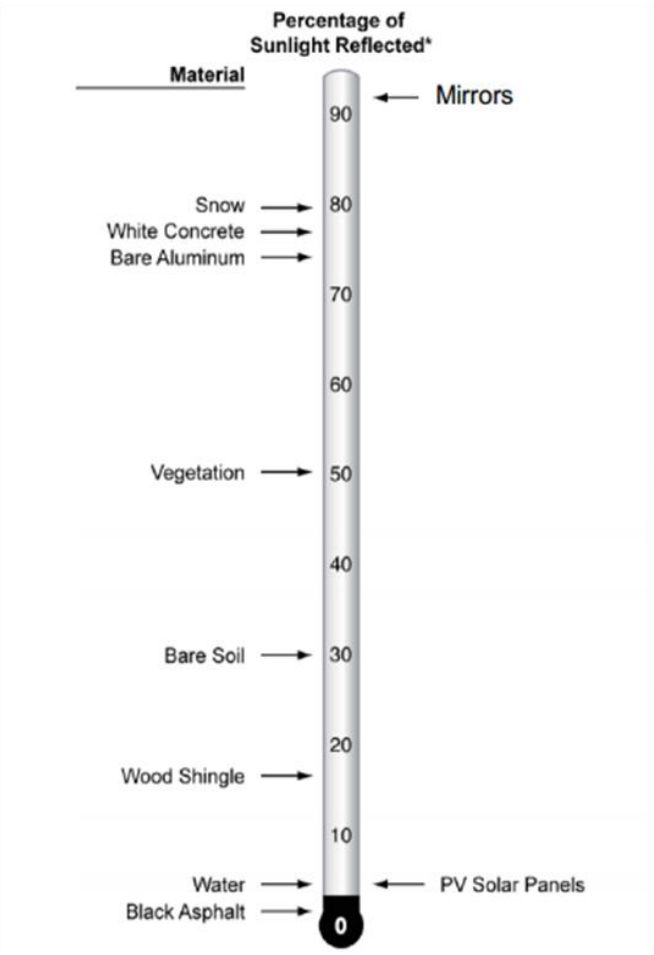

Figure 35: Comparative Reflection (Sandia National Laboratories)

9.3.4 LIGHTING

The only night lighting associated with the WWSF would be targeted security lighting. This will generally be for the O&M building, front gate, inverter stations and substation. Full perimeter security lighting is not proposed.

Lighting would be designed and operated to comply with *Australian Standard AS4282 Control of Obtrusive Effects of Outdoor Lighting*. In so doing there would be negligible light spill above the horizontal plane and no impacts to adjoining properties.

9.4 MITIGATION MEASURES

Limited landscape plantings are proposed as part of the development for the following reasons.

Where screen plantings are not required, it is preferable not to undertake them as they can introduce an unnecessary risk in terms of bushfire fuel loading and because shading from tall vegetation can compromise the efficiency of the solar farm.

Consultation with the neighbour to the south has resulted in the development as proposed including the establishment of landscape screen plantings in the south east corner of the farm. The species used in this planting will include those listed in *Wagga Wagga Development Control Plan (Section 5, Table 5.2.2)* as native species of conservation significance.

The location of these plantings has been refined to accommodate this neighbour's preference for screen plantings to be positioned on the northern side of the existing overhead transmission line.

The plantings will be at least 5 metres deep, and be comprised of at least 2 rows of staggered trees and shrubs. The location and extent of these planting is shown on **Drawing EV05** and will provide screening.

9.5 CONCLUSION

Visual impact is essentially a subjective judgement. What is intrusive or objectionable to some can be either innocuous or pleasing to others. For this reason, conclusions as to the acceptability or significance of a visual impact is basically an opinion.

In the absence of any recognised landscape conservation areas as listed in local, State or Commonwealth heritage registers, or noted scenic or significant vistas, it is assumed that visual amenity would be valued most by neighbours: local people who live and work in the locality.

The development as proposed will retain the topography, drainage lines and vegetation which are identified as significant elements of the Bomen landscape that should be preserved and reflected in the form of development proposed.

The ridge located west of the development site will be protected and remain visible above the solar farm structures when viewed from the east.

Traffic

10.1 INTRODUCTION

Once commissioned and operational the WWSF will generate negligible traffic. The farm will have up to three (3) permanent staff stationed on-site. Visitation will be limited to periodic maintenance and infrequent plant and equipment replacements. It will be during construction and any future decommissioning of the farm that traffic movements will be significant.

10.2 TRAFFIC GENERATION

10.2.1 TOTAL VEHICLE MOVEMENTS

Construction is expected to be completed over a twelve (12) month period with an expected peak period of six (6) months during which a range of construction tasks will be undertaken concurrently. During this peak it is anticipated that up to 100 workers will be on-site daily, dropping to 20 workers or less for the six (6) month shoulder periods.

It is expected that the EPC contractor will look to provide a shuttle bus service for workers. Notwithstanding, for assessment purposes it is assumed that a shuttle service is not provided and only 30% of the 100 workers would participate in some form of carpooling; resulting in an estimated 70 private light vehicles travelling to and from the site daily for the six (6) month peak period.

Estimates of total heavy vehicle movements associated with the delivery of farm infrastructure and associated materials and resources to build the WWSF are provided in **Table 10.1.**

Table 10.1 – Heavy Vehicle Numbers

Plant/Equipment	Description	Heavy Vehicles
Modules	576 modules per 40' container: 101,562 modules delivered on 176 semi-trailers.	176
Mounting frames	4 x 40' container per MWdc, inclusive of piles, torque tubers and all associated hardware, delivered on 130 semi-trailers.	130
Inverter Stations	13 x 2.2 MW inverter stations; delivered 2 per semitrailers, requiring 7 semi-trailers.	7
Transformer	One (1) over mass vehicle will be required to deliver the transformer for the step-up substation	1
Concrete	Estimated 360m^3 required for sub-station compound, inverter assembly foundations and security fence: generate 33 X 11m^3 concrete trucks.	33
Gravel	Estimated 5,000m^3 (6,500 tonne) of gravel for internal access roads and temporary hardstand lay down and construction compound area: delivered in 42.5 tonne truck & dog trailers. Assumes 2.82 ha of access road and construction compound/hardstand 100 m x 200 m – all at 100 mm	153
Sand	Estimated 500m^3 of sand (~800 tonne) would be delivered in 16 x 50 tonne truck & dog trailers	19
Miscellaneous	Provision for 5 miscellaneous deliveries (fencing, substation equipment, building materials for the operations building, water for dust suppression, etc) a week during the six month peak, dropping to 2 trucks a week for the six month shoulder periods.	182
TOTAL		**~700**

10.2.2 PEAK DAILY VEHICLE MOVEMENTS

In terms of peak daily vehicle numbers,

- the maximum number of heavy vehicles accessing the site daily, during the peak of the construction period, is not expected to exceed 20 (i.e. generating a total of 40 heavy vehicle movements in a day).
- the maximum number of light vehicles accessing the site daily, during the peak of the construction period, is not expected to exceed 70 (i.e. generating a total of 140 light vehicle movements a day during the six month peak).

10.3 SITE ACCESS

The development site provides suitable and existing access from the Olympic Highway to the existing Bomen industrial precinct: noting that the Bomen Industrial Area and associated road network is intended to service an intermodal transport terminal of choice for industries and transport business across south-eastern Australia.

The development site will be accessed off East Bomen Road, via Byrnes Road. All heavy vehicles and the bulk of light vehicles will approach the site from the west.

Property access will be constructed to provide for a swept path of a semi-trailer with the access sufficiently set back to ensure heavy vehicles are completely off East Bomen Road when at the entrance gate.

10.4 MITIGATION MEASURES

10.4.1 SITE ACCESS

Prior to commencement of construction the property access will be constructed to provide for a swept path of a semi-trailer with the access sufficiently set back to ensure heavy vehicles are completely off East Bomen Road when parked at the entrance gate.

10.4.2 ROAD CONDITION SURVEY

East Bomen Road would have a road conditions survey be completed prior to and after construction and submitted to Council.

10.4.3 TRAFFIC MANAGEMENT PLAN

A traffic management sub-plan would form part of the CEMP to be prepared and approved prior to construction of the WWSF commencing.

This sub-plan would include details of the measures to be implemented to protect traffic safety and minimize any disruption to local users of the road network, including

- Temporary traffic controls, including signage.
- Notifying the local community about project-related traffic.
- Scheduling of haulage vehicle movements to minimize convoy lengths or platoons.
- Ensuring all vehicles are loaded and unloaded on site and enter and leave the site in a forward direction.
- A driver's code of conduct that addresses travelling speeds; procedures to ensure that drivers adhere to the designated transport routes; and procedures to ensure that drivers implement safe driving practices.
- Ensuring there is sufficient parking on site for all vehicles and no parking occurs on the public road network in the vicinity of the site.
- Procedures for maintaining accurate records of the number of heavy vehicles entering or leaving the site each day.

10.5 IMPACT

Traffic impacts associated with the WWSF will be limited to the construction phase. These impacts will be temporary, manageable and monitored. A road condition survey pre and post construction, along with a commitment by the proponent to make good any damage to the road network attributable to the solar farm construction, will ensure Council's road assets are not degraded, and that the efficiency and safety of the public road network is maintained for motorists.

Catchment Impact

11.1 EXISTING ENVIRONMENT

11.1.1 SURFACE WATER

Three main drainage lines cross the site, draining towards the east to south-east (refer – **Figure 36**). All drainage lines at the site (excepting the drainage line at the north-eastern extent of the development site) are 1st and 2nd order Strahler steams. The drainage line at the north-eastern corner of the development site is a 4th order Strahler stream.

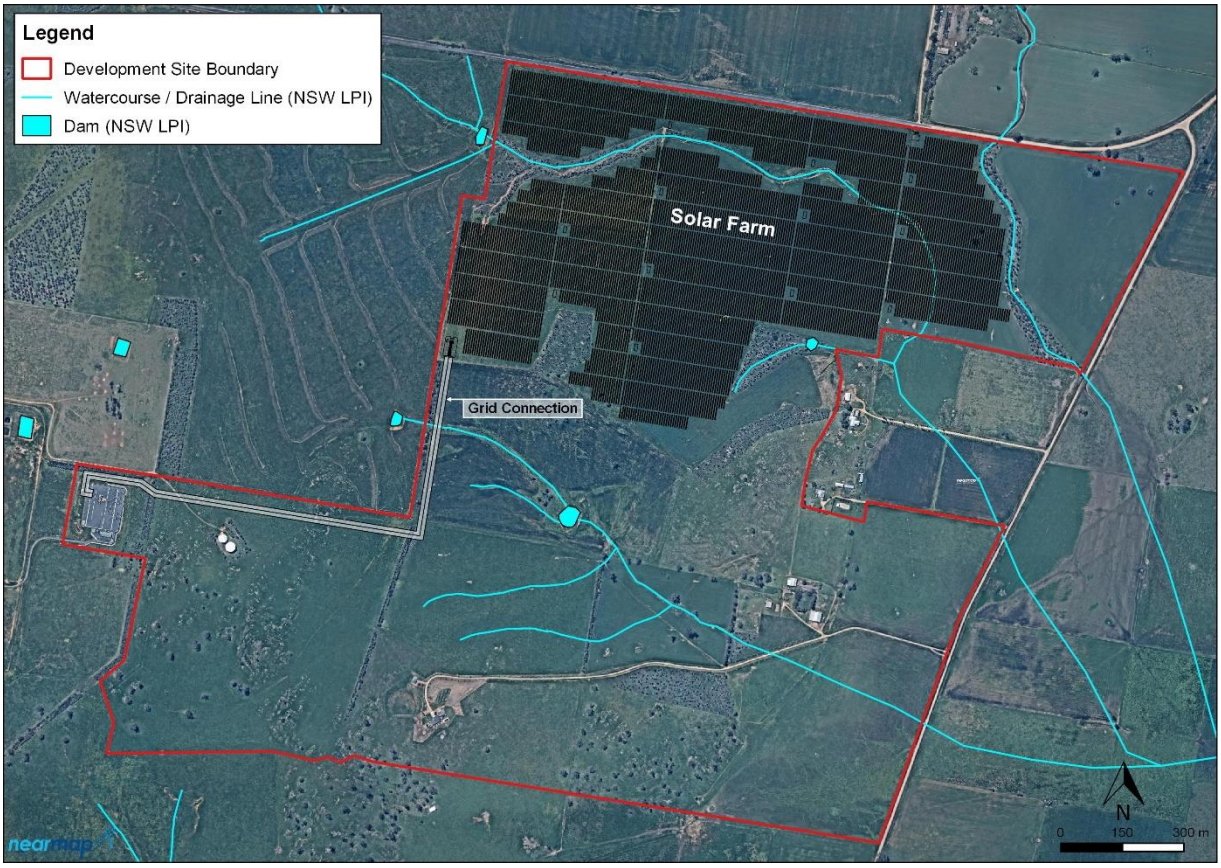

Figure 36: Surface Water

Part of one drainage line crossing the site is mapped as a 'Waterway' in the WWCC's LEP Water Resource Map (refer – **Figure 37**).

