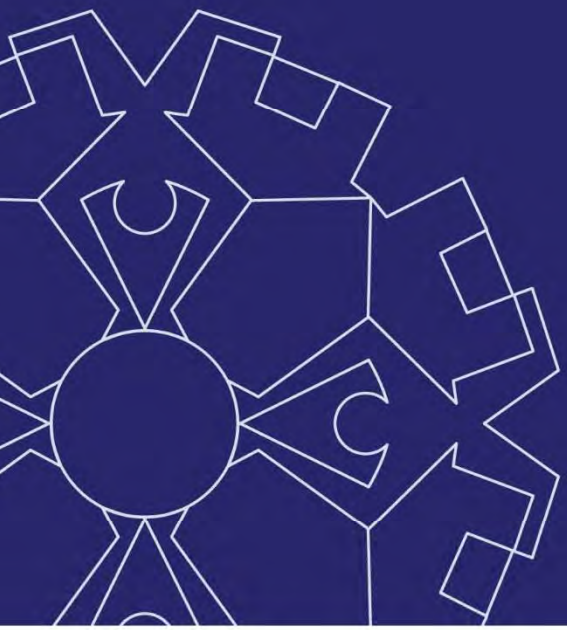
ENVIRONMENTAL IMPACT STATEMENT
GOONUMBLA SOLAR FARM

PREPARED FOR
RENEWABLE ENERGY DEVELOPMENTS PTY LTD

SEPTEMBER 2016



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

ENVIRONMENTAL IMPACT STATEMENT

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SEPTEMBER 2016

GEOLYSE

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Certification

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*

EIS PREPARED BY:

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APPLICANT:

Goonumbla Solar Farm Pty Ltd
PO Box 363
LINDFIELD NSW 2070

PROPOSED DEVELOPMENT:

Goonumbla Solar Farm which includes the construction, operation and reconstruction or decommissioning of a solar photovoltaic plant up to 70 MWac, and associated infrastructure, including a grid connection.

LAND TO BE DEVELOPED:

The development site incorporates Lot 1 DP 602329; Lot 2 DP 602329; Lot 409 DP 750152; Lot 5 DP 854193 and Lot 1 DP 877903 in the Parish of Currajong, County of Ashburnham and a Crown road.

CERTIFICATION:

I declare that this statement has been prepared in accordance with Schedule 1 *Environmental Planning and Assessment Regulation 2000*, contains all available information that is relevant to the environmental assessment of the development to which the statement relates, and that the information contained in this statement is neither false nor misleading.

ANDREW BROWNLOW

26 September 2016

CHLOE BIGG

26 September 2016

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ABBREVIATIONS

Acronyms

AEMO	Australian Energy Market Operator
ABS	Australian Bureau Statistics
AC	Alternating Currents
ACHAR	Aboriginal Cultural Heritage Assessment Report
AER	Australian Energy Regulator
AHIMS	Aboriginal Heritage Management System
AHIP	Aboriginal Heritage Impact Permit
ANL	Acceptable Noise Levels
ARENA	Australian Renewable Energy Agency
ARPNSA	Australian Radiation Protection and Nuclear Safety Agency
BAR	Biodiversity Assessment Report
BWAHS	Binjang Wellington Aboriginal Heritage Survey
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CASA	Civil Aviation Safety Authority
CC	Carbon Credit
CEMP	Construction Environmental Management Plan
CO_2e	Carbon Dioxide Equivalent
CRTN	Calculation of Road Traffic Noise
CWLLS	Central West Local Land Services
DA	Development Application
DC	Direct Current
DCP	Development Control Plan
DECCW	NSW Department of Environment Climate Change and Water
DMP	Decommissioning Management Plan
DoE	Commonwealth Department of Environment
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMF	Electric and Magnetic Field
EPA	NSW Environment Protection Authority
ESD	Ecologically Sustainable Development
FBA	Framework for Biodiversity Assessment
FRNSW	Fire and Rescue New South Wales
GHG	Greenhouse Gas
GSF	Goonumbla Solar Farm
HV	High Voltage
ICNG	Interim Construction Noise Guideline (2009)
INP	Industrial Noise Policy
IPA	Inner Protection Area
LEMC	Local Emergency Management Committee
LEP	Local Environmental Plan
LGA	Local Government Area
LGC	Large Generation Certificates
LPI	NSW

LV	Low Voltage
NEM	National Electricity Market
NERR	National Energy Retail Rules
NHMRC	National Health and Medical Research Council
OEH	NSW Office Environment and Heritage
OEMP	Operations Environmental Management Plan
PACWP	Parkes Aboriginal Community Working Party
PCT	Plant Community Type
PFM	Planning Focus Meeting
PSC	Parkes Shire Council
PSF	Parkes Solar Farm
PV	Photovoltaic
RAP	Registered Aboriginal Parties
REAP	Renewable Energy Action Plan
RED	Renewable Energy Developments Pty Ltd
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RMP	Recommissioning Management Plan
RMS	NSW Roads and Maritime Service
RNP	Road Noise Policy
SAT	Single-Axis Tracking System
SEAR	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TSR	Travelling Stock Reserve
Units of measure	
ºC	degrees Celsius
dB(A)	A-weighted decibel
GW	Gigawatt
GWh	Gigawatt Hour
Ha	Hectare
kV	Kilovolt
kV/m	kilo Volts per metre
kW	Kilowatt
kWh	Kilowatt hour
m	Metres
m/s	Metres per second
ML	Megalitre
MW	Megawatt
MWh	Megawatt Hour
MWp	Megawatt Peak
µT	micro Teslas

Executive Summary

The proposed Goonumbla Solar Farm (GSF) is a 70 MW 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 electrical control room, site substation and perimeter fencing. The farm may also include an electrical storage system which would include batteries housed in electrical enclosures. The generated electricity will be exported into the network by a 66 kV line into TransGrid's substation which is located adjacent to the north-western corner of the development site.

The development is consistent with the Commonwealth's Renewable Energy Target, the NSW's Renewable Energy Action Plan and the Central West region's vision for a sustainable future. The *Draft Central West and Orana Regional Plan* identifies renewable energy as an industry linked to the region's future prosperity.

Once built the GSF will generate 168,000 MWh of clean electricity a year, enough to power 28,880 households and displace 141,120 tonnes of greenhouse gas emissions annually. During the 12 month construction effort it will have a peak workforce of up to 100 and inject new expenditure into the district. The benefits of the GSF are clear and significant.

The costs of the development in terms of potential bio-physical and social impacts have been avoided and minimised through accommodating site constraints and consulting with neighbours. 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.

All farm infrastructure will be contained within a 385 hectare property located approximately 10 km west of Parkes in the Central West Slopes and Plains of New South Wales. The site is not Biophysical Strategic Agricultural Land, it does not contain any watercourses, is not mapped as bush fire prone, is not subject to flooding and is free of Aboriginal heritage constraints. Stands of native vegetation that do exist in this predominantly cleared landscape will also be protected.

Community consultation has been targeted to representatives of the Aboriginal community and potentially impacted neighbours. There are just nine residences within 1 km of the property boundary, only three of whom have limited views of parts of the development site from the curtilage of their homes. Two of these have indicated no concern with the development, and the preference of the third for strategically located screen plantings has been incorporated into the development to his satisfaction.

Noise modelling under a range of operating scenarios and meteorological conditions concludes that cumulative impacts, given the neighbouring Parkes Solar Farm, can comply with all applicable criteria designed to protect acoustic amenity values.

The GSF is not an incompatible land use with a potential to create land use conflicts. It is not a threat to continued primary production activities by neighbours. There would be no impact to any groundwater resource nor any change to surface hydrology in terms of modified flow patterns leaving the property. Harvesting sunlight is a passive land use and effectively constitutes an extended fallow that would provide benefits to soil health.

The GSF 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

Goonumbla Solar Farm Pty Ltd, a wholly owned subsidiary of Renewable Energy Developments Pty Ltd, is proposing to develop a solar Photovoltaic (PV) farm at Parkes. Hereafter this development is referred to as the Goonumbla Solar Farm (GSF).

Renewable Energy Developments (RED) is an Australian company which develops utility scale solar plants, which unlike conventional coal or natural gas power plants, will provide a long-term source of clean electricity whilst avoiding Greenhouse Gas (GHG) emissions. The company's leadership has extensive experience in delivering solar and wind energy projects to regional communities in Australia and Europe and has been operating in the industry since 1990.

1.2 DEVELOPMENT OVERVIEW

The GSF will generate electrical energy by converting solar radiation into electricity through the use of solar PV panels (also known as modules). 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 very limited on-site presence, apart from maintenance periods.

The farm will consist of solar modules, steel racking and piled supports, electrical transformers and inverters, electrical cabling, telecommunications equipment, an electrical control room, site substation, perimeter 1.8 m chainmesh security fencing, site gates and security lighting. The farm may also include an electrical storage system which would include batteries that would be housed in electrical enclosures approximately the size of a shipping container.

The farm is proposed to include an estimated 214,000 solar modules, although the precise module count will be dependent upon the specific PV technology selected. The ultimate decision for the module type and racking system will be dependent upon availability and market conditions at the time of procurement.

The solar modules will be similar to those used for domestic purposes and will operate at either a fixed tilt or 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 modules organised into blocks of approximately 2.5 megawatt (MW). Each block will connect to a central pad or skid mounted inverter/transformer assembly that will convert the direct current (DC) energy into grid-compatible alternating current (AC) energy.

The generated electricity will be regulated on site via a securely enclosed substation and exported through a 66 kilovolt (kV) line to TransGrid's Parkes Substation, which is located adjacent to the north-western corner of the site. The farm's substation will include a transformer, switch gear and protection equipment.

A small control room will include facilities and car parking to allow for occasional maintenance staff. Site access tracks will provide all weather access as required.

1.3 DEVELOPMENT SETTING

The development site is a 385 hectare (ha) property located approximately 10 km west of Parkes in the Central West Slopes and Plains of New South Wales (refer **Drawing EV01**). The site fronts Henry Parkes Way (Condobolin Road) to the north and Pat Meredith Drive on its western boundary.

TransGrid's Parkes Zone Substation is located adjacent to the north-west corner of the site, and the recently (June 2016) approved 65 MW Parkes Solar Farm (PSF) neighbours the site to the south west.

The Parkes National Logistics Hub (Hub) is located on land immediately to the south-east. The Hub is a multi-modal transport facility strategically located at the cross roads of the Newell Highway connecting Brisbane and Melbourne, and the transcontinental railway linking the eastern seaboard to Perth.

Whilst the site is productive farming country it is not Biophysical Strategic Agricultural Land (BSAL).

The site does not contain any watercourses, is not mapped as bush fire prone, is not subject to flooding and is predominantly cleared of native vegetation.

There are 19 residential dwellings within a 2 km radius of the site; nine (9) of which are within 1 km of the site; only three of which have partial views of part of the development site from their home curtilages.

1.4 STATEMENT PURPOSE

The construction and operation of the GSF requires development approval under NSW planning legislation.

This Environmental Impact Statement (EIS) has been prepared to support a Development Application (DA) lodged with the NSW Department of Planning and Environment (DPE).

1.5 STATEMENT REQUIREMENTS

This EIS identifies and assesses the environmental impacts associated with the construction, operation and recommissioning/decommissioning of the proposed GSF.

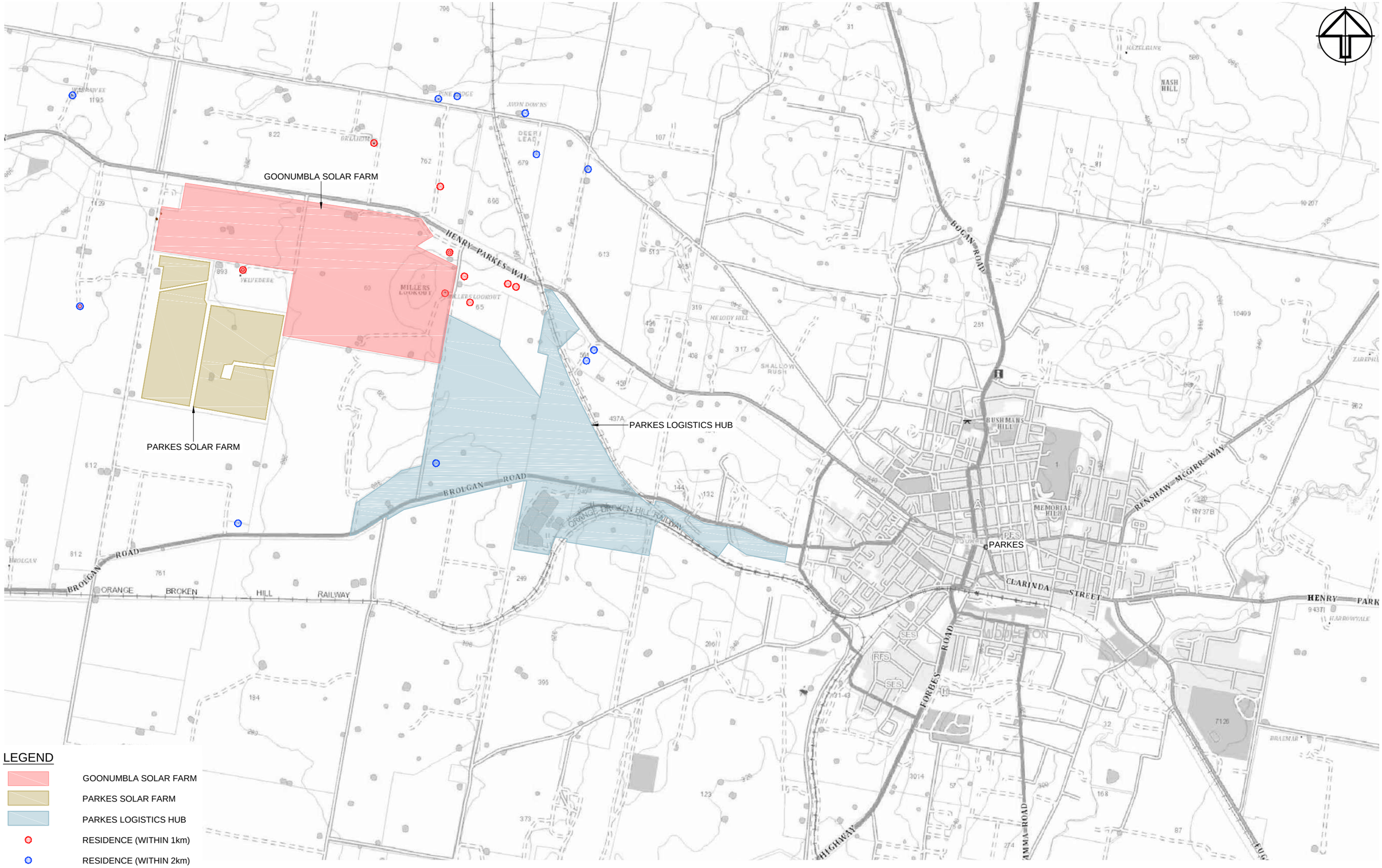
It has been prepared in accordance with the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*

1.6 STATEMENT STRUCTURE AND SCOPE

The structure and content of this EIS addresses the Environmental Assessment Requirements (SEAR) issued by DPE on 16 May 2016. The SEAR were issued by DPE following the conduct of an on-site Planning Focus Meeting (PFM) and consultation with relevant Government agencies.