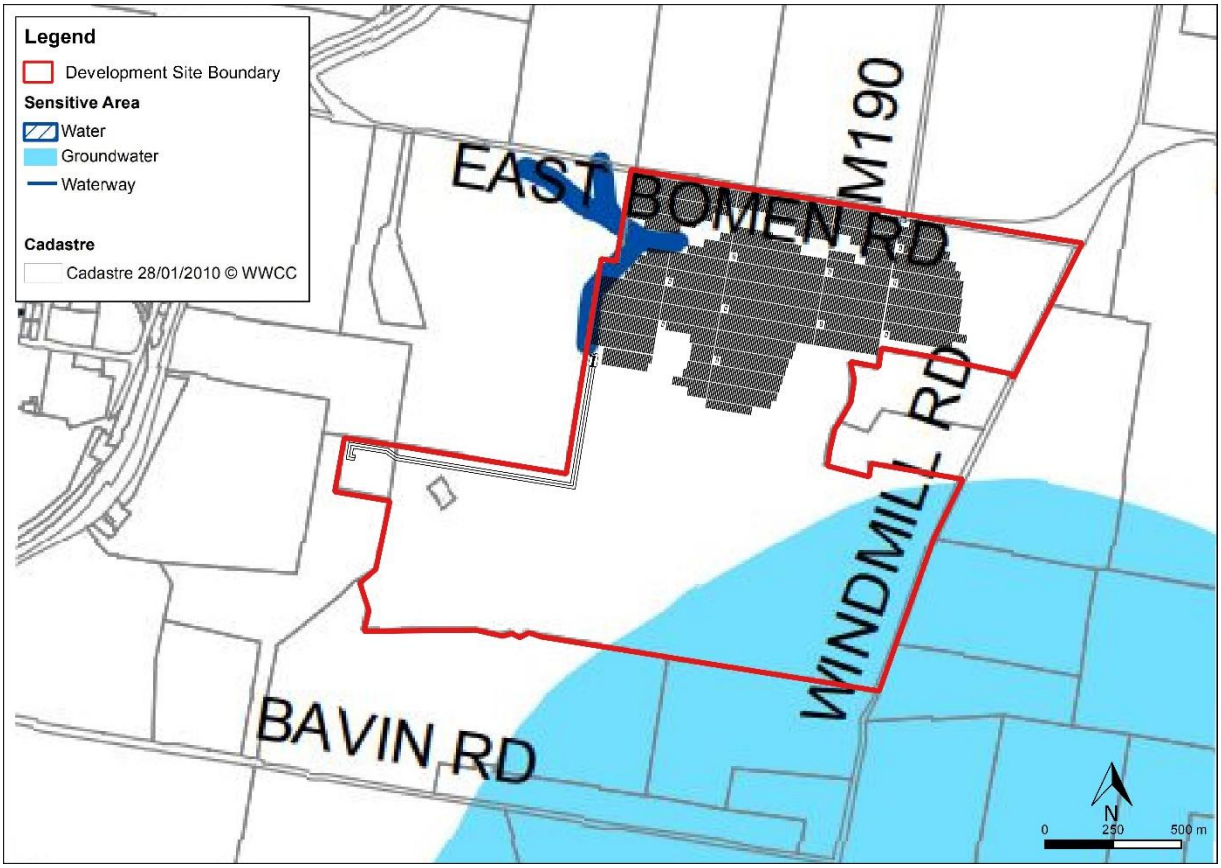

Figure 37: LEP Mapped Waterway

The current condition of the drainage line that traverses through part of the solar farm is depicted in the following Figures and Plates. **Figure 38** identifies the location where photographs were taken of the drainage line. **Plates 5 – 11** provide corresponding photos for each photo location.

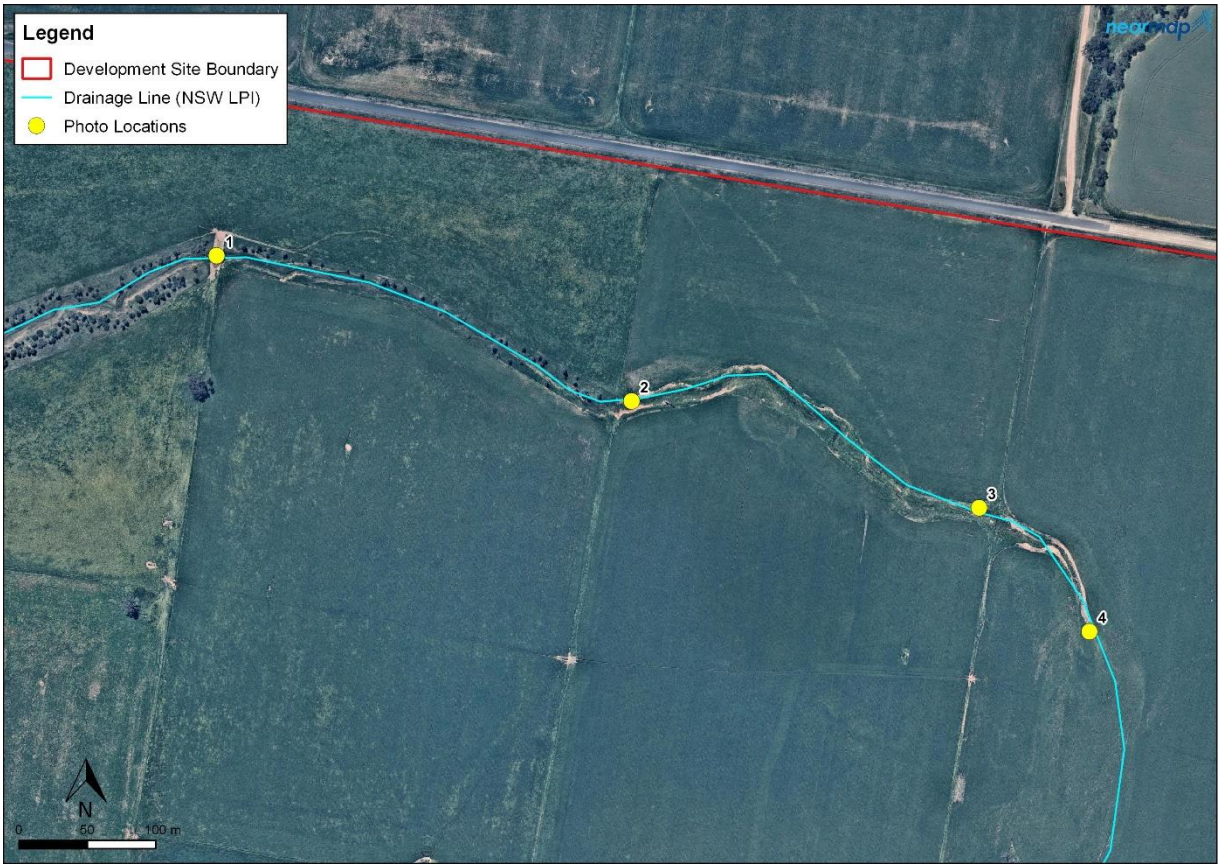

Figure 38: Drainage Line Photo Locations

Plate 5: Photo Location 1 – Existing access road across drainage line (Left: Looking North, Right: Looking South))

Plate 6: Photo Location 1 – Upstream (west)

Plate 7: Photo Location 1 – Downstream (east)

Plate 8: Photo Location 2 – Upstream (west)

Plate 9: Photo Location 2 – Downstream (east)

Plate 10: Photo Location 3 – Downstream (east)

Plate 11: Photo Location 4 – Downstream (south-east)

The drainage line depicted in **Plates 5 – 11** was observed to be dry during a site visit on 7 June 2017. The *Wagga North Solar Farm Preliminary Geotechnical Investigation* (August, 2017) prepared by Coffey Services Australia Pty Ltd (Coffey) also noted landowner observations from the past 10 years that the gully has minimal flow. Coffey describe the gully as deeper towards the western side of the development site (3 m deep and 6 m wide with side slopes at approximately 80º) and shallower towards the east (depth of approximately 2 m with side slopes at approximately 40º).

As evident in **Plate 11**, in the eastern most part of the site the drainage line loses definition, with discernible banks or bed and is farmed, sown paddock.

11.1.2 FLOODING

Review of the WWCC *Wagga Wagga Detailed Flood Model Revision - Final Report* (August, 2014) and associated mapping confirms that the solar farm footprint is not within the 1% AEP flood inundation area (refer **Figure 39**).

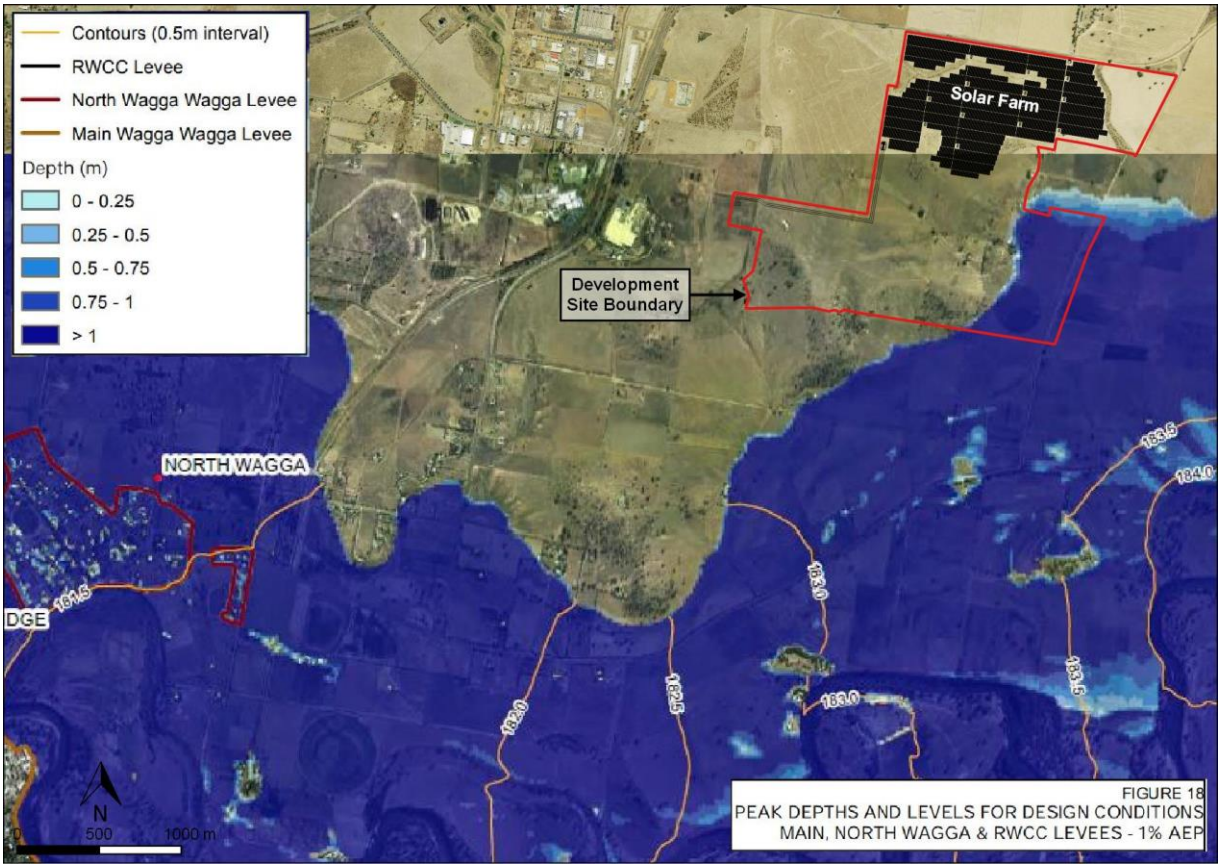

Figure 39: 1% AEP flood inundation (Wagga Wagga Detailed Flood Model Revision)

Consultation with the neighbour to the south (R1 – refer **Drawing EV03**) indicates that localised flooding can impact on their property access (refer **Drawing EV04**). Concern was raised that the solar farm could exacerbate this situation. Specifically, that the significant area of hard surface from the solar panels would cause drip lines from the panels concentrating and increasing surface water run-off and erosion; compounded by a reduction in groundcover over the site. These issues are discussed in **Section 11.3**.

11.1.3 GROUNDWATER

11.1.3.1 Resource

Part of Lot 15 DP 1108978 is mapped as a 'Groundwater Sensitive Area' in the LEP Water Resource Map (refer – **Figure 40**). This land is located ~500 m from the solar farm infrastructure.

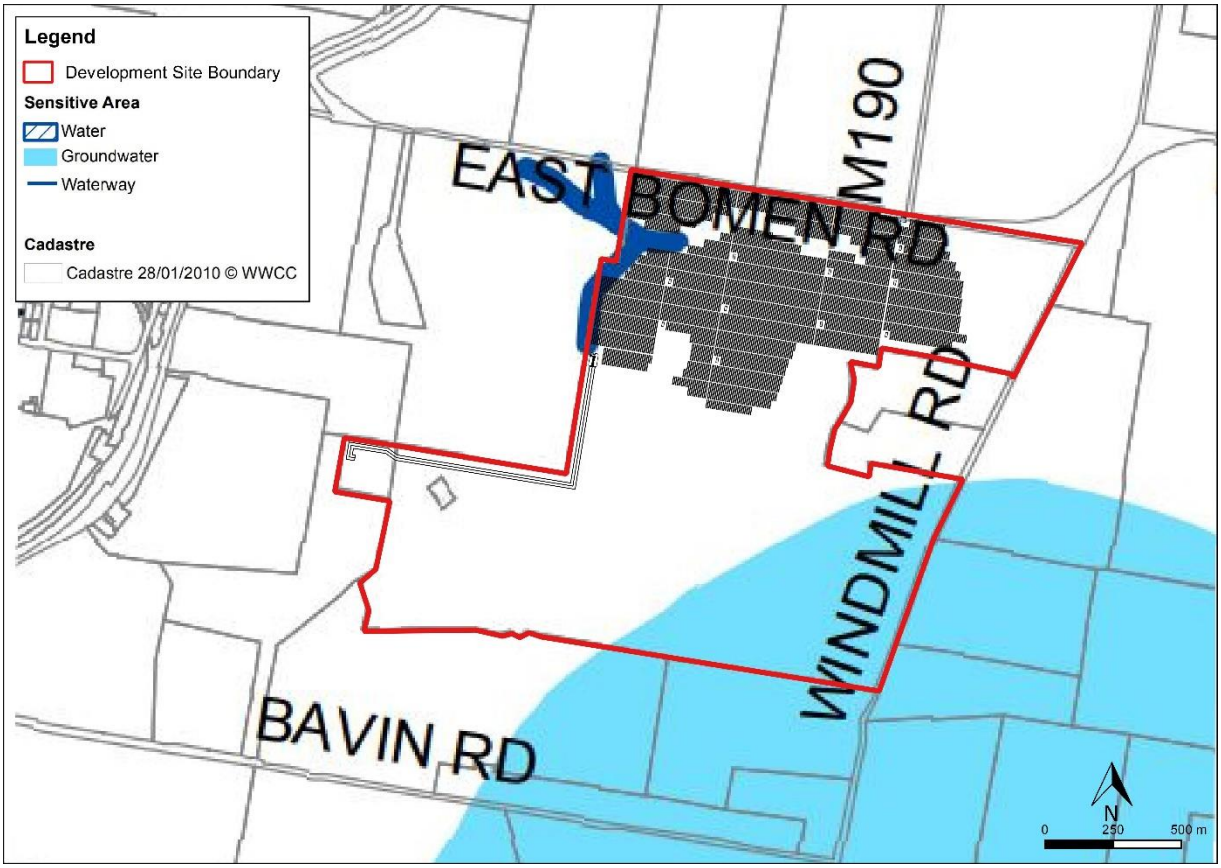

Figure 40: LEP Mapped Groundwater Sensitive Area

Whilst the buildable footprint does not contain any groundwater bores, a review of the NSW Office of Water (NOW) online *All Groundwater Map* identifies 6 bores within the development site lot boundary and 26 bores within a 1 km radius. 14 of those bores do not have any recorded water bearing zones (WBZ). 18 bores do have WBZ recorded. Available data from those 18 bores indicate that the depth to the WBZ ranges from 5.2 – 14.0 m, with an average depth to the upper limit of the WBZ of 7.9 m. Groundwater intersected by these bores is in unconsolidated sediments, predominantly sand and gravel.

Geotechnical investigations of the development site undertaken by Coffey (2017) did not encounter groundwater inflows in any of the test pits excavated and it was concluded unlikely that groundwater will be encountered to a depth of 3 m.

11.1.3.2 Groundwater Dependent Ecosystems

The Bureau of Meteorology's (BOM) *Groundwater Dependent Ecosystems Atlas* identifies that part of the proposed development site is located within areas mapped as containing a terrestrial Groundwater Dependent Ecosystem (GDE). Areas mapped as terrestrial GDE have the potential for groundwater and vegetation communities to interact (BOM, 2017).

The location of mapped GDEs are depicted in **Figure 41**. All areas of GDE mapped within the development site are designated as 'low potential GDE' and the proposed solar farm infrastructure is not located within the mapped GDEs.

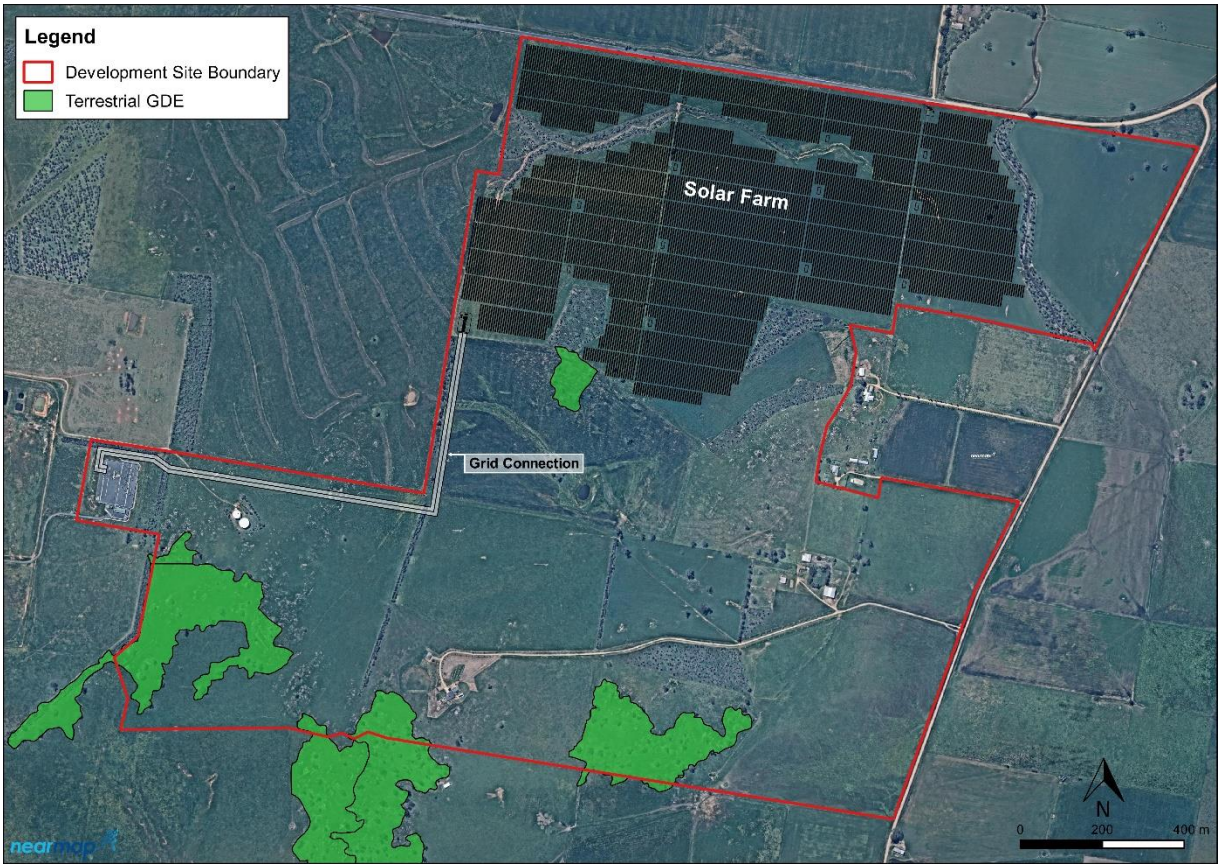

Figure 41: Groundwater Dependent Ecosystems (Source: GDE Atlas)

The NSW DPI Office of Water (2012) *Risk assessment guidelines for groundwater dependent ecosystems: Volume 1 – The conceptual framework* identifies the main risks to GDEs. These risks are provided in **Table 11.1** and considered in the context of the proposed development.

Table 11.1 – Risks to GDEs

Risk Area	Description	Comment
Water Quantity	• Risk of a change in groundwater levels / pressures on GDEs. • Risk of a change in the timing and or magnitude of groundwater level fluctuations on GDEs. • Risk of changing base flow conditions on GDEs. • Risk of changing aquifer flow paths. • Risk of disrupting ecological processes that deliver ecosystem services.	No groundwater extraction proposed for construction or operation.
Water Quality	• Risk of changing the chemical conditions of the aquifer. • Risk on the aquifer by a change in the freshwater / salt water interface. • Likelihood of a change in beneficial use of the aquifer.	No interaction with groundwater proposed.
Aquifer Integrity	Risk of damage to aquifer geological structure; e.g. substrate, fracturing, compaction, bed cracking.	Installation of solar array posts is typically < 3m and trenching for cabling is typically to 1 metre depth. As identified in **Section 11.1.3.1**, groundwater bearing zones in the locality are hosted in unconsolidated sediments rather than bedrock, and on average approximately 7.9 m below

Table 11.1 – Risks to GDEs

Risk Area	Description	Comment
		surface (with minimum depth to a WBZ of 5.2 m), indicating that the proposed development would not impact geological structures. Based on known groundwater levels in the surrounding locality and geotechnical investigations by Coffey (2017), it is not anticipated that the development would intersect or impact aquifers.
Biological Integrity	• Risk of alteration to the number of native species within the groundwater dependent communities (fauna and flora) • Risk of alteration to the species composition of the groundwater dependent communities (fauna and flora) • Risk of exotic flora or fauna being introduced • Risk of removal or alteration of a GDE type / subtype habitat; e.g. quarrying of limestone around karsts, tramping of cave habitats, sand and gravel extraction	No removal of native species proposed within areas of mapped GDE and no non-native species will be planted. Weed management will form an integral component of ongoing operation of the solar farm. Trenching works would be progressively backfilled with the excavated soil to restore groundcover from the existing soil seed bank.

The *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (WSP 2012) applies to the site, as the site is located within the *Murrumbidgee Central (Burrinjuck to Gogeldrie) Water Source* and *Wagga Wagga Alluvial Groundwater Source*.