A copy of the SEAR is provided in **Appendix A.**

Appendix B provides a checklist identifying where these environmental assessment requirements have been addressed in this EIS.



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B	05/09/2016	BSH	AGB	ADDITIONAL INFORMATION - FOR DEVELOPMENT APPLICATION
C	26/09/2016	BSH	AGB	MINOR AMENDMENTS - FOR DEVELOPMENT APPLICATION

DRAWING SCALE

0 400 800 1200 1600 2000

APPROXIMATE SCALE 1:20000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

DEVELOPMENT LOCALITY

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV01 OF EV08	

The Development

2.1 DEVELOPMENT OBJECTIVE

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

2.2 FARM CAPACITY

The GSF will have a maximum capacity of 70 MWac and once operational will generate 168,000 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 household electricity usage in Australia in 2014 was 5,817 kilowatt hours (kWh) per year (ACIL, 2015).

Based on the above, the energy generated from the GSF will be sufficient to service 28,880 homes annually during the life of the farm.

Census data on the number of households by Local Government Area (LGA) from 2011 indicates this supply would significantly exceed the electricity demand for all households in the LGAs of Parkes, Forbes, Lachlan, Cabonne, Weddin and Cowra Councils combined (ie. 22,386 households). For context, this supply would provide over 40% of total household demand for all residences in the Central West Region which includes, in addition to the above, the LGAs of Blayney, Bathurst, Oberon, Lithgow, Mid-Western Regional and Orange Councils.

2.3 FARM DESIGN AND LAYOUT

2.3.1 DESIGN PRINCIPLES

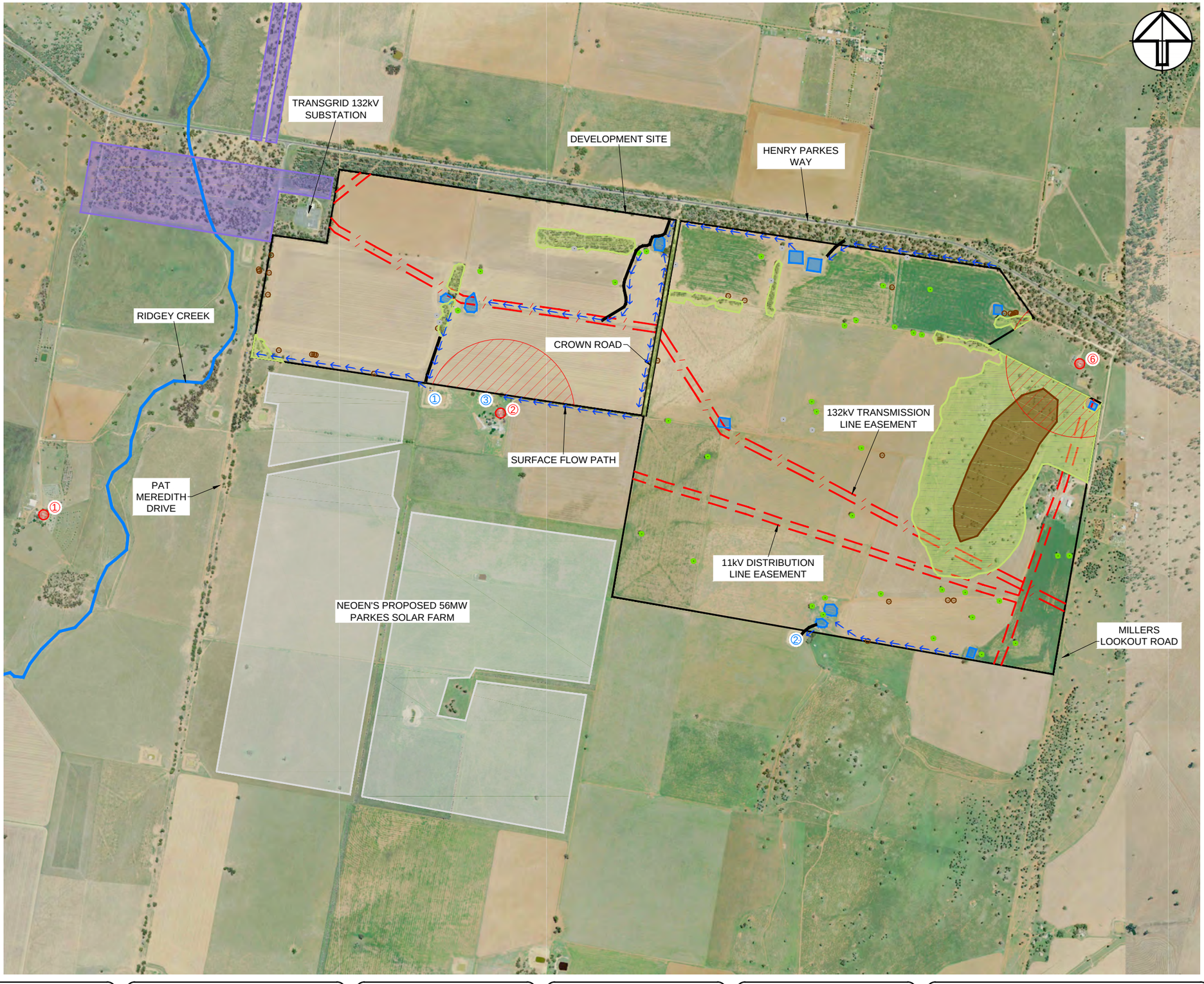
The GSF has been designed to a concept level according to principles established through the deployment of similar projects worldwide. The installed capacity of solar PV globally was around 256,000 MW[1] at the end of 2015 and the technology is well understood.

The capacity and development footprint of the GSF has been refined through consideration of site investigations, including the identification of constraints and opportunities mapped through the environmental impact assessment process as well as discussions with TransGrid about electricity transmission network connection capacity.

Following site inspections, the conduct of specialist surveys (including those for Aboriginal heritage and biodiversity values) and consultation with neighbours, physical and land use features and constraints within the development site and its environs were mapped. This mapping has accurately located the development site boundary, neighbouring residences, recorded Aboriginal artefacts, stands of native vegetation as well as isolated paddock trees, the electricity transmission lines, TransGrid's zone substation, public roads, Crown land, the Currajong Travelling Stock Reserve (TSR), the closest watercourse, and all farm dams.

Drawing EV02 provides a detailed map identifying these environmental features and constraints that have been used to inform a concept design and general layout of the GSF through delineation within the 385 ha development site a 295 ha buildable footprint that avoids constraints.

[1] http://www.greentechmedia.com/articles/read/gtm-research-global-solar-pv-installations-grew-34-in-2015



FEATURES

- DEVELOPMENT SITE BOUNDARY
- TRAVELLING STOCK RESERVE
- ABORIGINAL ARTEFACTS
- PADDOCK TREE
- HOLLOW BEARING TREE
- 11kV DISTRIBUTION LINE EASEMENT
- KEY CONTOUR BANK
- SURFACE FLOW PATH
- ① RESIDENCE
- ① FARM DAM

CONSTRAINTS

- NATIVE VEGETATION
- INVERTER BUFFER
- 132kV TRANSMISSION LINE EASEMENT

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APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

DEVELOPMENT SITE

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		
STATUS FOR APPROVAL	SHEET EV02 OF EV08	SET 03C

Drawing EV03 identifies this proposed development footprint, including the site access and the locations where cabling would pass under Crown land.

This 295 ha footprint for the proposed GSF has been optimised to accommodate a farm layout that avoids impacts on biodiversity values, protects acoustic amenity and adopts landscape plantings to mitigate visual impacts as requested by the only neighbour with views of the development who asked for screen plantings.

The identified development footprint would accommodate all infrastructure and facilities associated with the development, including the temporary construction compound and laydown areas.

2.3.2 ELECTRICAL GENERATION EQUIPMENT

The solar PV module technology will be either crystalline silicone or thin film. The modules will be connected together via a DC collection system consisting of cables mounted on the module support structure. The racking system will either be fixed-tilt or a SAT or a combination of both.

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 to 7 m apart, depending on the technology used. The flatness of the GSF site will lead to optimal spacing without output being affected by shading of adjacent strings. The choice of fixed tilt or SAT will determine the orientation of the strings, whether east-west (fixed) or north-south (SAT). The racking system will be supported by steel piles. These are hollow sections or I-sections which are driven into the ground or otherwise placed in bored holes and concreted in place.

Figure 1: Indicative Single Axis Tracking (SAT) System

Inverters will convert the DC current to AC current and medium voltage transformers will increase the voltage to the collection system rating. Inverter and transformer assemblies are mounted on a steel platform (skid) or slab at ground level and are generally covered with an all-weather kiosk. Contingent on procurement, the GSF will have 28 x 2.5 MW inverter assemblies. These inverters will be positioned within the array of modules with each power block of the solar farm corresponding to the capacity of the inverter assembly.

LEGEND:

- 132kV TRANSMISSION LINE EASEMENT
- 11kV DISTRIBUTION LINE EASEMENT (11kV LOW VOLTAGE LINE TO BE RELOCATED)
- DEVELOPMENT FOOTPRINT
- INVERTER EXCLUSION BUFFER
- RESIDENCE
- LANDSCAPING

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GOONUMBLA SOLAR FARM

DRAWING

DEVELOPMENT FOOTPRINT

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DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV03 OF EV08	

Figure 2: Typical Inverter Assemblies

The AC collection system will consist of cabling at 22 kilovolt (kV) or 33 kV which connects to each inverter assembly and delivers the electricity to the site substation. Cables are laid underground and backfilled. Trench details are determined by local regulations and voltage specifications, but typically are approximately 1 m deep.

Figure 3: Typical cable trench for MV collection system

2.3.3 GRID CONNECTION

The site substation will transform the voltage from the collection system to 66 kV and grid compliant energy will be delivered to the network by connecting to TransGrid 132/66 kV substation located adjacent to the north-west corner of the site.

The site substation will consist of a secure enclosure with several pieces of electrical equipment and supporting structures for cables. It will include a transformer to increase the voltage to 66 kV. It will also include essential switch gear and protection equipment. Steel structures are required to suspend the overhead cables or alternatively underground cables will be laid in trenches. The equipment and structures will be installed on concrete foundations and the yard will be kept free of vegetation. The site substation will be monitored remotely via a security system.

The site's proximity to the TransGrid substation minimises the amount of interconnecting infrastructure required to the high voltage (HV) network and is a significant benefit of the location.

2.3.4 BATTERY STORAGE

The GSF may include an energy storage system which would consist of batteries housed in enclosures the size of a shipping container. Battery storage can add significant benefits to solar generation because it allows for the despatch of energy according to market demand and overcomes potential issues associated with intermittency of output.

However the inclusion of batteries will depend on future cost reductions and the GSF project does not depend on them for its viability. Further, battery storage could be retrofitted at a suitable time in the future.

The battery assemblies would be mounted on pad foundations and include bunded containment. Buried cables would connect the battery assemblies to the substation equipment. Up to ten containers would be installed on the site and any commercially available battery technology could be used, including but not limited to, lithium iron, lead acid, sodium sulphur, and sodium or nickel hydride. Accepted industry practice will be observed for handling the respective battery components during installation, maintenance, replacement and recycling.

Figure 4: Indicative 2.4 MWh Battery Storage Unit

2.3.5 ANCILLARY INFRASTRUCTURE

A control room with a parking area will be located conveniently on the site. This will be a relatively compact structure which will provide shelter and facilities for a limited number of site staff. Staff will occupy the control room during commissioning in order to advance the farm to its operational readiness. Once the farm is operational, staff will occasionally occupy the control room as needed to monitor the performance of the farm and to diagnose any faults. From the control room there will be communications connections to the electricity market operator, TransGrid, and the operation's team.

A site gate, security fence and site access tracks will also be provided.

2.4 FARM CONSTRUCTION

2.4.1 DEVELOPMENT PROGRAM

Construction will include all pre-operation activities associated with the project other than survey, acquisitions, fencing, investigative drilling or excavation, or other preparatory activities that have minimal environmental impact such as site mobilisation, minor adjustments to services/utilities, establishing temporary construction sites or minor clearing.

Construction is estimated to take up to 12 months with the scheduled program for construction activities provided below. The earliest date for commencement of construction is October 2017.

Activity	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18
Site Preparation													
Installation of Panels													
Cabling													
Commissioning													
Site Restoration													

Figure 5: Target Construction Program

2.4.2 SITE PREPARATION AND SUBSTATION CONSTRUCTION

The site will require minimal preparation in advance of installing the PV modules as it is flat and largely devoid of vegetation. A site entrance will be opened on Pat Meredith Drive and site gates secured in position. Fencing will be upgraded or installed around the site perimeter. The site will be cleared of internal fences and timber or rock debris and the grass will be slashed as required. Trees within the development footprint whose clearing has been approved will be removed. It is possible that the Essential Energy LV 11 kV distribution lines crossing the south-east and north-west of the site will need to be relocated to avoid impacting the layout. This will be carried out at this stage if required and undertaken in close cooperation with Essential Energy and residents supplied by these connections.

Site facilities and construction laydown areas will be established within the development footprint and construction vehicles and equipment will be mobilised to the site. The site access tracks will be staked and established through scraping, grading and compacting. Some tracks may require road base to create an all-weather surface, however extensive track construction is not planned. Tracks will be treated to create a durable, dust-minimising surface.

The site substation will also be commenced at this phase. Civil works will be required to prepare the base including shallow excavations for slab foundations and cable trenches. Concrete slab foundations will be poured and road base will be laid down to create an all-weather compound. Cables will be laid in trenches and installed through foundation cavities. The transformer, switch gear and protection equipment will be installed on the slab foundations. Cabling will be terminated onto the inverters. HV cables will be suspended or laid in a trench to connect the GSF to the TransGrid substation. A secure fence will be installed around the substation compound and a security system will be installed.

The site preparation and substation construction phase 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.

2.4.3 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 equipment will be pegged. Top soil will be left intact wherever possible. The circular hollow sections or flanged sectioned steel piles which support the racking system will be driven into the ground pneumatically or alternatively holes will be bored and the piles will be 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 are then installed on the racking and secured in position to withstand wind loading. Once the modules have been installed the DC collection cables are laid on the structure and terminated to the modules. If a tracking system is being used, the rotating mechanism and server motors will be installed on the support structure.

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

2.4.4 INVERTER ASSEMBLIES AND ELECTRICAL COLLECTION SYSTEM

Once the PV modules have been installed cable trenches will be excavated and AC and DC cables will be laid. Trenches will be backfilled with excavated material and cables will be terminated to the modules. Foundations for the inverter assemblies will be constructed as either concrete slabs on the ground or

piles. The inverter and transformer assemblies will be placed on the foundations and the cables will be terminated to them. Testing and quality assurance will be carried out as connections are made.

Once all the inverter assemblies and electrical collection system has been installed, commissioning of equipment can commence. Commissioning will include terminations, testing, calibration and troubleshooting. The inverters, transformers, collection system, solar PV array, substation and storage system (if any) will be tested prior to commencement of commercial operations to ensure any system issues are rectified. Commissioning will involve site crews and TransGrid personnel. Upon completion of successful testing, the solar farm can be connected to the TransGrid network and it will be ready to export electricity.