Pursuant to clause 3 of WSP 2012, the Murrumbidgee Unregulated Water Sources include all water:

> *(a) occurring naturally on the surface of the ground within the boundaries of the Murrumbidgee Unregulated Water Sources shown on the Plan Map, and*
>
> *(b) in rivers, lakes and wetlands within the boundaries of the Murrumbidgee Unregulated Water Sources shown on the Plan Map.*

Pursuant to clause 4 of WSP 2012, the Murrumbidgee Alluvial Groundwater Sources includes:

> *all water contained within all alluvial sediments below the surface of the ground within the boundaries of the Murrumbidgee Alluvial Groundwater Sources shown on the Plan Map.*

By reference to Schedule 7 of WSP 2012, there are no high priority GDEs at or near the development site as there are no high priority GDEs identified in the schedule.

The *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* (WSP 2011) also applies to the site, as part of the site is located within the *Lachlan Fold Belt MDB Groundwater Source*.

Pursuant to clause 6 of WSP 2011, the Lachlan Fold Belt MDB Groundwater Source includes all water contained in:

> *(a) all rocks within the outcropped and buried areas, and*
>
> *(b) all alluvial sediments within the outcropped areas,*
>
> *within the boundary of the Lachlan Fold Belt MDB Groundwater Source as shown on the Plan Map.*

By reference to Table A of Schedule 3 of the WSP, there are no high priority GDEs at or near the development site.

By reference to Table B of Schedule 3 of the WSP, there are no high priority karst environment GDEs at or near the development site.

11.1.4 GEOLOGY AND SOILS

A preliminary geotechnical investigation has been completed over the development site to help inform design considerations Coffey (2017) and included.

- A site walkover including geomorphological and geological mapping of the site;
- An assessment of the subsurface soil and groundwater conditions at the site relevant to the proposed solar farm development, including depth to rock;
- Provision of information on the aggressivity of subsurface material with respect to buried structures;
- Provision of recommendations on the suitability of a driven pile foundation system at various locations including design values;
- Provision of recommendations on shallow pad foundations;
- Comments on the presence of expansive or collapsible soils (if encountered);
- Provision of recommendations on the excavatability of materials including batter slopes for temporary and permanent excavated slopes;
- Provision of geotechnical advice on drainage, earthworks, and site preparation relevant to the proposed solar farm development.

Subsurface conditions encountered by test pits were consistent with geological mapping. The site is underlain by granite and associated residual soils, as well as alluvial soils associated with local creek systems. Coffey note that outcrops of granite rock are scattered throughout the southern parts of the site, typically at higher elevations.

Coffey recorded a 50 mm thick layer of disturbed soil associated with the cultivation of paddocks. A summary of subsurface conditions across the site is reproduced in **Table 11.2**.

Table 11.2 – Summary of Subsurface Conditions

Ground Type	Material	Encountered subsurface conditions	Typical depth range of unit (m)
A	SILT	Sandy SILT: low plasticity, pale brown, fine grained sand, dry, very stiff / friable	0.15 – 0.5
B	CLAY / SILT	CLAY / Sandy CLAY / Sandy SILT: low to high plasticity, red-brown, dry to moist, hard / friable	1.5 – > T D
C	SAND	SAND: fine to coarse grained, brown, white, black, dry to moist, moist, dense to very dense	> T D

1. This profile encountered across most of the site.
2. > T D: Test pit or borehole did not penetrate this unit.

Source: Coffey Services Australia Pty Ltd (2017)

Laboratory chemical testing was also undertaken by Coffey on selected soil samples to assess the material aggressivity to steel and concrete structures. The results indicate that the subsurface materials are basic (pH values of > 6.7), and have low concentrations of sulphates (<100 ppm) and chlorides (<120 ppm). The resistivity of the subsurface materials range between 9260 Ohm.cm and 71400 Ohm.cm.

Five Emerson Class Number tests were undertaken on soil samples recovered from five test pits. The tests returned an Emerson Class Numbers of 4. Class 4 indicates that the remoulded soils do not disperse in water, Class 4 also indicates that calcium carbonate (calcite) or calcium sulfate (gypsum) is present. The soils are not considered dispersive.

Coffey state that trafficability of the site in the dryer months is typically expected to be good, however clays and silts are expected to deteriorate with increased moisture content as a result of inclement weather.

Review of the NSW Government online SEED database confirms that there is no known Naturally Occurring Asbestos (NOA) at or near the development site.

Review of the CSIRO Australian Soil Resource Information System (ASRIS) identifies the development site as having an 'extremely low probability' of occurrence of acid sulphate soils.

11.2 WATER QUALITY

11.2.1 SURFACE WATERS

Potential impacts to water quality are essentially restricted to the construction phase and can be readily managed through installation and maintenance of standard erosion and sedimentation control measures.

Poor construction techniques and inadequate erosion and sedimentation control during construction have the potential to create erosion as works will involving some earthworks to meet ground clearance tolerances for the tracker equipment. Extensive earthworks and deep excavation are not proposed nor required.

Post-construction, as a land use, a solar farm presents less potential risk to water quality than conventional primary production. With returns driven by passive harvesting of sunlight as opposed to primary production, ground disturbance will be significantly less, there will not be a need for fertiliser inputs, there will be less grazing pressure, an improved capacity to retain groundcover, and less herbicide/pesticide applications.

11.2.2 GROUNDWATER

Subsurface works would be limited to trenching (typically to 1 m depth), shallow excavations for foundation and hardstand for the substation and inverter stations, and driving array posts (up to 3m depth) into the ground to support panels. The prospect of interfering with any groundwater resource through inflow or seepage is negligible.

There is no requirement or intent to source groundwater for either construction or operation of the WWSF.

The development does not involve any aquifer interference activity pursuant to the *NSW Aquifer Interference Policy*. The WWSF will not require works that would penetrate an aquifer, interfere with water in an aquifer, obstruct the flow of water in an aquifer or take water from an aquifer. GDEs will not be impacted.

11.3 HYDROLOGY

Land use developments that require significant cut and fill earthworks and create large impermeable surfaces change drainage patterns in terms of both flow paths and the volume of stormwater runoff generated in rainfall events. Increased volumes of runoff at higher velocities can cause adverse impacts within the site and lower in the catchment.

Generally the site slopes gently at approximately 1^{o} to 5^{o} down to the north, with steeper slopes near the southern boundary of the site. The site typically slopes down into the gully, which runs east-west through the site.

The gully varies in width and depth from east to west. Toward the east, the gully is about 3 m deep and 6 m wide, with side slopes at approximately 80^{o}. Toward the west, the gully is about 2 m deep and 6 m wide, with side slopes at approximately 40^{o}. The gully is fed by a series of levy banks/drains from adjacent paddocks. A dam is located at the easternmost extremity of the gully.

Construction of the WWSF will not require extensive or significant earthworks and will not result in any fundamental changes to existing drainage patterns. The basis for this conclusion is that the solar farm footprint is located on land with slopes less than 10% (refer **Figure 42**) and while the general flow regime

of the site is not expected to change as a result of the development, it is noted that the grade of the site will be reduced through some cut and fill works, which will reduce the peak discharge from the site and velocity of overland flow.

The post development scenario involves the inclusion of minimal impervious area. The internal access roads will be unsealed gravel and the inverter stations will be raised above the ground and not impeded overland flow. It is concluded that the proposed development will not adversely affect downstream flood levels and stormwater quantity controls are not necessary.

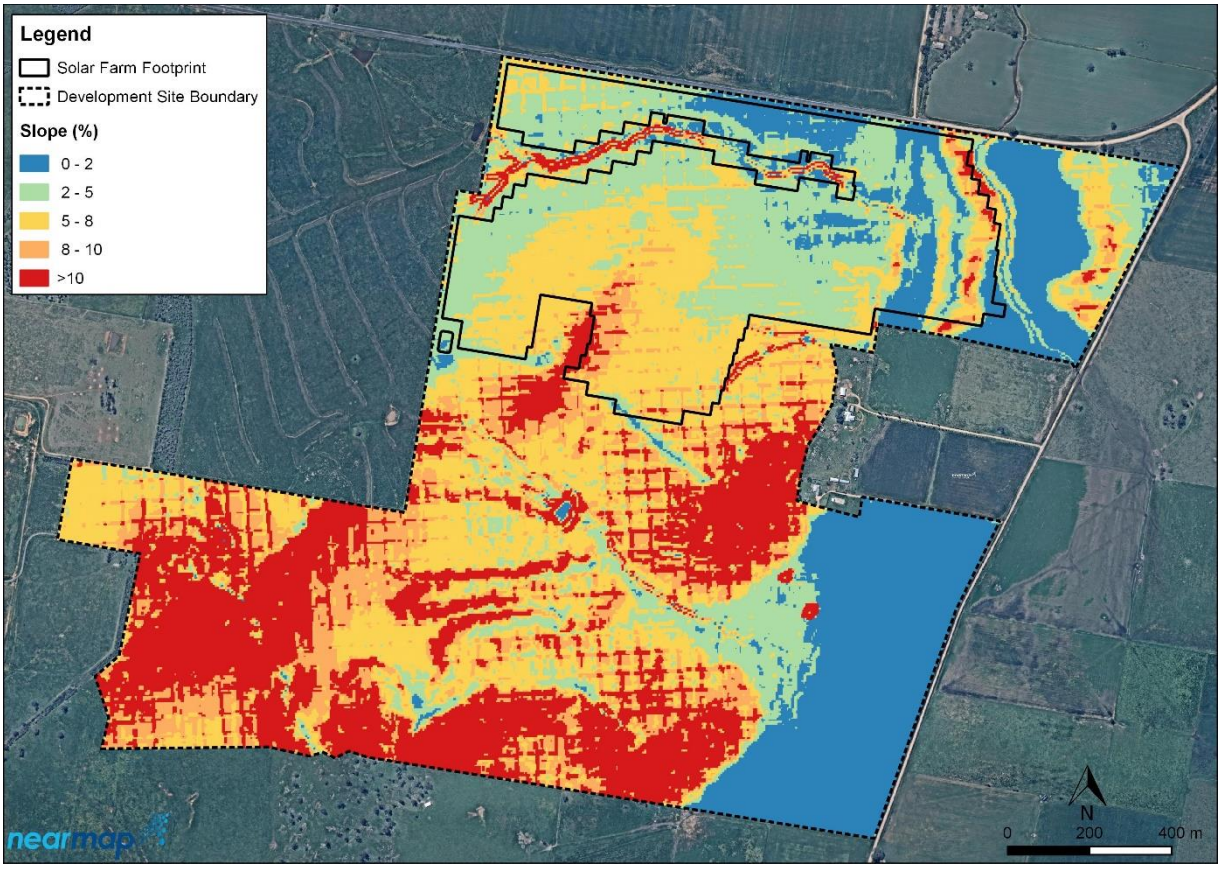

Figure 42: Slope

The solar farm layout provides for road crossings through the drainage line that traverses the site. One of these crossings (the western most one) already provides a formed vehicle crossing This existing crossing will be upgraded and the eastern crossing constructed to comply with *Water Guidelines for Controlled Activities on Waterfront Land* (2012). Culvert sizing will form part of the detailed design.

It is proposed to submit to both WWCC and DPI-Water a drainage design prior to construction commencing, and when the detail required to complete this design is available.

Securing development consent is a precursor to progressing to detailed design of a solar farm. As part of the detailed design a suite of targeted site investigations and decisions will be undertaken. These decisions include refining the concept layout to accommodate any specific consent conditions as well as 'locking-in' equipment procurement, including the panel tracker specification.

The length of the tracker assemblies influence the extent of any preparatory earthworks around the solar arrays in order to satisfy requisite structural tolerances and provide for the necessary ground clearances for the PV panels. Until this information is known a detailed drainage design cannot be prepared.

In terms of runoff volumes the solar farm does not introduce large areas of impermeable surface that will cause increased runoff. Compacted hardstand surfaces will be restricted to internal access roads and pads around the inverter stations. The panel arrays are positioned off-ground and the SAT technology, compared to fixed tilt systems, will not create drip lines under the panels that concentrate flows and increase the potential for runoff.

A reduction in rainfall infiltration across the solar farm will not result because of any diminution of permeable ground surface. Rather, with an enhanced capacity to retain a vegetated groundcover across the site, and with appropriate drainage design on the internal access roads, the volume of runoff would not be increased and improved water quality can logically be expected.