This phase of the construction process will require skid steers, pile drivers, trenchers, backhoes, cranes, aerial lifts, flatbed trucks and concrete trucks on site.

2.4.5 SITE RESTORATION

During construction there will be additional infrastructure established including site offices and amenities, vehicle parking and turning areas, equipment laydown and storage areas, safety fencing, and temporary power. This infrastructure will be removed at completion of commissioning and disturbed ground made good through ripping and establishing a groundcover.

2.4.6 MATERIALS AND RESOURCES

The following provides approximate quantities for materials and resources during the 12-month construction program.

2.4.6.1 Labour

Over the 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. 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 6 month period (January 2018 to June 2018 inclusive). Outside this peak the workforce would drop to 50 (ie. October 2017 – December 2017 and July 2018 – September 2018).

These jobs will include construction managers, electricians, fitters, plant operators, mechanics and other skilled labour.

2.4.6.2 Water

Water demand during construction would 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 Parkes Shire Council (PSC). Consultation with PSC's Water and Sewer Manager has confirmed a capacity and willingness to make available non-potable water for this purpose. The potable supply will be provided through bottled water.

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

2.4.6.3 Sand and Gravel

The construction of all-weather access tracks and compacted hardstand for the inverter assemblies and substation will require gravel, whilst sand will be required for the bedding of cabling in the trenches before backfilling. These materials will be sourced from local suppliers.

2.4.7 HOURS OF WORK

Construction will be limited to the Environment Protection Authority's (EPA) recommended standard hours. That is, Monday to Friday 7.00 am – 6.00 pm; Saturday 8.00 am to 1.00 pm; and with no work on Sunday's or Public Holidays.

2.5 FARM OPERATION

2.5.1 MAINTENANCE ACTIVITIES

Following commissioning the GSF will begin operating with the production of electricity for contribution to the electricity grid. The solar modules will operate during daylight hours, seven days per week, 365 days per year.

The farm will operate independently and no permanent employees will be stationed on-site. The farm will be monitored remotely from an off-site location and apart from a routine maintenance program, operators will only visit the farm when responding to any performance issues (ie. where actual output measured by the monitoring system deviates from generation forecasts and other key performance metrics).

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 and maintenance.
- Fence, access road and control room management.
- Vegetation (fuel load), weed and pest management.
- Possible solar PV module washing on an as-needed basis (see below).
- Security monitoring.
- Communicating with customers, transmission and distribution network operators, Australian Energy Market Operator (AEMO), Parkes Shire Council, neighbours and other stakeholders.

2.5.2 SOLAR PV MODULE WASHING

The solar PV modules may be periodically washed to remove excess dirt, dust or other matter (i.e. bird droppings) which can prevent sunlight from effectively reaching the solar cells and subsequently reducing the electricity production output.

The frequency of any washing will depend on monitoring the actual performance of the farm. RED note that experience indicates washing may be limited to occasional events such as following severe dust storms and in many applications cleaning is not required at all due to the anti-static properties of the modules and normal precipitation.

If required washing will be carried out manually or mechanically. Clean water would be transported to site by a water trucks that would then be driven down the rows between the strings of modules and personnel or mechanical devices would use spray equipment to clean the surface of modules. Washing panels would not require any detergent or cleaning agent and, based on experience overseas the 70 MWac GSF with around 214,000 PV panels would require less than 100 kilolitres (kL) to wash.

2.5.3 FUEL MANAGEMENT

Fuel management will be a key ongoing activity targeting bushfire risk presentation (refer **Section 13**). Groundcover across the property 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.

2.6 FARM RECOMMISSIONING/DECOMMISSIONING

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 (ie. Year 2048). In all likelihood the economics will be favourable because the farm infrastructure, including network connection, underground cabling, foundations, control room and access tracks will continue to be serviceable and the cost of replacing modules and inverter assemblies

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.

Recommissioning would involve removal of any obsolete equipment such as modules and inverters and disposing of these off-site according to good practice, including recycling wherever possible. The technology available at that time would be installed using the existing structures and infrastructure to the extent possible and the farm would be recommissioned.

If the decision at the time is to decommission the farm the procedure would be to initially disconnect the solar farm from the TransGrid network. The interconnecting cable 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. The substation compound fencing would be removed and area would be graded and seeded.

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 more 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. Finally, the surface of the site would be ripped and returned to agricultural use.

Statutory Planning

3.1 DEVELOPMENT SITE

The proposed development site includes lands described as Lot 1 DP 602329, Lot 2 DP 602329, Lot 1 DP 877903 and Lot 409 DP 750152 in the Parish of Currajong, County of Ashburnham, and Lot 5 DP 854193 in the Parish of Brolgan, County of Ashburnham. These lands are owned by Greens Contracting Pty Ltd. The development also entails traversing a Crown Road.

3.2 PERMISSIBILITY

The development site is located on land zoned RU1 – Primary Production under the *Parkes Local Environmental Plan 2012* (LEP). As a solar farm is not expressly listed as permitted with consent or without consent, it would be considered a prohibited land use under a strict reading of the LEP.

However, based on a broader reading of the LEP, and consideration of the objectives of the RU1 zone and other PSC documents, the DPE has recently satisfied itself that there is no clear intention to prevent the development of a solar farm on land zoned for Primary Production in the Parkes LGA.

The basis for this position includes the following considerations.

Firstly, the Parkes LEP expressly references *State Environmental Planning Policy (Infrastructure) 2007* and acknowledges that electricity generating works and solar energy systems are regulated by the Infrastructure SEPP rather than the LEP. A solar farm is permitted with consent under the Infrastructure SEPP.

Secondly, a solar farm is not inconsistent with the objectives of the RU1 zoning, particularly in relation to:

- *encouraging diversity in primary production industries;*
- *permitting a range of activities that support the agricultural industries; and*
- *minimising fragmentation and alienation of resource lands.*

A solar farm encourages a new element of agricultural enterprise and diversity through the generation of solar energy, while maintaining the opportunity for an element of traditional agricultural land use through strategic grazing of the site to manage fuel loads. The GSF would not fragment or alienate any resource lands during its operation as it will have no off-site impact that would compromise the use of neighbouring lands for primary production purposes. Similarly, post-operation the site can be easily returned to agricultural land use in the future if the solar farm is decommissioned. Arguably, the land returned after what would effectively be a 30 year fallow would, subject to appropriate management during the intervening period in terms of weed control, be in improved condition.

Thirdly, a solar farm contributes to some of PSC's broader goals around land use for the region. Specifically, the GSF development would meet a key objective of the *Parkes Shire Land Use Strategy* (2012) for the RU1 Primary Production zone:

> *To provide for other types of development that are appropriate within a rural zone and that do not compromise the future productivity of the land, including …. Employment generating development that is well located within a rural area, for example solar power electricity farms.*

It is also noted that the proposed GSF is consistent with the vision of the *Draft Central West and Orana Regional Plan* (April 2016). Specifically,

- Managing the region's energy resources sector in a sustainable way is identified as a strategy for attaining the goal of a growing and diverse regional economy, where renewable energy industries are a sector that has significant economic and employment benefits in the region.

- Renewable energy is identified as an industry on which the region's future prosperity depends, and over the coming decades the region will continue benefiting from the economic and employment flow-on effects through the development of new industries that can provide alternative energy supplies for the State.
- The NSW Government is working with the Commonwealth to identify additional lands capable of accommodating large-scale renewable energy projects to support the development of these industries.
- The NSW Government is working to support the diversification of energy supplies for NSW within the Central West, including working with Councils to identify new opportunities for renewable energy industries.
- With respect to the goal of a region with strong freight transport and utility infrastructure networks that support economic growth, and the associated action to coordinate the delivery of infrastructure to support the future needs of residents, business and industry, the following is identified:
  - *The challenge of providing cost-effective extended and upgraded services to some remote areas in the region creates opportunities for stand-alone alternative energy generation, and the use of renewable energy options, such as solar generation to meet local needs.*

3.3 STATE SIGNIFICANT DEVELOPMENT

The GSF is an electricity generating activity with a capital investment value of approximately $130 million.

Accordingly the development is classified as a State Significant Development (SSD) and pursuant to *State Environmental Planning Policy (State and Regional Development) 2011* the Minister for Planning is the consent authority.

3.4 STATE LEGISLATION

3.4.1 NATIVE VEGETATION ACT 2003

An authorisation to clear native vegetation is not required for SSD pursuant to s.89(J) of the *Environmental Planning and Assessment Act 1979*. Clarification in relation to the extent of impact on native vegetation is provided in **Section 6**.

3.4.2 THREATENED SPECIES CONSERVATION ACT 1995

The *Threatened Species Conservation Act 1995* is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and ecological communities and the declaration and mapping of their critical habitats, as well as the identification of key threatening processes. This Act also establishes a system for biodiversity certification and establishes the Biodiversity Banking and Offsets Scheme. For all major projects, such as the GSF, impacts to biodiversity are assessed in accordance with the Framework for Biodiversity Assessment (FBA).

Through adopting the principles of avoidance and identifying ecological constraints on the development site that will be protected, the biodiversity assessment (refer **Appendix C**) has determined that a significant impact on threatened species, populations or ecological communities (or their habitats) is not likely.

3.4.3 FISHERIES MANAGEMENT ACT 1994

The development site does not contain any watercourse or potential fish habitat. There is no dredging or reclamation works required, nor would fish passage be blocked. A permit under s. 201, 205 or 219 of the *Fisheries Management Act 1994* is not required.

3.4.4 NATIONAL PARKS AND WILDLIFE ACT 1974

An Aboriginal Heritage Impact Permit (AHIP) under s.90 of the *National Parks and Wildlife Act 1974* is not required for SSD pursuant to s.89(J) of the *Environmental Planning and Assessment Act 1979*.

An assessment of impacts on Aboriginal heritage is provided in **Appendix D**.

3.4.5 WATER MANAGEMENT ACT 2000

The development does not require a water use approval, a water management work approval or either a controlled activity approval or aquifer interference approval under s. 89, 90 or 91 of the *Water Management Act 2000*.

3.4.6 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

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

3.4.7 ROADS ACT 1993

The GSF will commence construction activity after the recently approved PSF. NSW Roads and Maritime Service (RMS) has stipulated that both solar farms must access their respective sites off Pat Meredith Drive. A condition of the Minister's consent for the PSF is that before construction on the PSF can commence, the intersection of Henry Parkes Way and Pat Meredith Drive must be upgraded to the satisfaction of the RMS and PSC.

Accordingly, by the time the GSF construction commences the requisite road upgrades will have been completed and there will be no requirement for a consent under s.138 of the *Roads Act 1993*.

3.4.8 CROWN LANDS ACT 1989

Access to the property "Velvedere" (refer **Drawing EV02**) is via a formed road with a formal access treatment off Henry Parkes Way (Condobolin Road). PSC has advised that it does undertake maintenance on this road. This road essentially bisects the development site. At two locations (taking advantage of existing tree breaks and using an established farm machinery access cross-over) it is proposed to construct 6 m wide gravel access tracks with electrical cabling buried underground to connect the eastern and western portions of the solar farm.

RED will apply for two (2) easements at these two (2) cross overs of the Crown road, consistent with the Minister's authority to grant easements, in such manner and subject to such terms and conditions as the Minister determines, pursuant to s.34(1) of the *Crown Lands Act 1989*.

3.4.9 NOXIOUS WEEDS ACT 1993

The *Noxious Weeds Act 1993* was enacted to provide for the identification, classification and control of noxious weeds. Plants declared as noxious weeds are currently listed under Weed Control Order No. 28 Declaring Certain Plants to be Noxious Weeds published in the New South Wales Government Gazette No. 97 (Department of Premier and Cabinet 2011). No declared noxious weeds were identified in the study area during ecological surveys undertaken for this EIS (refer **Appendix C**).

3.5 STATE PLANNING POLICIES

3.5.1 SEPP 55 - REMEDIATION OF LAND

A review of the EPA Contaminated Land Record under s.58 of the *Contaminated Land Management Act 1997* and the List of NSW contaminated sites notified to EPA under s.60 of the Act does not identify any registered contaminated sites at or near the development site. Nor is the development site located on land upon which development referred to in Table 1 of the *Managing Land Contamination Planning Guidelines SEPP 55 – Remediation of Land*, is being or is known to have been carried out. Pursuant to

Clause 7 of *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land on the development site would be contaminated.

3.5.2 SEPP - RURAL LANDS 2008

Pursuant to this Policy the GSF does 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 on State significant agricultural land.

3.5.3 SEPP 44 - KOALA HABITAT PROTECTION

The aim of the *State Environmental Planning Policy 44 – Koala Habitat Protection* is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. The SEPP applies to the Parkes LGA.

White Box and Bimble Box, feed tree species as defined in Schedule 1 of the SEPP, were both identified within the study area during ecological surveys (refer **Appendix C**). However, these feed tree species do not make up 15 per cent of the total number of trees in the upper or lower strata of the tree component. Therefore the vegetation within the study area would not be considered potential Koala habitat as defined under the SEPP.

3.5.4 SEPP 33 – HAZARDOUS AND OFFENSIVE DEVELOPMENT

The proposed GSF 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 GSF 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 GSF is neither a hazardous or offensive industry.

3.6 COMMONWEALTH LEGISLATION

3.6.1 ENVIRONMENT PROTECTION BIODIVERSITY CONSERVATION ACT 1999

The development does not involve any actions that would have a significant impact on any matters of National Environmental Significance (NES). The development will have no impact on any World Heritage properties, National heritage places, Ramsar wetlands, threatened species and ecological communities, migratory species, a Commonwealth marine area or the Great Barrier Reef Marine Park. The development is not a nuclear action, coal seam gas development or large coal mine. Referral under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* is not required.

3.6.2 NATIVE TITLE ACT 1993

The development site is located on freehold land and a Crown Road and not subject to any lodged native title claims.

3.6.3 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 GSF, 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.*

Consultation

4.1 INTRODUCTION

The approach to the consultation undertaken as part of this EIS has been to target stakeholders that have a potential to be impacted by the development. This has included all neighbours within 2 km of the development site boundary, representatives of the Aboriginal community, several Government agencies and the service provider TransGrid.

4.2 NEIGHBOURS

4.2.1 CONSULTATION LETTER

On 15 June 2016, RED sent a letter to everyone who owns land within 2 km of the development site. This letter was sent to all these landowners regardless of whether they have a residence located within 2 km of the development site.

The letter outlined the scale and location of the proposed solar farm as well as the anticipated timeline for approvals and construction. The letter clarified that community engagement was important to the approvals process and extended an offer to meet, if the landowner would like, to discuss any aspect of the development. Contact details were provided and the invitation included the offer to meet at a time that was convenient to the landowner.

No response from any landowner has been received.

4.2.2 FACE TO FACE MEETING

Individual face to face meetings were undertaken with the three landowners who, from their residence curtilage, have partial views of the development site. The location of these residences are shown on **Drawing EV02**

Residence R1

This residence is located on the western side of Pat Meredith Drive, and a dominant feature of the house yard and adjoining paddocks are the extensive tree plantings that have been undertaken over a number of years. These trees screen most of the development site from the home. The land owner indicated he had no issues with the proposed project nor any concern about visual impact. The offer was made to prepare a visual montage and the landowner advised that this was not necessary.

Residence R6

This residence is located on the western side of Millers Lookout Road. This land owner also indicated he had no issues with the proposed project nor any concern about visual impact. The offer was made to prepare a visual montage and the landowner advised that this was not necessary.

Residence R2

The owner of this residence has the greatest potential to be impacted by the GSF. His property ““Velvedere” is located on Lot 2 DP 807412 and accessed by the Crown Road that essentially bisects the eastern and western portions of the development site.

Several meetings were held with the landowner during the preparation of the EIS. The first meeting was undertaken on 9 May 2016 and a second meeting on 28 August 2016. Two issues were raised: visual impact and security of farm dam water supply.

With regards to visual impact the landowner requested that a row of screen plantings be established, on his land, along the eastern boundary of his property. RED agreed to this and a visual montage was

prepared and shown to the landowner (refer **Section 9**). Feedback from the landowner resulted in a commitment to also establish scattered plantings immediately north of his house. The landowner indicated that the composition and density of these plantings on the northern side of his house could be finalised in consultation with RED after detailed design was completed. The screen plantings along the eastern boundary would comprise three rows of staggered native trees and shrubs extending 450 m along the boundary.

With regards to water supply the dams on "Velvedere" rely on directed surface flows emanating from within the development site. The need to retain these inflows was discussed and an assurance given that detailed design of the GSF will not compromise these dam inflows (refer **Section 12**).

4.3 ABORIGINAL COMMUNITY

A four step process of consultation with Aboriginal stakeholders was undertaken in accordance the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents (ACHCRP 2010)*.

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 was undertaken via the placement of a newspaper notice in the *Parkes Advocate* on Friday 13 May 2016. Following receipt of a list of potential Aboriginal stakeholders from the OEH, notification letters were sent to these organisations and individuals on the 17th of May 2016. Notification resulted in the Parkes Aboriginal Community Working Party (PACWP) and the Binjang Wellington Aboriginal Heritage Survey (BWAHS) expressing interest in the project:

Consultation Step 2 Information to Respondents

A *Project Proposal Information* document was forwarded to these respondents. The document provided details of the project and the proposed heritage assessment methodology and invited comments from the interested parties. The document also sought any information regarding known Aboriginal cultural significance values associated with the development area.

Consultation Step 3 Information Gathering

An archaeological survey was then undertaken involving both the PACWP and the BWAHS. General discussion was had regarding local Aboriginal heritage and the potential cultural significance of the area.

Consultation Step 4 Review

The draft report Aboriginal Cultural Heritage Assessment Report (ACHAR) was then provided to the Registered Aboriginal Parties (RAP) on 12 July 2016 with the report finalised after the 28 day period for comment.

4.4 GOVERNMENT AGENCIES

Consultation was undertaken with the following Government agencies during the preparation of the EIS.

4.4.1 OFFICE OF ENVIRONMENT AND HERITAGE

Following completion of the ecological field survey an on-site meeting was held with OEH on 21 July 2016 to discuss the implications and options for dealing with areas of native vegetation. The OEH position was that avoidance rather than mitigation or off-setting was preferable. Consequently the development footprint was refined consistent with this advice, resulting in areas of native vegetation accurately mapped and identified as a site constraint that would not be impacted (refer **Drawing EV02** and **Drawing EV03** and **Section 6**).

4.4.2 LOCAL LAND SERVICE

Consultation was undertaken with the Central West Local Land Services (CWLLS) on 28 July 2016 and 12 August 2016. The use of the Currajong TSR on the northern end of the Pat Meredith Drive is noted, and the potential interaction between stock and construction traffic was discussed.

CWLLS had previously recommended the construction of a fence along Pat Meredith Drive to minimise any impacts on the use of the TSR during construction of the PSF, and the DPE included this requirement as a condition of consent for the PSF. Specifically, the consent condition requires Neoen Australia, as the proponent of the PSF, prior to commencement of construction, to temporarily fence the Pat Meredith road reserve to the satisfaction of the CWLLS and for the fencing to remain in place until the relevant stage of development is completed.

The GSF is to utilise this same access, with construction scheduled to commence after the PSF is built. RED), as the proponent of the GSF, will provide the same temporary fencing (refer **Section 19.4.4**).

4.4.3 CIVIL AVIATION SAFETY AUTHORITY

Consultation with the Civil Aviation Safety Authority (CASA) has established that at 13 km from the Parkes Airport, CASA does not consider the proposed GSF to be a potential hazard to aircraft operations and has no objection to the proposal (Air Navigation, Airspace & Aerodromes Branch, 11 August 2016).

4.4.4 CROWN LAND

Consultation was undertaken with the Department of Industry – Lands with regards to the Crown Road that essentially bisects the development site and provides access to the property “Velvedere” (refer **Drawing EV02**). This is a formed road, with a formal access treatment of Condobolin Road, and PSC has advised it does undertake some maintenance on this road.

At two locations (taking advantage of existing tree breaks and using an established farm machinery access cross-over), it is proposed to construct 6 m wide gravel access tracks with electrical cabling buried underground to connect the eastern and western portions of the solar farm. The impact is highly localised, will have no environmental consequence, and would not compromise the function of the existing formed road as the sole access to “Velvedere”.

Closing this Crown road is not proposed or required. RED will apply for easements for these two cross over points on Crown land, consistent with the Minister’s authority to do so, in such manner and subject to such terms and conditions as the Minister determines, pursuant to s.34(1) of the *Crown Lands Act 1989*.

4.4.5 PARKES SHIRE COUNCIL

Consultation with PSC have been undertaken on a number of issues.

- Following completion of the ecological survey preliminary discussions were held with PSC with regard to potential biodiversity off-set sites in their LGA. As the development footprint was subsequently refined to avoid stands of native vegetation, so too did the need for an off-setting site and the need to progress these discussions.
- As noted above, following discussions with PSC, RED has also made a formal approach to PSC with regards to taking over control of the Crown Road, with a view to subsequently permitting the creation of easements at the two cross over points.
- Consultation was also undertaken with PSC to confirm in-principle access to a source of water during construction of the GSF. PSC has a supply of non-potable water available at ‘the brick pit’ (a large flooded abandoned brick pit with reliable recharge rates). PSC has agreed to allow access to this water for the construction purposes (refer **Section 12.3**).

4.5 NETWORK OWNER

RED has continued to consult with TransGrid about the network connection.

Trans Grid's 132 kV Parkes substation is located on a strong part of the HV transmission network and has significant capacity to accommodate new generation. TransGrid recently published information on the capacity to connect at various substations on their network. They identified Parkes as one of eight opportunities. At 132 kV, TransGrid forecasts 260 MW-390 MW capacity to connect. At 66 kV, TransGrid forecasts 140 MW capacity to connect.

The GSF has been sized to take advantage of available capacity at 66 kV taking into account another potential solar project in the region. Combined, the two projects will have less than 140 MW capacity. Network studies are currently underway to design the connection and to identify the technical requirements for the operation of the farm. These studies may have some impact on the final capacity of the GSF. However, neither RED nor TransGrid expects these studies will conclude that less than 70 MWac is capable of being connected.

In addition to the above, RED has also instigated discussions with regard to a possible option of accessing the GSF site using TransGrid's existing substation access road. Access to the GSF through the TransGrid site is not necessary, but would provide convenient access for construction traffic.

4.6 NEOEN AUSTRALIA

Consultation has been undertaken, and will continue, with Neoen Australia with regards to its recently approved 65 MW Parkes Solar Farm (SSD 6784). Specifically, this consultation has focussed on clarification of construction schedules and issues relating to the Henry Parkes Way/Pat Meredith Drive intersection treatment works.

Pat Meredith Drive is the proposed access for the PSF and, consistent with advice from the RMS, the required access for the GSF.

Neoen Australia's project schedule is for construction to commence in January 2017 with the PSF to be completed in nine (9) months: ending in September 2017. The timeline for the GSF is for construction to commence no earlier than October 2017. The implication being that an upgraded access treatment to Pat Meredith Drive will be in place before the GSF construction commences. While simultaneous construction works at both the PSF and GSF are therefore not anticipated, a possibility for this to occur for a short period, does exist.

For the above reason the Minister's approval for the PSF includes as a condition of consent a requirement for Neoen Australia to prepare a traffic management plan before road upgrade works commence, and that amongst other things, this plan must consider the potential interaction with the GSF, in consultation with RED. Conversely, the SEARs issued for the GSF require RED to consult with Neoen Australia about potential cost sharing arrangements for the relevant road works.

The consultations between RED and Neoen Australia are ongoing and will be progressed as the respective farms move through the development process (i.e. GSF secures development consent and PSF select an engineering, procurement and construction contractor)

Environmental Issues

5.1 PRELIMINARY RISK ASSESSMENT

The process of identifying key environmental issues associated with the construction and operation of the GSF has evolved over a period of 12 months. 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.

The process commenced with a preliminary desktop risk assessment that identified the likely planning and environmental issues associated with the development. A number of site inspections were then completed to ground truth the bio-physical data sourced from the desktop assessment and inspect the features in and around the development site.

In April 2016 a formal request for SEAR was prepared and lodged with the DPE. The following were identified as the key potential environmental issues:

- Cumulative impacts associated with the neighbouring PSF.
- Biodiversity
- Aboriginal heritage

Other environmental issues that were considered less likely to affect the development, but still requiring consideration, included:

- Land Use
- Access and traffic
- Soil and water
- Air quality
- Bushfire Risk
- Land contamination
- Electric and magnetic fields (EMF) hazard
- Groundwater
- Waste management

5.2 PLANNING FOCUS MEETING

A PFM was held 9 May 2016 on-site with representatives from:

- Department of Planning and Environment (DPE)
- Office of Environment and Heritage (OEH)
- Parkes Shire Council (PSC)
- Roads and Maritime Service (RMS)
- Department of Primary Industries (DPI)

The purpose of the PFM was to explain the proposed development, provide the opportunity for Government agencies to inspect the site and ask questions to inform their requirements for inclusion in the SEAR.

5.3 SECRETARY'S REQUIREMENTS

SEAR were subsequently issued on the 16 May 2016 and identified the following as the key specific issues that must be addressed in the EIS.

- Constraints
- Biodiversity
- Heritage
- Land
- Visual
- Noise
- Transport
- Water
- Electromagnetic Interference
- Cumulative Impacts

Biodiversity

6.1 INTRODUCTION

Secretary's Environmental Assessment Requirements (SEARs) were issued by the NSW Department of Planning and Environment (DPE) on 16 May 2016, including Agency Comments from the NSW Office of Environment and Heritage (OEH). The SEARs require that biodiversity impacts related to the proposed development are to assessed and documented in accordance with the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a) and *Framework for Biodiversity Assessment* (FBA) (OEH 2014b) by an appropriately accredited person.

Biosis Pty Ltd was commissioned to undertake a biodiversity assessment of the subject site and broader study area for the proposed GSF. All biodiversity assessment has been undertaken in accordance with the FBA. This report has therefore been prepared by Accredited BioBanking Assessor Nathan Garvey and a copy of the Biodiversity Assessment Report (BAR) is provided in **Appendix C**.

6.2 SUBJECT SITE

The final footprint of the solar farm infrastructure was refined through consideration of findings as a result of previous site investigations and identification of constraints and opportunities mapped through the environmental impact assessment process, including biodiversity. The intent, however, is to maximise the built footprint over the development site while avoiding impact on the ecological values present on the site.

The subject site is defined as the maximum area to be directly impacted by the proposal. The study area is defined as the subject site plus the immediately surrounding land investigated during the field surveys and potentially impacted by indirect impacts.

The study area consists of predominately flat, agricultural land with remnant native vegetation restricted to isolated patches within paddocks, along roadsides and farm tracks. There are no mapped watercourses or drainage lines located within the study area, although there are a number of farm dams. Ridgey Creek, which flows into Goobang Creek, is located approximately 80 metres from the western boundary of the project area. RED plans to develop as much of the 'buildable' site as possible, with infrastructure proposed across 295 hectares of the 385 hectare site.

The site is located predominantly on cleared land used for agricultural purposes, such as cropping and grazing. There are some small areas of native vegetation remaining within the site, and a hill (known as Millers Lookout) at the eastern extent of the site that is not cultivated due to outcropping rock.

Currently, vegetation exists as a mix of native remnants and agricultural land as well as cleared land forming exotic grasslands. Vegetation is significantly modified through past and current land practices and weed infestations. Where present, plant communities reflect the underlying geology and soils, with areas of *Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion*.

6.3 BIOREGIONS AND LANDSCAPES

The study area occurs within the NSW South Western Slopes IBRA bioregion and the Lower Slopes IBRA subregion. The Lower Slopes IBRA subregion covers the entire study area and is the subregion used in this assessment.

The study area occurs within the Bimbi Plains and Goonumbla Hills Mitchell Landscape**.** The Goonumbla Hills Mitchell Landscape was used in this assessment as it covers the majority of the study area.

6.3.1 WATERWAYS AND WETLANDS

The study area is located within the Lachlan catchment, in central NSW and west of the Great Dividing Range. The Lachlan catchment borders the Murrumbidgee catchment to the south and the Darling catchment to the north.

There are no mapped watercourses or drainage lines within the subject site. The closest mapped watercourse (non-perennial) is Ridgey Creek, located (at its closest point) approximately 80 metres from the western boundary of the study area. Ridgey Creek flows south-west into Goobang Creek, a tributary of the Lachlan River. Ridgey Creek is mapped as Key Fish Habitat by the NSW Department of Primary Industries. A drainage line mapped by NSW LPI flows towards a dam adjacent to the southern boundary of the site.

The study area does contain several farm dams.

6.3.2 NATIVE VEGETATION EXTENT

Mapping of vegetation within the inner and outer assessment circles was undertaken using the *Central West / Lachlan Regional Native Vegetation Map Version 1.0* (OEH 2015), which is considered the most reliable and comprehensive local vegetation mapping study. This mapping was modified using vegetation extent as assessed by Biosis. OEH (2015) map seven native vegetation communities within the outer assessment circle, including:

- LA145 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion (PCT201).
- LA138 Derived tussock grassland of the central western plains and lower slopes of NSW (PCT250).
- LA218 White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (PCT267).
- LA174 Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion (PCT45).
- LA223 White Cypress Pine woodland on sandy loams in central NSW wheatbelt (PCT70).
- LA154 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (PCT76).
- LA338 Derived grassland of the NSW South Western Slopes (PCT796).

6.4 CONNECTIVITY

The study area does not support any of the following:

- An area identified as being part of a state significant biodiversity link.
- A riparian buffer 50 metres either side of a 6th order stream.
- A riparian buffer 50 metres around an important wetland or estuarine area.
- An area identified as being part of a regionally significant biodiversity link.
- A riparian buffer 20 metres either side of a 4th or 5th order stream.

Therefore, the proposed development will not impact on any state significant biodiversity links or regionally significant biodiversity links.

The study area was assessed as being part of four connective links. Native vegetation in the Henry Parkes Way road reserve provides an east-west connective link along the northern boundary of the study area. Native vegetation in the Pat Meredith Drive road reserve, a Crown road in the centre of the site and in the eastern section of the study area provide north-south connective links through and along the edges of the study area. The centre connective link terminates in the centre of the study area, while connective links along Pat Meredith Drive and in the east provide connectivity beyond the study area.