The need to ensure post development flows from the site do not exacerbate impacts for downstream landowners is understood and accepted by Terrain Solar. This includes the requirement to ensure localised flooding that can restrict property access to R1 is not exacerbated. As detailed in **Section 14.2**, subject to securing Development Consent and 'locking in' detailed design parameters, a Stormwater Management Plan (SMP) will be prepared and submitted to WWCC and DPI – Water for approval. This SMP will include hydrologic and hydraulic modelling of overland flow paths to validate the sites pre and post development peak discharge volumes and flow velocities. A copy of this plan will also be provided in neighbour R1.

Post construction, an Operations Environmental Management Plan (OEMP) will be prepared prior to the WWSF commencing operation. The OEMP will include procedures, reporting, and the allocation of responsibilities designed to minimise environmental impacts. The OEMP will document the environmental procedures and controls that would be implemented to operate the solar farm as a responsible rural land owner. A key component of the OEMP will be procedures for monitoring and managing groundcover.

The long term performance measure will be to establish a healthy, self-sustaining, noxious weed free groundcover over the solar farm that does not create a fuel hazard. How this can best be achieved, and maintained, through a combination of mechanical slashing and/or periodic crash grazing will require monitoring and implementation of adaptive management principles. Specifically, this will entail adapting the frequency, duration and intensity of any grazing and the timing of any mechanical slashing to suit and accommodate the prevailing seasonal conditions. It will also require regular inspection across the site following intense rainfall events to check that drainage is stable and localised scouring hot-spots are not appearing.

Adaptive management principles will be driven by the performance measure of maintaining a groundcover rather than agricultural production.

11.4 MITIGATION MEASURES

11.4.1 HOLD POINTS

Effective mitigation of potential soil and water impacts associated with the WWSF will be achieved through establishing several hold points, at which time specific information will be prepared and submitted to WWCC and/or DPI – Water for approval.

Detail on these is provided below.

11.4.2 DRAINAGE DESIGN

Subject to securing Development Consent and 'locking in' detailed design parameters, a Stormwater Management Plan (SMP) will be prepared and submitted to WWCC and DPI – Water for approval. This SMP will include hydrologic and hydraulic modelling of overland flow paths to validate the sites pre and post development peak discharge volumes and flow velocities.

11.4.3 SOIL AND WATER MANAGEMENT PLAN

Erosion and sedimentation impacts associated with construction can be minimised by undertaking works in accordance with *Managing Urban Stormwater: Soils and Construction* series, in particular:

- *Managing Urban Stormwater: Soils and Construction*, Volume 1, 4th edition (Landcom 2004), known as 'the Blue Book'.
- *Volume 2A Installation of Services* (DECC, 2008a).
- *Volume 2C Unsealed Roads* (DECC, 2008b).

Prior to construction commencing a Soil and Water Management Plan (SWMP) will be prepared and submitted to WWCC and DPI – Water for approval.

11.4.4 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Prior to construction commencing a Construction Environmental Management Plan (CEMP) will be prepared and submitted to WWCC for approval. The CEMP will include measures related to minimising risks to water quality during construction, including (but not restricted to):

- Storage, handling and use of any potentially hazardous materials (e.g. fuel) would be in accordance with the WorkCover NSW *Guideline for Storage and Handling of Dangerous Goods* (2005).
- Activities with the potential for spills (refuelling) would not be undertaken within 50 m of any of the gully and a suitable spill response and containment kit will be available on site whenever and wherever this type of higher risk activity is undertaken.
- Progressive site rehabilitation.

Further detail on the scope and content of the OEMP is provided in **Section 17.4**.

11.4.5 OPERATIONS ENVIRONMENTAL MANAGEMENT PLAN

Prior to commencing operations an OEMP will be submitted to WWCC for approval. Operation of the WWSF would commence when electricity is fed into the grid, but does not include commissioning trials of equipment.

A key element of the OEMP will be the procedures for monitoring and maintaining a groundcover across the farm.

Further detail on the scope and content of the OEMP is provided in **Section 17.5**.

Bushfire

12.1 RISK

The development footprint does not contain bushfire prone land. The closest bushfire prone land is approximately 3.2 km south of the development site boundary (refer **Figure 43**).

Notwithstanding mapping, the development site has the potential to carry grass fires.

The *Rural Fires Act 1997* places a duty of care on all land managers/owners to prevent a fire spreading on or from their land. This duty of care for the WWSF will be addressed through solar farm design, construction and operation.

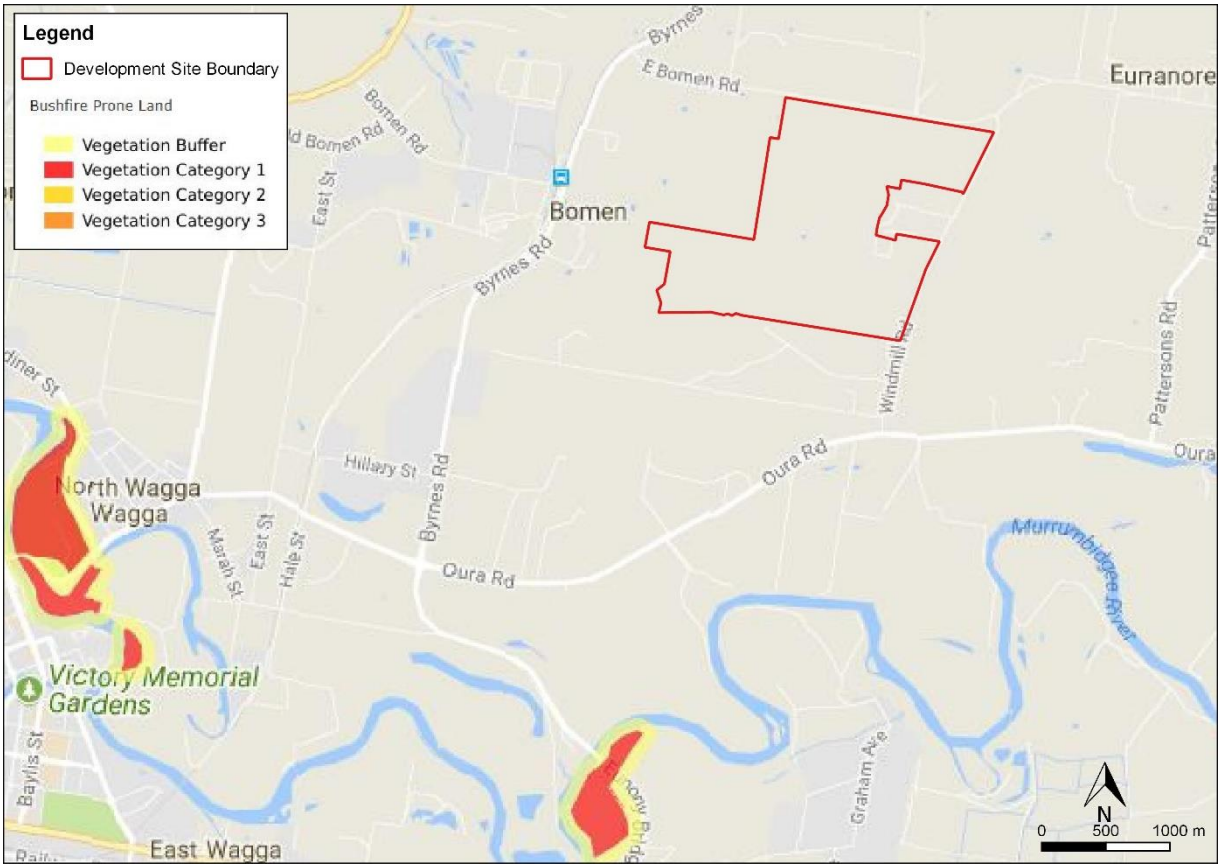

Figure 43: Mapped Bushfire Prone Land (NSW Planning Portal)

12.2 DESIGN

Detailed design of the solar farm will incorporate the following design features relevant to minimising bushfire risk.

12.2.1 ASSET PROTECTION ZONE

A security fence will be installed around the solar farm infrastructure. Outside this fence a 10 m wide asset APZ will be maintained to provide for bush fire control and tanker access.

The APZ will be maintained consistent with the standards prescribed in the Rural Fire Service (RFS) *Practice Note for Telecommunication Towers in Bush Fire Prone Areas* (RFS, 2012).

These standards are considered appropriate given that the development site is not located on land mapped as bush fire prone land and the RFS Practice Note is predicated on the assumption that telecommunications towers are critical infrastructure.

Compliance with these standards means the APZ must be free of surface fuel, noting that the will be no canopy providing any elevated fuel source. The APZ will provide the requisite defendable space around the solar farm infrastructure.

12.2.2 TANKER ACCESS

The layout of the solar farm will provide for appropriate emergency vehicle access across the entire site, with setbacks from the site boundary wide enough to permit required fire tanker manoeuvrability. Internal access tracks will provide rapid access routes to all inverter stations.

12.3 CONSTRUCTION

- Prior to construction commencing contact will be made with the Local Brigade of the RFS and details about the construction schedule, contact numbers and site access arrangements will be shared.
- During bushfire season a mobile fire fighting unit will be provided on-site.
- The fuel load over the site prior to and during construction will be monitored and reduction measures implemented as required. These measures will be restricted to mechanical slashing or stock crash grazing.
- The CEMP will include specific procedures and responsibilities for minimising bushfire risk through work practices. These would include:
  - No burning of vegetation or any waste material would take place on the construction site;
  - Fire extinguishers will be available in all vehicles;
  - All vehicle and plant movements beyond formed roads and trafficable hard stand areas will be restricted to diesel, not petrol vehicles;
  - During the bushfire season (October to March) the fire danger status would be monitored daily (through the RFS website *http://www.rfs.nsw.gov.au*) and communicated to personnel;
  - Total Fire Ban rules will be adhered to. That is, the EPC Contractor (and any of its contractors) will not:
    - (in any grass, crop or stubble land) drive or use any motorised machine unless the machine is constructed so that any heated areas will not come into contact with combustible matter;
    - carry out Hot Works (e.g. welding operations or use an angle grinder or any other implement that is likely to generate sparks), unless the necessary exemption from the

RFS Commissioner has been obtained and work complies with all requirements specified in the exemption; and

- It is not anticipated that any fuel or flammable liquid will be stored on-site. If any is, this material would be stored in a designated area and will be sign posted “Fuel Storage Area.” A register will be maintained that confirms the quantities and location of any flammable material stored on-site.

12.4 OPERATIONS

Unmanaged grasslands can create a bushfire risk hazard. The performance measure for managing the bushfire risk will be to operate the WWSF and maintain the site in a such a manner that no grass fire originates from within the WWSF site, and/or any approaching bushfire does not intensify as a consequence of entering the WWSF site because of excessive fuel loads.

The fuel load over the WWSF will need to be constantly monitored and fuel load reduction measures implemented as required. These measures will be either mechanical slashing or stock crash grazing. Procedures for ensuring this outcome will be specified in the OEMP.

Air Quality

13.1 CONSTRUCTION IMPACTS

Potential adverse air quality impacts associated with the solar farm are restricted to the construction phase. Any activity that entails the use of plant and equipment and earthworks has the potential to generate localised dust emissions.

These impacts can, however, be readily managed through the adoption of suitable mitigation measures during the construction effort. Such measures would include:

- Restricting vehicle movements and ground disturbance to the minimum area that is safely practicable.
- Undertaking dust suppression through strategic watering, as required.
- If necessary, temporary cessation of some works during excessively dry and windy conditions.

13.2 OPERATIONAL IMPACTS

The change in land use from cropping to a solar farm will reduce the potential for localised particulate emissions from this land. The principal source of dust is ground disturbance and wind exposure to an un-vegetated ground surface. In this context cropping provides a greater risk exposure of fugitive particulates than the solar farm.

With the financial return on the land asset driven principally by passive harvesting of solar energy above ground, rather than grazing and/or farming and the associated periodic ground disturbance and changes to groundcover, the retention of groundcover over the site will be comparatively easier to maintain.

As a source of particulates and localised dust emissions the solar farm will, in comparative terms, be a land use that has the potential to improve local air quality.