These connective links will be unaffected by the GSF, and no change in linkage will occur.

Overstorey vegetation within these links was assessed as being in benchmark condition. No change in overstorey condition will result from the GSF. Midstorey/groundcover condition was assessed based on a rapid assessment of vegetation within the locality, with vegetation reviewed from roadsides. Midstorey/groundcover vegetation adjacent to the study area is also largely intact, with a moderate to high diversity in most areas. No change to Midstorey/groundcover condition will result from the GSF.

The proposed development will not result in any change in linkage condition classes.

6.5 NATIVE VEGETATION

6.5.1 VEGETATION DESCRIPTION

The study area supports 55.54 hectares of native vegetation patches with varying levels of disturbance. Across the study area, ongoing cropping and grazing activities were noted.

Native vegetation within the subject site is composed of isolated patches of vegetation in an agricultural matrix. These isolated patches have heavy weed infestations, with most patches subject to ongoing grazing. This has prevented recruitment of native shrubs and eucalypts. The vegetation is therefore characterised by a canopy of mature and semi mature native trees over an understorey of mostly exotic herbs and grasses. Resilience in the understory was low, with a low diversity of native grasses.

Areas of native vegetation outside the subject site but within the study area are in better condition, with a relatively high diversity of native species and much lower levels of disturbance evident. This includes areas of native vegetation along Henry Parkes way and in the south-west corner of the study area.

A rapid vegetation assessment identified approximately 42 hectares of a potentially derived grassland community located in the eastern area of the study area, associated with rocky ground on Millers Lookout. The canopy is mainly dominated by a very sparse layer of White Box *Eucalyptus albens* with some occurrence of White Cypress Pine *Callitris glaucophylla.* Shrubs are very sparse and limited to the top of the hill. Due to heavy grazing the groundcover vegetation could not be reliably identified. This vegetation community may potentially align with the *White Box Yellow Box Blakely's Red Gum Woodland* endangered ecological community. This area is not going to be impacted by the project; therefore, it was not assessed further in this report.

Two plots/transects showed very low levels of native species cover, with no native overstorey or midstorey cover and less than 50 per cent cover of native groundcover. These areas meet the definition of cleared land and were not mapped as native vegetation.

6.5.2 PLANT COMMUNITY TYPE

Site investigations identified the presence of one Plant Community Type (PCT) within the study area. The PCT, vegetation formation and vegetation class (Keith 2004) are described below.

Table 6.1 – Plant Community Type

Plant Community Type	Vegetation Formation	Vegetation Class
LA152 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion (PCT 82)	Grassy Woodland	Floodplain Transition Woodlands

Vegetation within the subject site shows high levels of disturbance. Vegetation along Henry Parkes Way, immediately north of the subject site, shows low levels of disturbance and higher species diversity. Vegetation west of Pat Meredith Drive showed moderate levels of disturbance.

6.6 FAUNA HABITAT

The study area has an extensive history of use for agricultural purposes, and has recently been used for extensive cropping and grazing. As a result, the study area provides limited refuge or habitat for fauna.

Fauna habitat features were limited to areas of remnant vegetation, as outlined above, and scattered trees. No wet areas other than barren farm dams, mistletoe, large she-oaks, dense canopy foliage or dense understorey vegetation were present in the subject site. However, some of the remnants of native vegetation contain a moderate level of fallen timber and rocky outcrops are present in the south-eastern boundary of the study area. The subject site contains 15 hollow-bearing trees, containing small to medium sized hollows. Trees within the subject site were found to contain small to medium hollows. A few trees contained dead sections of the trunk. Trees of a range of sizes were present and comprised remnant native species scattered within the subject site and adjacent road reserves. Some winter flowering tree species were present, comprising mostly of Western Grey Box. Yellow Box and Dean's Wattle provide additional foraging resources on the site for nectivorous species throughout the year.

The proposed GSF will not result in any removal of native vegetation, other than paddock trees and some trimming of vegetation for site access. No impacts to threatened species will result from the GSF.

6.7 POTENTIAL IMPACTS

Potential direct and indirect impacts arising from the development are outlined below. Potential direct impacts arising from the project include:

- Removal of all native vegetation within the subject site, avoiding 7.57 hectares of an endangered ecological community.
- Trimming of two trees or removal of a single tree for site access through the TransGrid substation.
- Removal of all paddock trees.
- Impacts to connectivity values due to removal of vegetation.

Potential indirect impacts arising from the project include:

- Decreased viability of retained vegetation due to edge effects and use of retained areas of native vegetation due to disturbance and degradation of habitat, including erosion and/or compaction of soils, as well as damage to seedlings and new growth.
- Encroachment of invasive exotic weeds species, leading to loss of habitat and suppression of native seedling establishment resulting in changes to vegetation communities over time.
- Temporary increased noise levels from construction equipment, leading to disturbance of fauna, especially during breeding seasons.

6.8 MITIGATION MEASURES

The principal means to reduce impacts on biodiversity values will be to avoid and minimise removal of native vegetation and fauna habitat include:

- Suitable site selection and consideration of ecological values in defining the development footprint.
- Adoption of safeguards during construction.

6.8.1 SITE SELECTION AND CONSTRAINTS CONSIDERATION

The site has been selected due to its suitability, the fact that it is essentially cleared and because it is adjacent to the TransGrid substation.

In identifying the development footprint and extent of buildable area, RED has considered all biodiversity values identified by the ecology specialists and has nominated a development footprint that avoids all

direct impacts to the identified biodiversity values. As a result, no removal of native vegetation will be required.

Site access for construction and operation will be undertaken off Pat Meredith Drive. In identifying access points, consideration has been given to ensuring they result in the least amount of vegetation trimming possible. Two access points have been identified; one through the existing TransGrid substation and one further south off Pat Meredith Drive. Access through the substation, which will require TransGrid consent, may require trimming of two trees or removal of a single tree. For the other site access no removal of vegetation will be required, with only minor branch trimming needed.

6.8.2 CONSTRUCTION

No additional direct impacts are expected to occur as a result of the construction phase. However, indirect impacts may result to retained biodiversity values. Additional mitigation measures recommended to avoid and minimise impacts include:

- Installation of appropriate exclusion fencing around trees and vegetation to be retained in the study area.
  - The radius of the tree protection zone (TPZ) is calculated for each tree by multiplying its diameter at breast height (DBH) by 12. (*TPZ = DBH x 12*) in accordance with the Standards Australia Committee (2009).
  - A TPZ should not be less than 2 metres nor did greater than 15 metres, except where crown protection is required (Standards Australia Committee 2009).
  - This would include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'.
  - Identify the location of any 'No Go Zones' in site inductions and a Construction Environmental Management Plan.
- All material stockpiles, vehicle parking and machinery storage will be located within cleared areas proposed for clearing, and not in areas of native vegetation that are to be retained.
- All scattered hollow-bearing trees to be removed should be placed in areas of retained vegetation to provide additional fauna habitat.
- Where appropriate native vegetation cleared from the study area should be mulched for re-use on the site, to stabilise bare ground.
- Wet down areas to reduce dust generation during construction.
- Implementation of temporary stormwater controls during construction to ensure that discharges to the drainage channels are consistent with existing conditions.
- Sediment and erosion control measures should be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect the drainage channels to the west and to the south. These should conform to relevant guidelines, should be maintained throughout the construction period and should be carefully removed following the completion of works.

Prescriptions for mitigation of potential impacts of construction activities on retained native vegetation and habitat would be addressed in a Construction Environmental Management Plan (CEMP).

6.8.3 OPERATION

The impacts arising from the operation of the GSF are expected to be negligible. As a result no additional mitigation measures are recommended.

6.9 OFFSETTING THRESHOLDS

This section outlines the thresholds for assessment and offsetting ion accordance with the FBA.

6.9.1 IMPACTS REQUIRING FURTHER CONSIDERATION

This section provides an assessment of impacts requiring further consideration in accordance with Section 9.2 of the FBA.

6.9.1.1 Landscape Features

The study area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links. The study area does not support any important wetlands. There are no impacts to landscape features requiring further consideration.

6.9.1.2 Native Vegetation

No critically endangered ecological communities have been mapped in the study area. A rapid vegetation assessment identified approximately 42 hectares of a potentially derived grassland community aligning with the *White Box Yellow Box Blakely's Red Gum Woodland* endangered ecological community. This community was nominated in the SARS. However, no impacts to this community will result from the proposed GSF. No other endangered ecological communities' nominated in the SEARs were mapped in the study area. No impacts to any endangered ecological community will result from the proposed GSF. There are no impacts to native vegetation requiring further consideration.

6.9.1.3 Species and Populations

The study area does not include any areas of critical habitat. No impacts to critically endangered or endangered species will result from the proposed GSF. There are no impacts to species or populations requiring further consideration.

6.9.2 IMPACTS REQUIRING OFFSETS

Since the GSF will not result in the removal of native vegetation, no offsets for native vegetation will be required.

The GSF will not result in removal of habitat for threatened species and populations. No offsets for species or populations are required.

6.9.3 BIODIVERSITY CREDITS

As the GSF will not result in the removal of native vegetation or habitat for threatened species or populations no biodiversity credits are required to offset the impacts to the GSF.

6.10 CONCLUSION

The ecological assessment has been completed in accordance with the Framework for Biodiversity Assessment (OEH 2014a). The proposed GSF will limit its impacts to the removal of paddock trees and trimming of vegetation for site access and will not result in losses of native vegetation and fauna habitat.

This includes the avoidance of impacts to 7.57 hectares of the Western Grey Box - Poplar Box - White Cypress Pine tall woodland (within the study area. This Plant community type aligns with Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions listed as an endangered under NSW TSC Act and endangered under the Commonwealth EPBC Act.

Measures to avoid and minimise impacts to vegetation were considered during the planning stage of the project, resulting in complete avoidance of impacts on native vegetation. Additional recommendations to mitigate any minor residual impacts are provided.

Since the Project will not result in impacts to native vegetation or habitat for threatened species or populations, there will be no biodiversity credits required.

No additional approvals will be required

Heritage

7.1 ABORIGINAL HERITAGE

7.1.1 ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Building the GSF would involve ground disturbance with the potential to disturb Aboriginal heritage objects which are protected under the NSW *National Parks and Wildlife Act 1974*. The proposed development has been determined to be SSD, and as such is exempt from the requirement to obtain an AHIP to harm Aboriginal objects.

Notwithstanding, it is a requirement that Aboriginal heritage be assessed 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*

Access Archaeology and Heritage (AAH) was engaged to prepare an ACHAR for the proposed GSF.

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 to standards prescribed in *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.

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

7.1.2 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 listed in the *ACHCRP* requesting details of any parties with a known interest, or who hold knowledge related to the study area. Notification of the Aboriginal heritage project was undertaken via the placement of a newspaper notice in the *Parkes Advocate* on Friday 13 May 2016.

Following receipt of a list of potential Aboriginal stakeholders from the OEH, notification letters were sent to these organisations and individuals on the 17th of May 2016.

The notification phase resulted in the following groups expressing interest in the project:

- Parkes Aboriginal Community Working Party (PACWP)
- Binjang Wellington Aboriginal Heritage Survey (BWAHS)

Consultation Step 2 Information to Respondents

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 interested parties. The document also sought any information regarding known Aboriginal cultural significance values associated with the study area and/or any Aboriginal objects contained therein.

Consultation Step 3 Information Gathering

An archaeological survey was then undertaken involving both the PACWP and the BWAHS. 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.

Consultation Step 4 Review

The draft report ACHAR was then provided to the Registered Aboriginal Parties (RAP) on 12 July 2016, with ACHAR finalised 8 September 2016.

7.1.3 REGISTER AND FIELD SURVEY

7.1.3.1 AHIMS Search

An AHIMS search of a ~45km x ~45km area (>2000 square kilometres) centred approximately on the study area was undertaken in June 2016 and showed 75 previously recorded sites. These included:

- 42 Culturally Modified Trees,
- 30 Artefact Scatters or isolated Artefacts,
- 1 Quarry,
- 1 Potential Archaeological Deposit, and
- 1 Ceremonial Ring.

Closer to the development site, the nearest Aboriginal sites are sites recorded by Navin Officer Heritage Consultants (2008) and NGH Environmental (Barber 2016). Sites recorded by Navin Officer Heritage Consultants include two culturally modified trees found to the north east of the proposed development area and two isolated artefacts found at the western end of the study area. These isolated artefacts are shown on **Figure 6**.

Figure 6: Location of Previously Recorded Sites

- PIF1 is recorded as being a Bogan Pick on the western side of the road reserve for Pat Meredith Drive and outside, albeit near, the current study area.
- PIF2 was recorded as a flake of volcanic material found just inside the property boundary.
- An additional site 'Ridgey Creek' recorded by the Peak Hill LALC is located in close proximity to PIF1.

No burials are recorded in the search area on the AHIMS database.

7.1.3.2 Field Survey

Intangible Heritage.

Discussion and correspondence with the Aboriginal Parties participating in the ACHAR did not reveal the existence of known intangible Aboriginal heritage. The parties considered the landscape highly modified and the lack of water sources and variation in topography suggested no strong indication of the locality being particularly noteworthy.

Tangible Heritage

A total of sixteen archaeological sites were recorded during the field survey, these being:

- 12 Isolated artefacts,
- 3 Artefact Scatters, and
- 1 stone hatchet quarry.

The locations of these sites are shown in **Figure 7.**

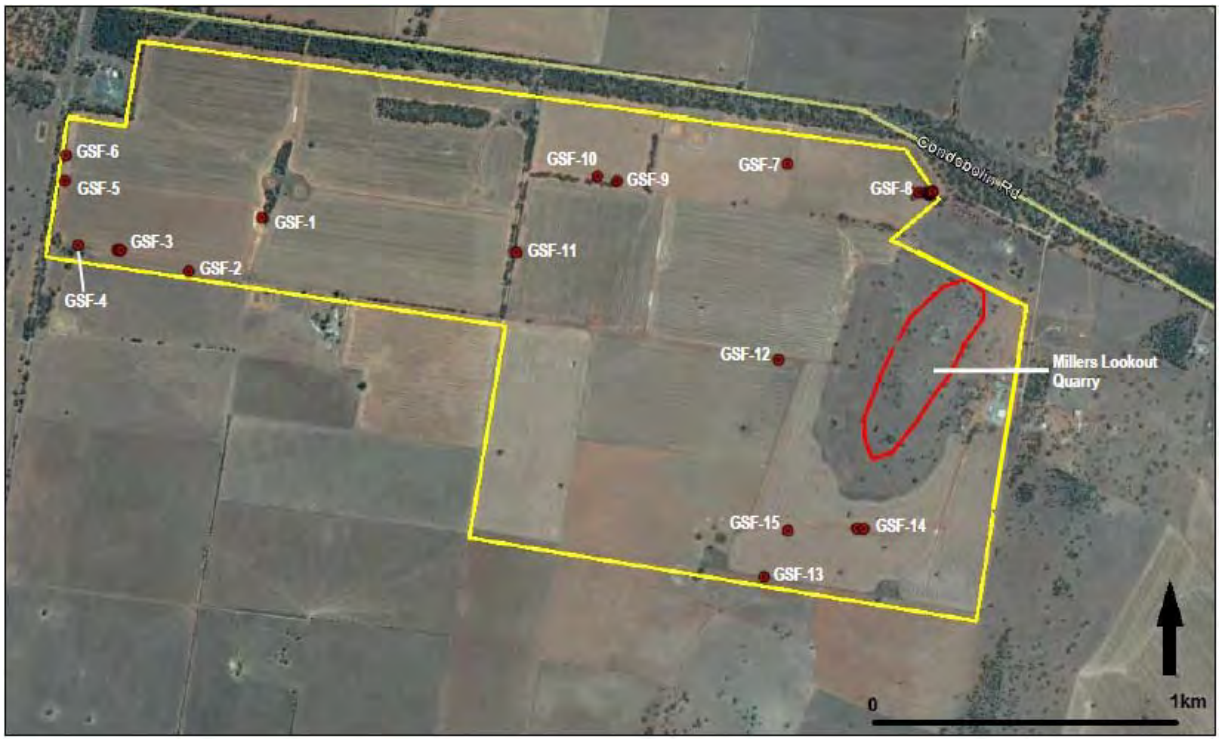


Figure 7: Site Locations

The stone hatchet quarry is not located within the proposed development footprint.