From a broader perspective the 26 MW_{AC} WWSF will generate 67,500 MWh of electricity annually. Indirect emissions of GHG are emissions generated in the wider economy as a consequence of an organisation's or individual's activities (particularly from its/their demand for goods and services), but which are physically produced by the activities of another organisation. The most important category of indirect emissions in Australia is from the consumption of electricity.

To this end the Department of Environment and Energy's (DoEE) Australian National Greenhouse Accounts specifies indirect emission factors to calculate GHG emissions from the generation of electricity purchased and consumed as kilograms of carbon dioxide equivalent (CO_2e) per unit of electricity consumed ($kgCO_{2\text{-}e}/kWh$). For NSW the indirect emission factor for the consumption of purchased electricity from the grid is 0.83 $kgCO_{2\text{-}e}/kWh$ (DoEE, July 2017).

Generating 67,500 MWh/year of electricity equates to a savings of 56,025 tonnes of GHG a year.

Waste Management

14.1 INTRODUCTION

Waste generation associated with the WWSF will be mainly restricted to the construction phase. Once operational the farm will not routinely generate any waste.

14.2 CONSTRUCTION

Solid waste generated during construction would include packaging materials, metal off-cuts, cabling, excess building materials, general refuse and other non-putrescible general solid wastes.

General refuse would be stored in secure covered skips.

Dry port-a-loos would be provided for amenities throughout construction negating the need for on-site domestic sewage treatment.

14.3 OPERATIONS

The farm will also be monitored remotely from an off-site location and apart from a routine maintenance program, specialist operators will only visit the farm when responding to any performance issues.

Wastes generated during operation is anticipated to be minor and would not be stored or disposed of on-site. All wastes would be disposed of at an approved waste management facility.

The Operations and Maintenance Building will provide basic amenities (toilet and hand basin) for the three staff and the septic system will comply with requisite Council guidelines.

14.4 DECOMMISSIONING

Any future decommissioning would entail removing the grid connection infrastructure and substation equipment. Opportunities for recycling this equipment will be investigated at the time, with off-site lawful disposal at an approved waste management facility the fall back option.

Foundations would be broken up and removed off site. Modules and the racking system would be removed and it could be expected that a significant amount of the support structure could be reused or recycled off-site. Piles will be lifted out of the ground and recycled wherever possible. Cables are also likely to be worth removing and recycling. However underground cables which are more than 300 mm below ground level, and are stable and inert, may be left buried to avoid unnecessary ground disturbance. At this depth, leaving cabling in the ground would not impinge future farming.

14.5 MITIGATION MEASURES

A Waste Management Sub-Plan will be prepared and form part of the CEMP prior to construction commencing. This sub-plan will include tracking of all waste leaving the site, identifying the waste classification, quantities and fate of materials to be recycled or disposed.

Electromagnetic Interference

Electric and magnetic fields (EMF) are produced naturally as well as by human activity. The earth has both a magnetic field, produced in the earth's core, and an electric field produced by electrical activity like storms in the atmosphere. Electrical equipment of all sizes and voltages produces EMF. Both fields drop away rapidly with distance from the source or due to shielding by insulation or earth (in the case of buried installations).

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has issued *Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields*. The relevant authority in Australia is the Australian Radiation Protection and Nuclear Safety Agency (ARPNSA) and it refers to the ICNIRP guidelines. These supersede earlier guidelines published by National Health and Medical Research Council (NHMRC).

The ICNIRP EMF guidelines provide relevant limits for the general public for 50 Hz sources as follows:

- Electrical Field Strength (E): 5 kilo Volts per metre (kV/m)
- Magnetic Flux Density (B): 100 micro Teslas (μT)

EMF increases with voltage and proximity to the apparatus producing, transmitting or consuming electricity. EMF varies according to specific design and construction parameters such as conductor height, electrical load and phasing, and most importantly, whether the conductors are overhead or buried.

On the site of the WWSF the various EMF generating components would be the PV panels, buried cables, inverters, step up transformers, the substation, and overhead 66 kV cable connecting to the TransGrid substation.

The components of WWSF that will emit the highest EMF are the 66 kV site substation and the 66 kV overhead line connecting to the TransGrid substation.

Terrain Solar will ensure that in detailed design and equipment procurement that the ICNIRP EMF guidelines will be complied with.

Economic Opportunity

16.1 OPPORTUNITIES

Construction will generate local employment opportunities and a demand for services and resources that can be locally sourced. The project is expected to take twelve months to build; inclusive of a six month peak period when there will be a requirement for up to 100 workers to be on site. For the other six months there is expected to be up to 20 workers on site.

The roles required will vary from highly skilled electricians able to work with solar PV systems (both low and high voltage) to general labourers. There will be contracts let for the provision of raw materials (eg. gravel, sand, concrete) and civil works plant and operators (e.g. graders, piling rigs, mobile cranes, trenchers, loaders, rollers, water carts). Money will be spent in town on accommodation, meals and support services. Construction will bring economic benefits to Wagga Wagga through business opportunities for local suppliers.

Post construction the WWSF will employ up to three full time equivalent positions. There will, however, also be a demand for contracted support services as regular maintenance on infrastructure and land management (e.g. weed spraying) will be required on an ongoing basis.

16.2 COMMUNITY EXPECTATIONS

A key finding of the Australian Renewable Energy Agency (ARENA) report *Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry* is that local community's expect and want to benefit from these type of projects. They want project related expenditure money to be spent in the district, and they wants the opportunity to secure as many jobs, contracts and supplies as possible. There is no reason to expect that the Wagga Wagga community would want or expect anything less.

Employment and contracting opportunities for local residents are seen as the key benefit to local economies, as well as the benefits to local businesses from the influx of workers from outside the local area. Job creation and the corresponding opportunities for local businesses and residents are seen as the key economic benefits of a large scale solar project.

ARENA's research showed that these expectations of developer engagement with the local economy included measures such as contacting local employment services and advertising tenders for contracting work in the local print media. In cases where these measures were perceived not to have been taken, or to have been taken half-heartedly, frustrations were expressed about lost opportunities. There was general acceptance, however, that in relatively small communities where labour resources and skills were not always available or appropriate for the job, that workers would inevitably be brought in from outside.

Based on the above it is reasonable to assume that any community support for the WWSF will be influenced, in part, on the expectation that it will provide opportunities for local business and workers to benefit from the project spend.

16.3 DEVELOPER COMMITMENT

To help ensure that the local economic opportunity is realised Terrain Solar is committed to do the following.

16.3.1 LOCAL ENGAGEMENT

Terrain Solar will deliver the WWSF through awarding an EPC contract. Typically a myriad of factors and criteria influence the decision on how and to who a contract is awarded. These include considerations relating to technical capabilities, demonstrated experience, scheduling availability and price.

In awarding the EPC contract for the WWSF Terrain Solar will incorporate local supplier relationships as an EPC evaluation criteria. That is, the EPC Contractor's commitment and means for maximising the local 'spend' will be considered in awarding the EPC contract.

16.3.2 WORKING GROUP

Terrain Solar will ensure that opportunities are actively 'pushed' into the community through working collaboratively with WWCC to establish a forum and means for maximising opportunities for local businesses and contractors. This is expected to include providing:

- accurate information about the project and associated timelines; and
- timely information about the job and contracting opportunities at each stage of construction.

Mitigation Measures

17.1 INTRODUCTION

This section of the SEE provides a consolidated summary of all proposed safeguards and environmental mitigation measures that form part of the proposed development. It collates all commitments made in this SEE and includes a description of the measures that would be implemented to monitor and report on the environmental performance of the development.

17.2 ENVIRONMENTAL MANAGEMENT STRATEGY

Potential environmental impacts will be avoided, minimised and managed through adoption of mitigation measures incorporated into all phases of the project, including:

- Detailed design;
- Construction;
- Operations;
- Upgrading; and
- Decommissioning.

The strategy for ensuring these commitments are acted upon will be to prepare and submit for Council approval a number of management plans at relevant stages of the development. These will include:

- Stormwater Management Plan;
- Soil and Water Management Plan
- Construction Environmental Management Plan;
- Operations Environmental Management Plan;
- Revised layout plans; and
- Decommissioning Management Plan.

These management plans will include, but may not be restricted to, inclusion of all relevant safeguards and environmental mitigation measures identified in this SEE and any associated conditions of consent.

The timing and scope of these management plans is detailed below.

17.3 STORMWATER MANAGEMENT PLAN

Subject to securing Development Consent and 'locking in' detailed design parameters, a Stormwater Management Plan (SMP) will be prepared and submitted to WWCC and DPI – Water for approval.

This SMP will validate hydrological impacts based on confirmed earthworks.

Approval of the SMP will be a precursor to construction commencing.

17.4 SOIL AND WATER MANAGEMENT PLAN

Erosion and sedimentation impacts associated with construction can be minimised by undertaking works in accordance with *Managing Urban Stormwater: Soils and Construction* series, in particular:

- *Managing Urban Stormwater: Soils and Construction*, Volume 1, 4th edition (Landcom 2004), known as 'the Blue Book'.
- *Volume 2A Installation of Services* (DECC, 2008a).
- *Volume 2C Unsealed Roads* (DECC, 2008b).

Subject to securing Development Consent and progressing to detailed design, a Soil and Water Management Plan (SWMP) will be prepared and submitted to WWCC and DPI – Water for approval.

Approval of the SWMP will be a precursor to construction commencing.

17.5 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Prior to construction commencing a CEMP will be prepared and submitted to WWCC for approval. The CEMP will document the environmental procedures and controls that would be implemented throughout construction, including detail on how neighbours would be kept informed about the construction program and how any complaint would be received, resolved and reported.

The CEMP would describe the role, responsibility, authority and accountability of all key personnel involved in construction and detail all monitoring that would be undertaken.

The CEMP would comprise various sub-plans detailing the specific mitigation measures that would be implemented to avoid and manage potential environmental impacts. These would include plans covering traffic management, biodiversity, Aboriginal heritage, soil and water protection, dust, noise and vibration, waste management and bushfire prevention.

Mitigation measures relevant to these issues, as identified in this SEE, are detailed below.

17.5.1 LANDOWNER CONSULTATION

- Early, regular and honest consultations with neighbours will be a core commitment.
- A procedure will be prepared for receiving, investigation and reporting any complaint received.

17.5.2 NOISE AND VIBRATION

- Limiting noise generating construction activities to standard construction hours except where an acceptable acoustic solution can be identified to minimise adverse amenity impacts on Receptors R1 and R2.
- Consultation with R1 and R2 landholders throughout the construction process to inform them on the duration and timing of potentially noisy activities.
- Using broad-band reversing alarms on all mobile plant and equipment.
- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine.
- Select quieter items of plant and equipment where feasible and reasonable.
- Operating plant in a quiet and efficient manner.
- Reduce throttle setting and turn off equipment when not being used.
- Regularly inspect and maintain equipment to ensure it is in good working order.

- Due to the proximity of receptors R1 and R2, prior to piling activities being undertaken, it is recommended that the following approach is considered:
    - Stage 1: Undertake consultation with the residents;
    - Stage 2: If possible procure piling rigs with a maximum SWL of 107 dB(A);
    - Stage 3: Where quieter piling rigs are unable to be sourced and consultation with Receptors 1 and 2 confirms unacceptable noise levels, piling activities should be managed such that when piling within 500 m of the boundary, only one rig is operational at any one time and piling must not occur for more than three (3) hours at any one time, with a minimum of one (1) hour break.
- Equipment and plant would be operated and maintained in accordance with the manufacturer's instructions including replacement of engine covers, repair of defective silencing equipment, tightening rattling components, repair of leakages in compressed air lines and shutting down equipment when not in use.
- As part of a general induction all employees and contractors would be informed of noise management measures, construction hours, the location of sensitive receptors and the protocol for handling any complaint.
- In the event that a complaint is received the source would be immediately investigated and measures implemented to avoid recurrence. Any complaint received would be documented.
- In the event that a complaint cannot be resolved noise monitoring would be undertaken with either attended or un-attended loggers. Precisely how the monitoring would be performed, where, for how long, and with what sort of equipment, would be determined on a case by case basis. The justification for the monitoring regime undertaken would be documented and the results made available.