The 15 locations of archaeological material within or close to the development footprint comprise a total of 25 stone artefacts. Silcrete was the most abundant stone material making up 36% of the assemblage, with quartz (20%) and Volcanic (16%) being the next most common materials recorded. Flakes, cores, broken flakes and retouched flakes were the most abundant artefact types, collectively making up 22 (88%) of the 25 recorded artefacts.

Of particular interest in the open scatter sites was GSF-5, which was a multi-function tool found near the western boundary of the subject area. It was found ~25m east of the property boundary fence and is a fine example of a rare multi-function tool.

The Millers Lookout hill is a prominent feature in the local landscape, being a large outcrop of Ordovician 'Goonumbla Volcanics'. At several locations along the crest signs of Aboriginal quarrying were observed. The quarried area is evident intermittently across ~500m x ~150m, and appeared to be restricted mainly to the crest and upper slopes of the ridge. Miller's Lookout hill is not proposed to be used for solar farm activities.

7.1.4 DISCUSSION

The survey recorded a sparse scatter of artefacts across the landscape, consistent with the results of other surveys undertaken in the area, particularly that of NGH Environmental (Barber 2016). Although this present survey recorded more artefacts at more locations it was undertaken over a larger area. Overall the results of the two surveys are consistent in the range of artefact types and stone materials recorded.

The distribution of archaeological material is widespread and sparse, although this study has identified the potential for clustering given adequate visibility conditions. This is evident at site GSF-3 and GSF-8, although neither of these sites is particularly dense.

Over the course of three separate studies/recordings a noteworthy cluster of artefacts occurs at the western end of the study area. Although sparse, the grouping of a Bogan Pick, a multi-function

muller/anvil and several flaked artefacts offers unusual diversity of assemblage, and it can be no co-incidence that this grouping occurs at, or close to the margins of a drainage line – Ridgey Creek.

The Millers Lookout Quarry site is a significant local and regional discovery. There have been no stone hatchet quarries recorded within ~25km of the study area prior to this recording. Stone sources make up ~1% of the Aboriginal site record in NSW (Hiscock and Mitchell 1993:33), so by virtue of rarity the site is important. As a quarry of volcanic material the site has high potential to be used in studies of stone hatchet distribution through petrology.

7.1.5 CULTURAL HERITAGE VALUES AND SIGNIFICANCE

7.1.5.1 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.

7.1.5.2 Scientific (Archaeological) Value

The scientific value of the occupation sites recorded during this study, while interesting, is limited due to overall low artefact numbers and sparse distribution. The archaeological value has largely been realised through the recording undertaken for this study.

7.1.5.3 Research Potential

Rarity

The assemblage associated with this study, and that of Navin Officer Heritage Consultants who recorded PIF-1 has elements of rarity in the Bogan Pick and the multi-function tool recorded during this study (GSF-5). These are artefacts that should be recovered if they are under threat from development activities. Millers Lookout Quarry is a rare site type.

Representativeness

The sites and objects recorded during this study are representative of their type and class in the region. While there are less common elements present, the majority of the archaeological remains observed will be very widespread in the local and regional landscape. Millers Lookout Quarry would appear to be representative of its type.

Overall

Overall, the archaeological remains of occupation sites recorded during this project have low research potential, bar isolated elements comprising less common artefact types. Millers Lookout Quarry has high research potential in of itself, and high potential to contribute knowledge to wider studies of stone hatchet production, distribution and exchange.

7.1.5.4 Aesthetic Value

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

7.1.5.5 Historic Value

The study area in question 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.

7.1.5.6 Statement of Significance

As a group of objects the Aboriginal artefacts recorded during this project have overall low significance in that their ability to inform on Aboriginal life-ways and technology is limited, and largely realised during this recording. They are common and widespread elements that are to be found across the entire region.

There are less common elements of the assemblage that have local significance in their ability to illustrate less commonly observed parts of the Aboriginal tool kit. The Millers Lookout Quarry has high significance due to its rarity and its ability to contribute knowledge to our understanding of Aboriginal hatchet production and exchange.

7.1.6 ASSESSMENT OF HARM

The establishment of the proposed GSF will have a low impact on the archaeological resources of the study area. 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 sparse, 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. It could be argued that establishment of the GSF could have a net beneficial effect on the conservation of the integrity of Aboriginal heritage objects by breaking the semi-annual cycle of cultivation.

Depending on the extent and configuration of the upgrade of Pat Meredith Drive, there is potential for the proposed development to disturb the recorded locations of previously recorded sites PIF-1 and Ridgey Creek.

7.1.7 IMPACTS ON VALUES

7.1.7.1 Social and Cultural Values

The proposed development would 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 on in the study area in high value.

7.1.7.2 Scientific (Archaeological) Values

The proposed development would not significantly diminish the scientific value of the archaeology of the landscape. Indeed, overall it could be argued that the alteration of the land use, accompanied by disturbance to a small proportion of the area, ceases processes that incrementally degrade the integrity of the archaeological resource.

7.1.8 MITIGATION MEASURES

7.1.8.1 Management of Known Sites

- The collection of flaked stone artefacts currently recorded within the property boundary is unnecessary as they are common and their ability to be found again is limited, through even a modest passage of time.
- The known location of site GSF-5 at the western end of the study area should be pegged prior to development to ensure it remains undisturbed. If this cannot be achieved site GSF-5 should be collected and the artefact conserved in cooperation with the RAP. If this artefact is moved to a new location on the property the AHIMS site record form for the site must be amended and submitted to the OEH.
- If the road works on Pat Meredith Drive required by the Minister's consent for the PSF have not been constructed before the GSF construction commences, and the proposed access to the Goonumbla site off Pat Meredith Drive is within 20 metres of the recorded location of PIF1 (43-3-0083 Bogan Pick) and Ridgey Creek – Parkes (43-3-0090 artefact) then an attempt to relocate

these sites/artefacts would be made before the road works are undertaken, consistent with the Minister's consent (SSD 6784, 16 June 2016). This should be undertaken by the RAP for this project and a qualified archaeologist.

- Millers Lookout Quarry will not be affected by the development of the proposed Goonumbla Solar Farm as it is sufficiently distant from the more level land able to be developed for the purpose.
- Ongoing management of the Millers Lookout Quarry must be considered in any overall property planning. Further management measures (for example, but not restricted to:, fencing, revegetation, stock management, fire management, leasing, quarrying) may constitute harm even if a particular action is undertaken with the intent to be have an overall beneficial effect. Further assessment of such actions should be undertaken on an as needs basis.

7.1.8.2 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 would undertake the following:

- Prepare an information poster for site staff that describes the most likely site occurrences that might be observed and how to recognise them.
- If an 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.
- If 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 RED would 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 NSW Police (Parkes Police Station) and the OEH (Dubbo Office) must be contacted immediately. The location would be made secure to prevent unauthorised access and work continue no closer than 100 metres from the potential human remains.

7.1.9 CONCLUSION

The development should proceed with no further archaeological assessment. No areas of Potential Archaeological Deposit (PAD) were identified that would warrant test excavation and the significance of the Aboriginal heritage objects within the study area is low. Monitoring of ground disturbing activities is not a warranted mitigation strategy as the widespread and sparse scatter is unlikely to be observed during the proposed development activities.

7.2 HISTORIC HERITAGE

7.2.1 HERITAGE ITEMS

A search of the NSW State Heritage Inventory (including the State Heritage Register, Interim Heritage Orders, State Agency Heritage Registers and Parkes LEP heritage items) did not identify any heritage items at or near the development site. Further, 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 potential heritage items have been identified on the development site during the site inspections.

7.2.2 MITIGATION MEASURE

Should any object or item of historic heritage be uncovered during construction, work in that area should cease and the item cordoned off. A qualified heritage specialist would attend the site to determine the nature of the find and determine the required course of action; including consultation with the OEH if appropriate.

Land

8.1 LAND USE

The development site and most surrounding land is zoned RU1 – Primary Production. Under the provisions of the *Parkes Local Environmental Plan 2012* 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 encourage eco-tourism enterprises that minimise any adverse effect on primary industry production.*
- *To permit non-agricultural uses that support the primary production purposes of the zone.*
- *To permit small scale rural tourism uses associated with primary production and environmental conservation with minimal impact on primary production and the scenic amenity of the area.*
- *To encourage the provision of tourist accommodation in association with agricultural activities.*
- *To provide opportunities for employment-generating development that adds value to local agricultural production and integrates with tourism.*

The proposed GSF is not antipathetic to the realisation of any of these land use objectives (refer **Section 3.2**).

Land adjacent to the south-eastern corner of the development site land is zoned SP1 – Special Activities for the purpose of a Freight Transport Facility, known as the Parkes National Logistics Hub. The objectives of this zoning are:

- *To recognise the Parkes "Hub" as a special industrial enterprise area.*
- *To provide suitable land for a national multi-modal freight and transport interchange.*
- *To encourage the growth of the freight logistics industry and provide economic benefits for Parkes.*

Surrounding land use zoning is depicted in **Figure 8**.

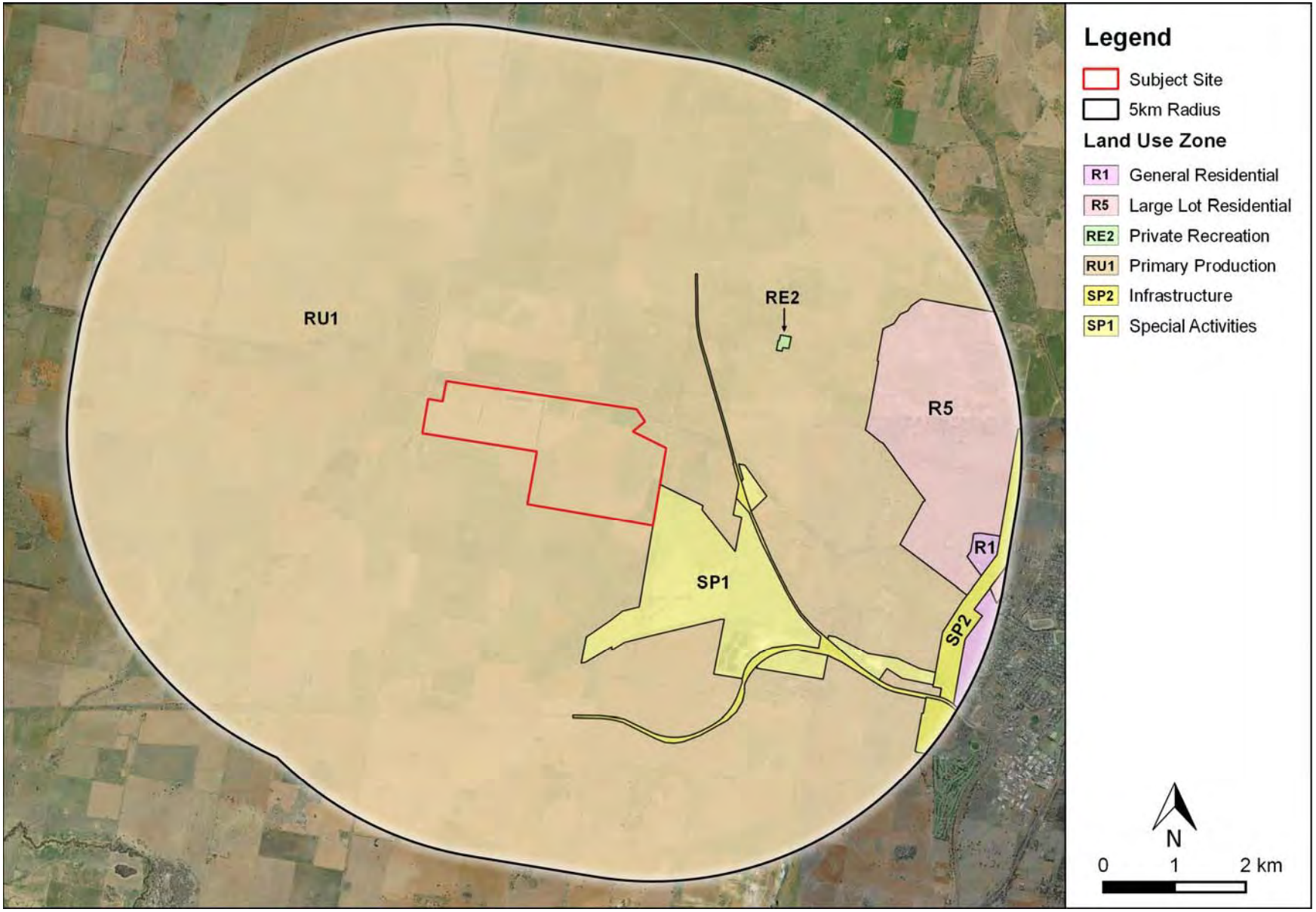


Figure 8: Land use zoning (Source: NSW LPI & NSW DPE)

8.2 LAND CAPABILITY

The OEH eSPADE identifies three soil landscapes occurring over the development site (refer **Figure 9**).

The Brolgan Plain soil landscape is mapped as occurring on the level to gently undulating plains on Quaternary alluvium, and the Parkes soil landscape occurring on the footslopes and sideslopes on Ordovician metasediments. Red Brown Earths are associated with both these soil landscapes.

The Goonumbla soil landscape occurs on the crests and ridges and undulating side slopes of Ordovician Goonumbla Volcanics (i.e. Millers Lookout) with Non Calcic Brown Soils occurring in association with this soil landscape.

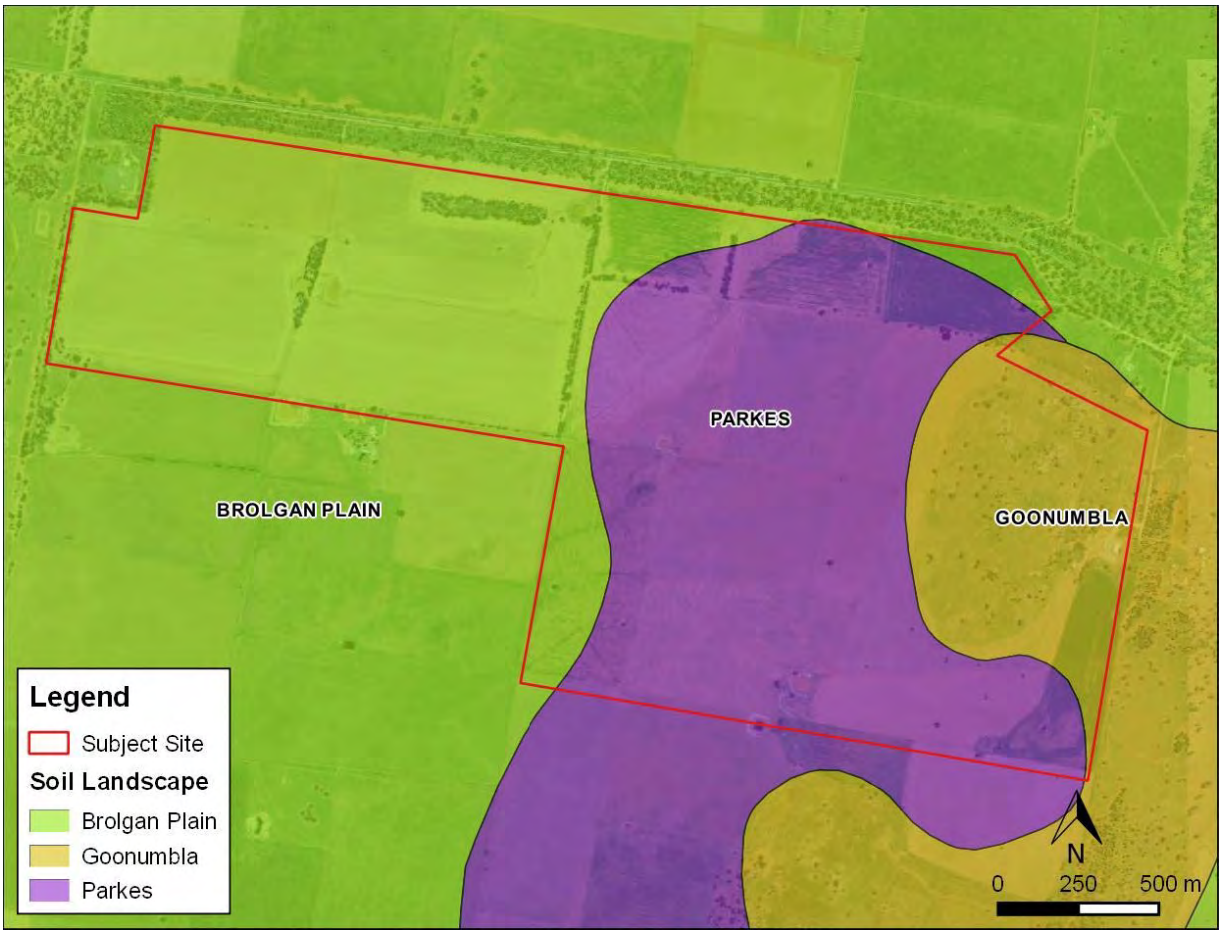


Figure 9: Soil landscape (Source: NSW OEH)

The Land and Soil Capability (LSC) assessment scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive classes for a range of land and soil hazards (OEH, 2012). These hazards include soil acidification, water erosion, soil structure decline, wind erosion, shallow soils/rockiness, salinity, mass movement and waterlogging. The land and soil capability mapping corresponds to each soil landscape and the LSC class is categorised based on the most limiting hazard.

Land in capability classes 1-3 is capable of a wide variety of uses and requires limited management. Land in capability classes 4-5 is also capable of a variety of land uses but requires careful management to prevent long-term degradation. Land in capability class 6 has limited land capability and is restricted to low-impact land uses. Land in capability class 7 has very low capability and can result in severe impacts if limitations are not managed (OEH, 2012). The soil and land capability for each soil landscape is provided in **Table 8.1**.

Table 8.1 – Land and soil capability

		Soil Landscape		
		Brolgan Plain	**Parkes**	**Goonumbla**
Hazard Classification	Soil Acidification	1	3	3
	Water Erosion	1	3	3
	Soil Structure Decline	4	3	4
	Wind Erosion	3	2	2
	Shallow Soils/Rockiness	1	1	4
	Salinity	3	3	1
	Mass movement	1	1	1
	Water-logging	3	1	2
	LSC Class	4	3	4
	Capability	Moderate	High	Moderate

Source: Land and Soil Capability Mapping for NSW (OEH, 2013)

Based on the above the GSF is locate on lands mapped as having Moderate and High capability.

8.3 ACID SULFATE SOIL

The Australian Soil Resource Information System (ASRIS) on-line database maintained by CSIRO Land and Water indicates there is a 'low' to 'extremely low' probability of occurrence of acid sulfate soils (refer – **Figure 10**). Further, based on the soil landscapes, iron sulphide minerals (or their oxidation products) are not considered to be abundant within the soil profile. Soil pH from each soil landscape are typically neutral, with topsoil pH ranging from pH 5.5 – 7.0 and subsoil pH ranging from pH 6.0 – 9.5. This, combined with a deep watertable, inhibits the formation of acid sulfate soils.

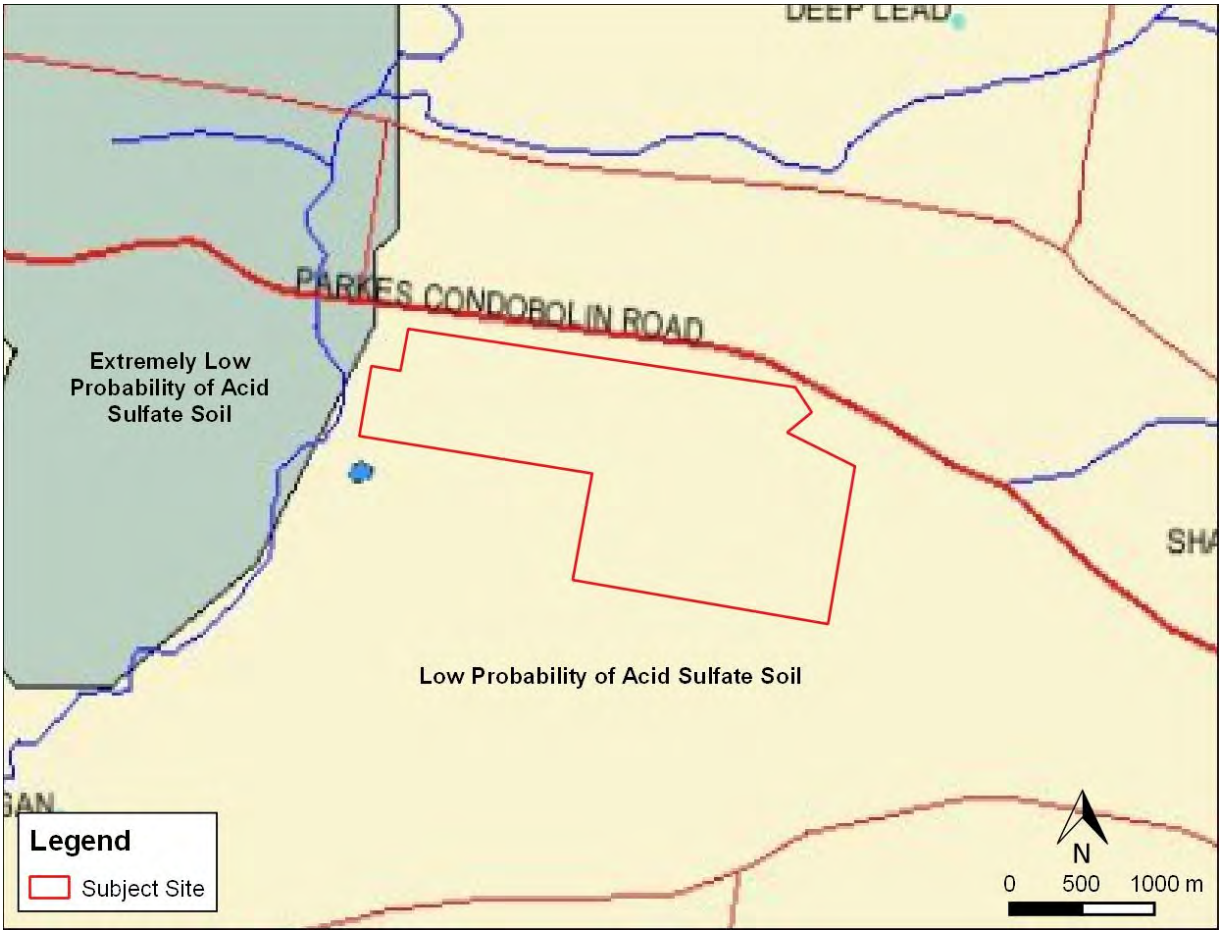


Figure 10: Probability of Acid Sulfate Soil (Source: CSIRO)

8.4 CONTAMINATED SOIL

A review of the EPA Contaminated Land Record under s.58 of the *Contaminated Land Management Act 1997* and the List of NSW contaminated sites notified to EPA under s.60 of the Act does not identify any registered contaminated sites at or near the development site. Nor is the development site located on land upon which development referred to in Table 1 of the *Managing Land Contamination Planning Guidelines SEPP 55 – Remediation of Land*, is being or is known to have been carried out. Pursuant to Clause 7 of *State Environmental Planning Policy No 55 – Remediation of Land* there is no apparent reason to consider that land on the development site would be contaminated.

8.5 MINERAL RESOURCES

Gold Fields Australasia Pty Ltd hold an Exploration Lease (EL 7676) that extends over the development site. This is a lease for Group 1 – Metallic Minerals and is due to expire January 2018. The lease was first granted in June 2011 and was last renewed in August 2015.

There are no other known mineral, petroleum or extractive resources within or adjacent to the development.

8.6 CROWN ROAD

A Crown road essentially bisects the development site and provides access to the property “Velvedere” located on Lot 2 DP 807412 (refer **Drawing EV02**). It is a formed road with a formal access treatment to Condobolin Road, and consultation with PSC has confirmed that PSC does undertake some road maintenance on this road.

At two locations (taking advantage of existing tree breaks and using an established farm machinery access cross-over – refer **Drawing EV03**) it is proposed to construct 6 m wide gravel access tracks with electrical cabling buried underground to connect the eastern and western portions of the solar farm. The impact is highly localised, will have no environmental impact, and would not compromise the function of the existing formed road as an access to "Velvedere".

RED will apply for two (2) easements at these two cross overs of the Crown road, consistent with the Minister's authority to grant easements, in such manner and subject to such terms and conditions as the Minister determines, pursuant to s.34(1) of the *Crown Lands Act 1989*.

8.7 TRAVELLING STOCK RESERVE

The Currajong TSR is located adjacent to the site on Lot 7002 DP 94814 (refer – **Figure 11**).

TSRs are parcels of Crown land reserved under legislation for use by travelling stock and at Goonumbla are managed by the CWLLS. TSRs provide pasture reserves for travelling or grazing stock. These reserves can be beneficial in times of drought, bushfire or flood. They are also used for public recreation, apiary sites and for conservation.

CWLLS role in managing TSRs includes:

- Authorising and monitoring stock, recreation and apiary site use.
- Controlling noxious weeds.
- Controlling pest animals and insects.
- Provision and maintenance of fencing, watering points and holding yards.
- Consideration of land management and animal health legislation.

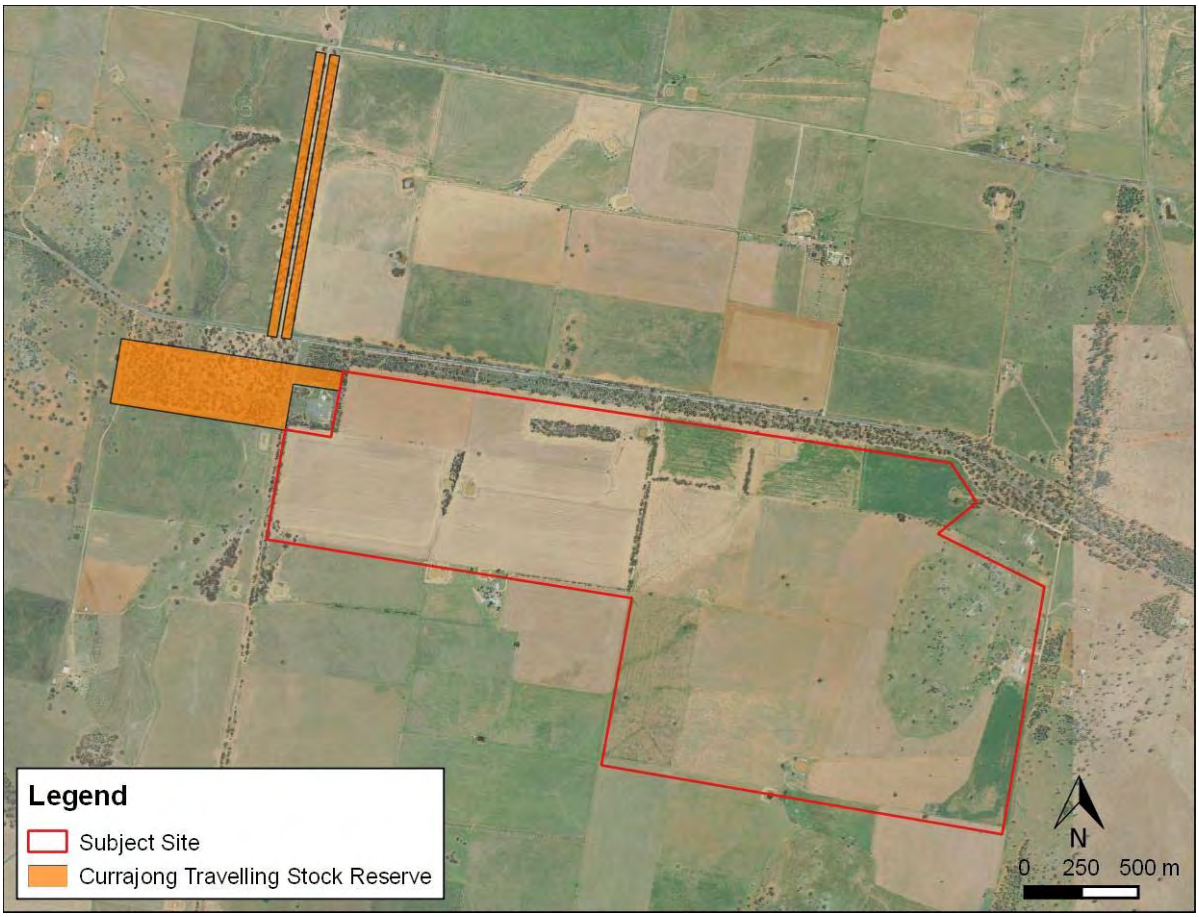


Figure 11: Currajong TSR (Source: NSW LPI & NSW DECCW)

Access to the development site off Pat Meredith Drive will require traversing the TSR and therefore creates a potential interaction with stock. The need to manage stock and traffic interaction is not unusual in a functioning TSR and mitigation measures will include on-going consultation with the CWLLS with respect to stock permits and temporary fencing.

The CWLLS has previously advised that passage through the Currajong TSR is used for travelling stock periodically. It was used twice in 2015 by a travelling mob of 800 head and used again in May 2016 by another mob of similar size. When mobs reach the reserve they generally stay a couple of days using the water supply before the walk into Parkes. As such stock amble across Pat Meredith Drive and around the existing sub-station.