17.5.3 TRAFFIC MANAGEMENT

A traffic management sub-plan will form part of the CEMP to be prepared and approved prior to construction of the WWSF commencing.

This sub-plan will include details of the measures to be implemented to protect traffic safety and minimize any disruption to local users of the road network, including

- Temporary traffic controls, including signage.
- Notifying the local community about project-related traffic.
- Scheduling of haulage vehicle movements to minimize convoy lengths or platoons.
- Ensuring all vehicles are loaded and unloaded on site and enter and leave the site in a forward direction.
- A driver's code of conduct that addresses travelling speeds; procedures to ensure that drivers adhere to the designated transport routes; and procedures to ensure that drivers implement safe driving practices.
- Ensuring there is sufficient parking on site for all vehicles and no parking occurs on the public road network in the vicinity of the site.

17.5.4 ABORIGINAL HERITAGE

17.5.4.1 General

In the event development footprint is extended beyond the area currently assessed, the additional area should be subject to further archaeological survey by a qualified archaeologist in association with the Registered Aboriginal Parties.

17.5.4.2 Management of Known Sites

- The proponent must apply for an Aboriginal Heritage Impact Permit (AHIP) that covers the development area.
- A condition of the AHIP should include the collection of complex Aboriginal artefacts such as anvil/grindstones and hatchet preforms in order that they are not damaged by the proposed works. They should be collected by the field team that recorded the site and securely stored until development is completed and then returned to a protected location on the site.
- A condition of the AHIP should be that the grindstone/anvil should be subject to residue analysis to investigate possibility it retains evidence of its use.
- The collection of flaked stone artefacts from within the development footprint is unnecessary as they are common and the development will not cause a high level of disturbance.
- In cooperation with the RAPs a location on site must be identified for the repatriation of archaeological material (reburial).

17.5.4.3 Chance Finds Protocol

Section 89A of the *National Parks and Wildlife (NSW) 1974* requires that any person who is aware of the existence of an Aboriginal Object is required to notify the Chief Executive of the NSW Office of Environment and Heritage. To ensure compliance with Section 89A the proponent should undertake the following outside of the site areas currently recorded.

- Prepare an information poster for site staff that describes the most likely site occurrences that might be observed and how to recognise them. A face to face heritage induction may be considered.
- Where a flaked isolated artefact is discovered:
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefact with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, ‘looking north’ or ‘looking east’ etc)
    - Move the artefact during work that may harm it and return it to the location immediately the work has concluded.
- Where an isolated implement (eg, hammer, hatchet, grindstone, etc) is discovered:
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefact with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, ‘looking north’ or ‘looking east’ etc)
    - Collect the artefact and store securely on site along with labelling that includes the Eastings and Northings.
- Where any other form or cluster of Aboriginal Objects is discovered,
    - Record the location with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum
    - Take a photograph of the artefacts with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, ‘looking north’ or ‘looking east’ etc)

- Isolate the area with a ~50m buffer and contact a qualified archaeologist for further information/advice on the most appropriate strategy

- Within three months of making a discovery Terrain Solar should inform OEH of its existence though a qualified archaeologist submitting an AHIMS recording form for each discovery. The person submitting the information will need to be supplied with the information recorded at the time of field recoding and/or collection.
- Although very unlikely, if any object is found suspected to be human remains work at the location must cease and the following must be contacted immediately:
  - NSW Police – Wagga Wagga Police Station
  - NSW OEH – Wagga Wagga Office

  The location is to be made secure to prevent unauthorised access. Work on the WWSF project may continue at a suitable distance from the potential human remains – not closer than 100m.

17.5.5 HISTORIC HERITAGE

Should any object or item of historic heritage be uncovered during construction, work in that area will cease and the item cordoned off.

A qualified heritage specialist will attend the site to determine the nature of the find and determine the required course of action; including consultation with WWCC.

17.5.6 BIODIVERSITY

The safeguards below will assist with minimising the impacts on biodiversity during vegetation removal.

- Pre-clearing surveys should be undertaken for hollow-bearing trees and include surveys for threatened birds, the presence of active nests or bats.
- If nests for any of these species are detected the host tree should be avoided and no works should occur within 100 metres until the eggs have hatched and the chicks fledged. If this cannot be achieved it may be appropriate for species other than threatened species for an ecologist or wildlife carer to remove the nest and to take the eggs/chicks to a wildlife care facility.
- Staged removal of hollow-bearing trees should be adopted as described in Guides 1 and 4 of the Roads and Maritime Biodiversity Guidelines (RTA 2011).
- Details of local WIRES contact to be kept readily available in the case of fauna being discovered or injured during tree felling.
- Hollow bearing trees to be retained will be protected by a physical barrier or fence or similar in accordance with AS 4970-2009.
- 10 nest boxes for displaced fauna (including non-threatened species) should be installed within the planted vegetation (Area A,B and C) on site. The type of nest boxes and final location would be selected in consultation with an ecologist.
- Nest boxes should be installed up to one month before the start of any tree removal to provide alternative shelter for hollow-dependent fauna displaced during clearing.
- Where practical, hollowed limbs removed from trees being felled will be placed in areas outside the proposal footprint or in the planted areas where they will in time form habitat for ground dwelling fauna. They should not be stacked into windrows, but scattered sparsely.
- Declared priority weeds should be managed according to the requirements stipulated by the Biosecurity Act, and recommendations made by the local control authority (LLS) and the Noxious and Environmental Weed Handbook (DPI, 2011), which contains details as to the management of specific noxious weeds.
- Regular targeted control of priority weeds should take place for at least 24 months following rehabilitation of disturbed areas.

- All weed material containing seed heads, weeds that contain toxins, and weeds that are able to reproduce vegetatively should be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.
- All herbicides should be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application should be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.
- Any fallen timber, dead wood and bush rock encountered in the impact area should be relocated to within the planted vegetation areas (Areas A, B, and C).
- The site induction should include measures to make employees aware of potential threatened flora and fauna during works and understand the procedures if threatened fauna are detected, this will be recorded as a part of the induction procedure and toolbox talks. The procedure should be to stop work and alert an ecologist for assessment and possible re-location during works.

17.5.7 SOIL AND WATER MANAGEMENT

Five principle measures will be adhered to during construction.

- Compliance with the approved Soil and Water Management Plan.
- At all times, in all locations, the area of ground disturbance will be limited to that which is the smallest possible footprint that is practicably possible.
- Erosion and sediment controls will be suitably maintained, including regular monitoring to ensure the measures and controls in place are effective.
- Immediate stabilisation of worked sections complemented by progressive rehabilitation.
- Erosion and sediment control measures only to be removed once the area is successfully rehabilitated.

17.5.8 BUSHFIRE PREVENTION

- Prior to construction commencing contact will be made with the Local Brigade of the RFS and details about the construction schedule, contact numbers and site access arrangements will be shared.
- Static Water Supplies dedicated exclusively for firefighting purposes will be located strategically around the site and appropriately plumbed for the duration of construction.
- The fuel load over the site prior to and during construction will be monitored and reduction measures implemented as required.
- No burning of vegetation or any waste material would take place on the construction site.
- Fire extinguishers will be available in all vehicles.
- During bushfire season all vehicle and plant movements beyond formed roads and trafficable hard stand areas will be restricted to diesel, not petrol vehicles.
- During the bushfire season (October to March) the fire danger status would be monitored daily (through the RFS website *http://www.rfs.nsw.gov.au*) and communicated to personnel.
- Total Fire Ban rules will be adhered to. That is, the EPC Contractor will not:
  - (in any grass, crop or stubble land) drive or use any motorised machine unless the machine is constructed so that any heated areas will not come into contact with combustible matter;
  - carry out Hot Works (e.g. welding operations or use an angle grinder or any other implement that is likely to generate sparks), unless the necessary exemption from the NSW RFS Commissioner has been obtained and work complies with all requirements specified in the exemption; and

- Any fuel or flammable liquid be stored on-site will be in a designated area and will be sign posted A register will be maintained that confirms the quantities and location of any flammable material stored on-site.

17.5.9 AIR QUALITY

Implementation of the following mitigation measures during construction will minimise potential impacts to air quality:

- Limit the area of soil disturbance at any one time.
- Maintain all disturbed areas, stockpiles and handling areas in a manner that minimises dust emissions (including windblown, traffic-generated or equipment generated emissions).
- Where required undertake strategic watering to achieve dust suppression.
- Where required, minimise vehicle movement and speed.
- Avoid dust generating activities during windy and dry conditions.
- Ensure all construction plant and equipment are operated and maintained to manufacturer's specifications in order to minimise exhaust emissions.
- Restricting vehicle movements and ground disturbance to the minimum area that is safely practicable.
- If necessary, temporary cessation of some works during excessively dry and windy conditions.

17.5.10 WASTE MANAGEMENT

- The work site will be kept free of rubbish and cleaned up at the end of each working day.
- All waste that cannot be recycled will be disposed at a legally operating waste facility.
- No waste will be burnt or buried on-site.
- All opportunities for recycling will be implemented.
- All waste would be classified in accordance with the EPA's *Waste Classification Guidelines* and stored and handled in accordance with its classification.
- All wastes removed from the site will be recorded. Details will include the quantity of material removed, the contractor transporting it off-site, its fate (ie. disposal or recycling) and its classification.

17.5.11 FUEL AND CHEMICAL STORAGE AND MANAGEMENT

- Storage, handling and use of any potentially hazardous materials will be in accordance with the WorkCover NSW *Storage and Handling of Dangerous Goods – Code of Practice* (2005).
- Activities with the potential for spills (refuelling) would not be undertaken within 50 m of the watercourse and a suitable spill response and containment kit will be available on site whenever and wherever this type of higher risk activity is undertaken.

17.5.12 INCIDENT MANAGEMENT

- Adequate procedures will be established including notification requirements for any incident that causes or has the potential to cause material harm to the environment.

17.5.13 INDUCTION

- All contractors undertaking any works on-site will, before commencing works, be inducted on the requirements of the CEMP and their specific responsibilities.

17.5.14 LANDSCAPE PLANTINGS

- Consultation with the neighbour to the south has resulted in the development as proposed including the establishment of landscape screen plantings in the south east corner of the farm. The species used in this planting will include those listed in *Wagga Wagga Development Control Plan (Section 5, Table 5.2.2)* as native species of conservation significance.

  The location of these plantings has been refined to accommodate this neighbour's preference for screen plantings to be positioned on the northern side of the existing overhead transmission line.
- The plantings will be at least 5 metres deep, and be comprised of at least 2 rows of staggered trees and shrubs. The location and extent of these planting is shown on **Drawing EV05** and will provide screening.

17.6 OPERATIONS ENVIRONMENT MANAGEMENT PLAN

An OEMP will be prepared prior to the WWSF commencing operation. The WWSF will be operational after commissioning and equipment trials and electricity is being distributed into the transmission network.

The OEMP will include procedures, reporting, and the allocation of responsibilities designed to minimise environmental impacts. The OEMP will document the environmental procedures and controls that would be implemented to operate the solar farm as a responsible rural land owner.

The OEMP would comprise various sub-plans detailing the specific mitigation measures that would be implemented to avoid and manage potential environmental impacts and minimise risks. These would include plans covering land management (specifically relating to fuel loads and noxious weeds) and emergency preparedness. Mitigation measures relevant to these issues, as identified in this SEE, are detailed below.

17.6.1 NEIGHBOUR ENGAGEMENT

- Ongoing and honest consultation with neighbours will be a core commitment.
- A procedure will be established for receiving, investigating and reporting any complaint received.

17.6.2 INCIDENT MANAGEMENT

- Adequate procedures would be established including notification requirements for any incident that causes or has the potential to cause material harm to the environment.

17.6.3 GROUNDCOVER, FUEL LOAD AND WEED MANAGEMENT

The long term performance measure is to establish a healthy, self-sustaining, noxious weed free groundcover over the solar farm that does not create a fuel hazard.

How this can best be achieved, and maintained, through a combination of mechanical slashing and/or periodic crash grazing will require monitoring and implementation of adaptive management principles.

Specifically, this will entail adapting the frequency, duration and intensity of crash grazing, and the timing of any mechanical slashing to suit and accommodate the prevailing seasonal conditions. It will also require regular inspection across the site following intense rainfall events to check that drainage is stable and localised scouring hot-spots are not appearing.

17.6.4 EMERGENCY MANAGEMENT PLAN

- Prior to the commencement of operations an Emergency Response Plan will be prepared in consultation with RFS and/or Fire & Rescue NSW. This plan will identify the procedures that would be implemented if there is a fire on site or in the vicinity of the site.

17.6.5 BIODIVERSITY

- Ten (10) nest boxes for displaced fauna (including non-threatened species) are to be installed within the planted vegetation (Area A, B and C) on site.

  Nest box monitoring and maintenance, including replacement, would be carried out for the life of the solar farm, in consultation with an ecologist. Damaged nest boxes would be replaced. Pests, such as non-native bees, would be eradicated.

- Declared priority weeds should be managed according to the requirements stipulated by the Biosecurity Act, and recommendations made by the local control authority (LLS) and the Noxious and Environmental Weed Handbook (DPI, 2011), which contains details as to the management of specific noxious weeds.

  Regular targeted control of priority weeds should take place for at least 24 months following rehabilitation of disturbed areas.

- All weed material containing seed heads, weeds that contain toxins, and weeds that are able to reproduce vegetatively should be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.

- All herbicides should be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application should be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.

17.7 FARM UPGRADING

Over time the owner of the WWSF may upgrade the farm. Upgrading of the farm would include the augmentation and/or replacement of solar panels and ancillary infrastructure within the development footprint. Prior to carrying out any such upgrades, the owner of the WWSF will provide revised layout plans of the development to WWCC incorporating the proposed upgrades.

17.8 DECOMMISSIONING

No later than 12 months before the intent to decommission the WWSF the owner of the solar farm will provide a DMP to WWCC for approval. The objective of the DMP would be to restore the land capability to its pre-existing agricultural use.

The design life of the PV modules will be at least 30 years. At the end of their useful life modules and electrical equipment will be either replaced and the farm re-commissioned, or the farm will be decommissioned and the site returned to agricultural land use. This will be a commercial decision based on the relative economics of solar PV generation compared to alternatives at the time (i.e. year 2047). In all likelihood the economics will be favourable because the farm infrastructure, including network connection, underground cabling, foundations, and access tracks will continue to be serviceable and the cost of replacing modules and inverter stations favourable compared to competing generating technologies. Further, the technology available in 30 years' time is likely to have much higher efficiency factors than today's modules.

Decommissioning would include initially disconnecting the solar farm from the TransGrid network. The overhead interconnecting cable (if used) and substation equipment would be removed and disposed of off-site, reusing and recycling wherever possible. Foundations would be broken up and removed off site. Modules and the racking system would be removed and it could be expected that a significant amount of the support structure could be reused or recycled off-site. Piles will be lifted out of the ground and recycled wherever possible. In general, cables are likely to be worth removing and recycling. However underground cables which are deeper than 300 mm below ground level may be left buried to avoid excessive ground disturbance. The site control room and facilities would be lifted off their foundations and transported off site on flatbed trucks.

The ground would be then be worked, stabilised and returned to agricultural use.

Justification

18.1 STRATEGIC FIT

The development is consistent with the Commonwealth's Renewable Energy Target (RET) and both the NSW Government's *Renewable Energy Action Plan* and *Climate Change Policy Framework*. At a regional level the development complements the *Riverina Murray Regional Plan's* objectives of diversified energy production, promoting energy supply through renewable energy generation and encouraging renewable energy projects at locations with renewable energy potential and ready access to connect with the electricity network. At a local level the WWSF, at the location proposed, is compatible with the strategic land use planning objectives that underpin the City of Wagga Wagga's *Bomen Strategic Master Plan (2010)* and *Spatial Plan 2013 – 2043*.

18.2 SITE SUITABILITY

The WWSF site was selected for development after an extensive screening process. It offers a number of key attributes which provide the opportunity to optimise the solar farm configuration and deliver lower cost energy.

It is suitably close to TransGrid's substation which provides for efficient connection into the transmission network, which has the capacity to accommodate the output of the WWSF.

The solar resource at Wagga Wagga is also suitable with enough cloud-free days over the year to generate significant energy.

18.3 ALTERNATIVES

18.3.1 DEVELOPMENT OBJECTIVES

The objectives of the WWSF are to:

- Select and develop a site to generate clean, long-term cost competitive power.
- Contribute to the NSW and Commonwealth Government's renewable energy and GHG emission reduction targets.
- Build and operate a solar farm with minimal environmental impact and which protects amenity values for neighbours.
- Provide local opportunities for economic benefits.

18.3.2 ALTERNATIVE SITES

During the site selection process for the proposed solar farm a number of alternative locations were considered. Minimising environmental and social impacts and maximising efficiency were major considerations in the evaluation of alternatives. The site as proposed was selected based on the:

- Availability of a suitable solar resource.
- Proximity to an existing electricity substation with sufficient connection capacity.
- Close proximity to the grid connection point, minimising transmission loss and connection costs as well as avoiding impacts to any third party.
- Network electrical efficiencies (e.g. low transmission and distribution losses for generation at this connection point in the network).
- Availability of suitable land.
- Suitability of the land in terms of factors that affect solar yield and construction costs (minimal shading, accessibility, low relief topography).

18.3.3 ALTERNATIVE TECHNOLOGY

Solar PV technology has been selected for the WWSF due to the following benefits:

- Commercially proven, robust and low technical risk.
- Low environmental impact in comparison to other power generation technologies.
- Fast deployment in comparison with other renewable and non-renewable power generation technologies.
- Solar projects are highly reversible at the end of the project's life which allows for the return of the land to agricultural use.

18.4 REASONS FOR APPROVAL

The benefits of the proposed WWSF are clear and significant. The farm will produce clean energy, displace GHG emissions, create employment opportunities and inject expenditure into the district. The costs, through the identification of site constraints and then avoiding these to inform the buildable development footprint, are minor and acceptable.

Impacts to native vegetation have been minimised. Biological diversity and ecological integrity will be maintained. Acoustic amenity values will not be adversely impacted.

The WWSF should be approved because the development site is suitable for a solar farm as it has a good solar resource and there is available capacity in the existing electricity network. The infrastructure can be built without impacting surrounding agricultural land uses.

The development of the 70 ha site would not result in any significant reduction in the overall agricultural productivity of the district and the land can be easily returned to agricultural use if the solar farm is decommissioned in 30 years.

The WWSF can be approved as this will be an outcome whereby the present generation is making a land use decision that does not compromise the health, diversity or productivity of the environment for the benefit of future generations. The WWSF will generate 67,500 MWh of clean electricity a year, enough to power 11,600 households and displace 56,025 tonnes of GHG emissions a year.

The WWSF is a development that is in the public interest.

Matters for Consideration

19.1 SECTION 79(C)

An assessment of matters for consideration pursuant to s.79(c) *Environmental Planning and Assessment Act 1979* follows.

(a)(i) the provisions of any environmental planning instrument,

All relevant environmental planning instruments are addressed in **Section 3.2**.

(a)(ii) the provisions of any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and

There are no proposed environmental planning instruments that have been publicly exhibited and applicable to the proposed development or the development site.

Public exhibition of a planning proposal closed in mid-October 2017 for the rezoning of part of the land to the west of the development site from RE1 to E2. This land relates to the Bomen axe quarry reserve. The quarry is approximately 600m west of the solar lot and.

(a)(iii) the provisions of any development control plan, and

Sections of *Wagga Wagga Development Control* apply to the development and are addressed in **Appendix D**.

(a)(iiia) the provisions of any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F, and

The development is not subject to any known planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F.

(a)(iv) the provisions of the regulations (to the extent that they prescribe matters for the purposes of this paragraph),

The only provision of the regulations specified for the purpose of this section of the Act that is relevant to the proposed development is clause 92(1)(d)(ii), as the development is included in Schedule 4A to the Act.

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

Likely impacts of the proposed development are addressed in **Section 4 – 16**.

(c) the suitability of the site for the development,

The site is suitable for the development as proposed, as detailed in **Section 5** and **Section 18**.

(d) any submissions made in accordance with this Act or the regulations,

To be determined following advertising of the DA.

(e) the public interest.

The proposed development does not compromise the public interest.

19.2 LEP ADDITIONAL LOCAL PROVISIONS

Table 19.1 provides consideration of the relevant Additional Local Provisions under Part 7 of the LEP.

Table 19.1 –LEP Additional Local Provisions

Clause	Matters for Consideration	Section Addressed
7.1A - Earthworks	(3) Before granting development consent for earthworks, the consent authority must consider the following matters: (a) the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality, (b) the effect of the proposed development on the likely future use or redevelopment of the land, (c) the quality of the fill or the soil to be excavated, or both, (d) the effect of the proposed development on the existing and likely amenity of adjoining properties, (e) the source of any fill material and the destination of any excavated material, (f) the likelihood of disturbing relics, (g) the proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.	 Section 11.3 Section 17.8 Section 11.1.4 Section 5, 8 and 9 TBC Appendix A Section 11
7.2 – Flood Planning	Not applicable.	This clause only applies to land shown on the ""Flood planning area" on the LEP Flood Planning Map or other land at or below the flood planning level. There is no LEP Flood Planning Map and the development site is not at or below the flood planning level (refer – **Section 11.1.2**)
7.3 – Biodiversity	(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority has considered the following matters: (a) any potential adverse impact of the proposed development on any of the following: (i) a native vegetation community, (ii) the habitat of any threatened species, population or ecological community, (iii) a regionally significant species of plant, animal or habitat, (iv) a habitat corridor, (v) a wetland, (vi) the biodiversity values within a reserve, including a road reserve or a stock route, (b) any proposed measures to be undertaken to ameliorate any such potential adverse impact.	Small patches of land mapped as biodiversity are present in three locations at the boundary of the development site (mostly outside the boundary). The propose development would not disturb native vegetation within the areas of mapped biodiversity. An assessment of impacts to biodiversity is provided in **Section 7**. The proposed farm layout has been designed and sited to avoid an adverse biodiversity impact and incorporates measures so as to have minimal impact
7.4 – Vulnerable Land	Not applicable	This clause applies to land identified as "Vulnerable Land" on the LEP Vulnerable Land Map. The site is not located on Vulnerable Land.
7.5 – Riparian Lands and Waterways	(3) Development consent must not be granted to development on land to which this clause applies unless the consent authority has considered the following matters: (a) any potential adverse impact on any of the following: (i) water quality within the waterway,	Part of a drainage line crossing the development site is mapped as a 'waterway' on the LEP Water Resources Map. Assessment of impacts to the catchment is provided in **Section 11**.

Table 19.1 –LEP Additional Local Provisions

Clause	Matters for Consideration	Section Addressed
	(ii) aquatic and riparian habitats and ecosystems, (iii) stability of the bed, shore and banks of the waterway, (iv) the free passage of fish and other aquatic organisms within or along the waterway, (v) habitat of any threatened species, population or ecological community, (b) whether or not it is likely that the development will increase water extraction from the waterway for domestic or stock use and the potential impact of any extraction on the waterway, (c) proposed measures to ameliorate any potential adverse impact..	The solar farm will not adversely affect water quality; aquatic and riparian habitats and ecosystems; the stability of the bed and banks of the waterway; the free passage of fish and other aquatic organisms within or along the waterway; the habitat of any threatened species, population or ecological community. It will not increase water extraction from a waterway. The proposed farm layout has been designed and sited to avoid an adverse waterway impact and incorporates measures so as to ensure minimal impact.
7.6 – Groundwater Vulnerability	(3) Development consent must not be granted for development specified for the purposes of this clause on land to which this clause applies unless the consent authority is satisfied that the development: (a) is unlikely to adversely impact on existing groundwater sources, and (b) is unlikely to adversely impact on future extraction from groundwater sources for domestic and stock water supplies, and (c) is designed to prevent adverse environmental impacts, including the risk of contamination of groundwater sources from on-site storage or disposal facilities.	Part of the development site contains a 'groundwater' sensitive area on the LEP Water Resources Map. The solar farm is not located on this land and is not specified development for the purpose of clause 7.6(3). Assessment of impacts to groundwater is provided in **Section 11.2.2**

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