Notwithstanding that stock must be supervised when using a TSR, CWLLS perceive an issue of stock accessing Pat Meredith Drive to the south during construction, when vehicles access the GSF site. Whilst there are existing gates to prevent this from happening, the CWLLS are concerned they could be left open and permit stock to escape. CWLLS also do not consider a stock ramp would provide an adequate control. The primary issue therefore is cattle entering Pat Meredith Drive and proceeding down the lane towards the solar farm's access, resulting in ongoing issues with vehicles and construction.

To resolve this concern CWLLS, for the PSF, requested that Pat Meredith Drive be fenced as part of the development. The location of this fencing, as proposed for the PSF, is shown in the **Figure 12.** This fence configuration would avoid stock and construction traffic interfaces.

Figure 12: TSR Temporary Fencing. Source: Parkes Solar Farm Submissions Report (May 2016)

RED commit to provision of this same fencing arrangement for the duration of its construction program as well as adopting the other safeguards CWLLS required for the PSF. Specifically, these include:

- The GSF would not result in anything that would require expansion of existing TransGrid zone substation infrastructure into the TSR, or the need for the removal of any trees in the TSR.
- The TSR will be acknowledged as a working environment, not vacant bushland.
- The TSR would not be used to stockpile any materials associated with the GSF.
- The GSF would not result in any changes to localised drainage off Pat Meredith such that existing flows into the dam located in the TSR is altered.
- Construction work will not take place at night, avoiding the potential for either light or noise impacts on resting cattle at night.

8.8 POTENTIAL IMPACTS

Notwithstanding limitations in terms of security of farm dam water supply because of the flat topography and high infiltration capacity of the soils, most of the development site is very good, productive farming country; whilst the hill on the east of the property provides grazing opportunities.

The development site is good agricultural land, but it does not contain any BSAL. The closest mapped BSAL is over 28 km distant from the GSF site.

The Parkes LGA covers a total area of 595,492 ha. Available data from the Australian Bureau of Statistics (ABS) dataset *National Regional Profile for Parkes LGA, 2004-2008* provides the total land areas for agricultural commodities in the Parkes LGA from 2006 (most recent data available). The data identifies the following:

- The total area of holdings for all agricultural land use is 550,573.40 ha, covering 92.46% of the Parkes LGA area.
- The total area for cereal crops for grain is 164,531.90 ha, covering 27.63% of the Parkes LGA.
- The total area for non-cereal broad acre crops for grain is 5,210.50 ha, covering 0.87% of the Parkes LGA.

The use of approximately 295 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 Parkes LGA. It does not reduce, nor impact directly or indirectly on any BSAL. It does not compromise the capacity for immediate neighbours to continue existing or proposed primary production land uses at this locality.

Infrastructure is low to the ground and would not compromise aerial agricultural spraying: noting that existing overhead power lines currently traverse the site. Conversely, RED do not envisage any unacceptable risk to the solar panels from activities on adjacent farm land such as aerial spraying and dust generation. The existing surrounding land uses are known and the GSF is not an incompatible land use with a potential to create land use conflicts. The GSF is not a threat to continued primary production activities by neighbours.

Harvesting sunlight is a passive land use. There would be no impact to any groundwater resource nor any change to surface hydrology in terms of modified flow patterns leaving the property. The importance of the existing contour banks and drainage swales in diverting flows to neighbours' farm dam is understood, and can be readily accommodated within the detailed design phase. That is, those farm dams on the two neighbour's properties to the south that currently rely on flows emanating from within the development site, will retain these surface water inflows. **Drawing EV02** shows the location of these neighbouring dams.

In the longer term, what could effectively be an extended (30 year) fallow would, in a relative sense, provide benefits to the land in terms of soil health. Again, in a relative sense, compared to continued cropping over the next 30 years there would be a substantial reduction in herbicide/insecticide/fungicide application and with less ground disturbance and a capacity to retain groundcover at all times, improved organic carbon levels in the soil. A solar farm, compared to dryland broad-acre farming, is a passive land use that would effectively rest the soil resource.

Post-construction the GSF would not have no impact on the Currajong TSR, whilst potential temporary impacts during the construction phase can be readily managed through on-going consultation with the CWLLS. Access to the development site from Pat Meredith Drive traverses the TSR on its northern end near the intersection with Henry Parkes Way. It is reported that that this TSR is used periodically for travelling stock (approximately two times a year for up to a week at a time). The DPE in its determination of the PSF development adopted the CWLLS recommendation for a fence to be constructed along Pat Meredith Drive to minimise nay impacts on the TSR during construction. This requirement has been included as a condition of consent for the PSF.

As the access to the GSF will also be off Pat Meredith Drive, albeit after the PSF is built, the same temporary fencing will be appropriate.

As an owner of land in a rural environment, the owners of the GSF 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 and include slashing and/or crash grazing, and periodic treatment for noxious and broad leave weeds.

Changing the land use of the development site from an agricultural use (whether it be for 30 years or for ever) will not diminish the productivity of the region in terms of primary production capabilities. In considering the cumulative impact of both the GSF and the PSF on agricultural land, the DPE, the DPI – Agriculture and PSC, recently determined that the operation of both these solar farms would not compromise the long-term use of the land for agricultural purposes.

Further, the DPE concluded that with an assumed combined size of 625 ha, this is a relatively small size and the combined loss of agricultural cropping land from the two solar farms would result in a negligible reduction in the overall productivity of the region. The inherent agricultural capability of the land would not be affected by the solar farms due to the relatively low scale of the developments, and the lands can be used for grazing during operations and could be returned to agricultural uses after the solar farms are decommissioned.

The DPE also noted the following. The potential loss of a small area of cropping land in the Parkes region must be balanced against:

- The broader strategic goals of the Commonwealth and NSW Governments for the development of renewable energy into the future.
- The environmental benefits of solar energy, particularly in relation to reducing GHG emissions.
- The economic benefits of solar energy in an area with good solar resources and capacity in the existing electricity infrastructure.

8.9 MITIGATION MEASURES

8.9.1 BASELINE SOIL AGRONOMICS

Prior to construction activity commencing, representative soil samples will be collected from across the site to establish baseline data on the pre-existing agronomic characteristic of the soil resource. This would include sampling for soil texture and structure, nutrients, acidity and organic matter.

8.9.2 OPERATIONS ENVIRONMENT MANAGEMENT PLAN

An OEMP will be prepared prior to the GSF 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.

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.

Whilst managing the fuel load (ie. groundcover) is important for managing the bushfire risk, overgrazing and creating areas denuded of any vegetative cover need to be avoided. The long term performance measure is to establish a healthy, self-sustaining, noxious weed free groundcover over the entire 385 ha property 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.

Adaptive management principles will, however, be driven by the performance measure of maintaining a groundcover rather than agricultural production. That is, in a bad run of seasons when vegetative growth may be negligible and fuel load reduction is not needed, stock grazing would not be undertaken.

Each and every time a fuel reduction measure is undertaken relevant details will be recorded to provide a baseline for informing future management decisions. This will include a record of the details of the grazing regime (ie. when sheep arrived, head numbers and when they were taken off the site) or the date of mechanical slashing and the location of the reduction measure.

The general health of ground cover across the entire site will be monitored regularly, at times in the season that will provide timely information on weed treatment. Indicators of groundcover conditions in will include:

- Vegetative cover and fuel load;
- Whether there are noxious weeds present;
- Whether landscape plantings are healthy;
- Whether there are any areas denuded of groundcover; and
- Whether there are any signs of localised erosion.

This information will be used to inform decisions about the need, timing and location for any impending fuel reduction or weed treatment.

Declared noxious weeds would be managed according to the requirements stipulated by the *Noxious Weeds Act 1993*.

8.9.3 DECOMMISSIONING MANAGEMENT PLAN

If the decision in 30 years is to decommission the solar farm, the procedure would be to initially disconnect the farm from the TransGrid network. The interconnecting cable and substation equipment would then be removed and disposed of off-site, reusing and recycling materials wherever possible. Foundations would be broken up and removed off-site.

Modules and the racking system would be removed and piles would 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 more than 300 mm below ground level, and are stable and inert, may be left buried to avoid unnecessary ground disturbance. The site control room and facilities would be lifted off their foundations and transported off-site and the security fencing removed.

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

Soil samples would be collected from those same representative sites from which samples were collected prior to construction of the farm to validate the health of the soil resource, and associated cropping/grazing productivity of the property.

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

Visual

9.1 VISUAL CATCHMENT

One of the key attributes of the proposed GSF development site is its very limited, highly contained visual catchment.

Only three neighbours can see parts of the development site from the curtilage of their homes. Two of these residents (refer R1 and R6 on **Drawing EV02**) have been consulted and advised they have no issue or concerns with the GSF in terms of visual impact. Both of these neighbours declined the offer of preparation of montages showing what the GSF would look like, from anywhere within their properties.

With the exception of the owner of "Velvedere" (refer R2 on **Figure 13** and **Drawing EV02**), broad, open and uninterrupted views of the development site do not exist for any home within 2 km of the development site.

Miller's Lookout Hill blocks any view of the development site for residents on the southern side of the Condobolin Road to the east. Similarly, the width (mostly > 70 m deep) and density of the road side vegetation that extends along the southern side of Condobolin Road blocks views of the development site for any residence on the northern side of Condobolin Road; as it does for motorists driving on Condobolin Road. **Figure 13** shows the location of residences and the extent of this roadside vegetation.

There are 19 residential dwellings within a 2 km radius of the site; nine (9) of which are within 1 km of the site; only three (3) of which have partial views of the development site from their residence curtilage; two (2) of which have indicated they have no concerns at all about visual impact.

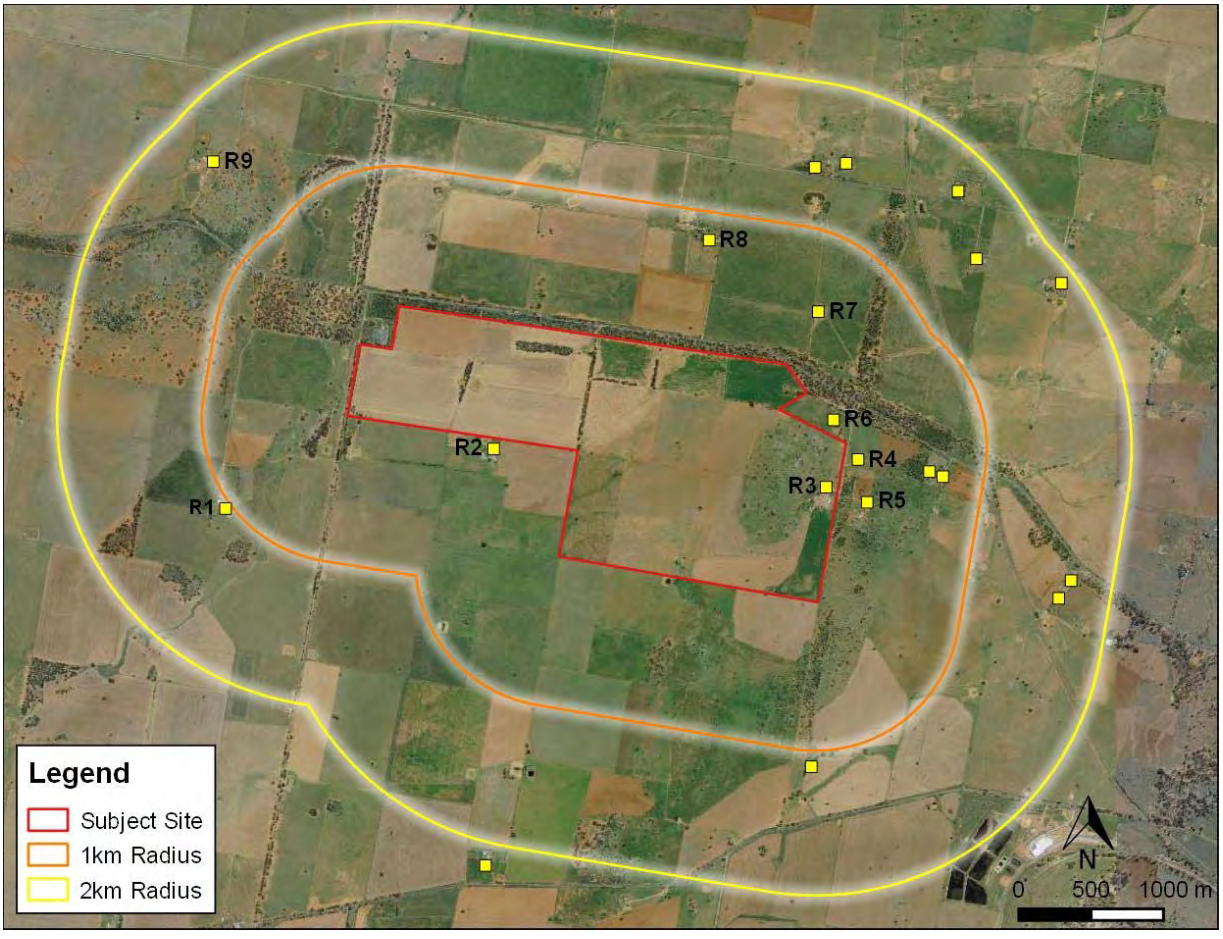


Figure 13: Neighbouring Homes and Roadside Vegetation

9.2 LIKELY IMPACTS

9.2.1 INTRODUCTION

The process for identifying and assessing visual impacts involved the following steps:

- Meeting with the three potentially affected neighbours to ascertain whether they had concerns or an interest in having a photomontage prepared and if so, what perspectives they wanted.
- Checking for the existence of any recognised landscape conservation areas, as listed in local, State or Commonwealth heritage registers and listings.
- Selecting a location along Condobolin Road where there is a gap in the roadside vegetation which would, for west bound motorists, provide a fleeting view of the north east corner of the development site.
- Providing the one landowner who expressed an interest in having a photomontage prepared with a copy of this photomontage to confirm it accurately picked up the screen plantings as discussed.

9.2.2 PHOTOMONTAGE METHODOLOGY

In depicting the extent, scale and type of impact photomontages have been prepared from two viewing locations. Photomontages provide a digital representation of the visual impact of the development from specific vantage points. The photomontages can be seen as a guide to what the real world impact of the development may be.

The process of creating the photomontages is outlined below:

- AutoCAD 2016 and Trimble SketchUP 2016 were used to develop a model of the proposed development site and the immediate environs.
- The proposed development was modelled in 3 dimensions using AutoCAD 2016 and Trimble SketchUP 2016. The 3-dimensional solar array model was placed on the model.
- Thea (rendering software) was used to apply textures to the model that replicate the proposed finishes and treatments of the development and to apply light settings to the model that match the date and time at which the photos used as base images in the photomontages were taken.
- Selected views are taken of the model from the identified vantage points. The selected view locations are matched to locations of digital photographs taken on site using the Easting, Northing height and data collected at the time of taking the photograph.
- Photoshop CC was used to combine the base photographs with the rendered views of the 3 dimensional computer model. The rendered view of the model is superimposed on the base photograph with only enough manipulation to stitch the model view into the photograph.

9.2.3 “VELVEDERE”

“Velvedere” is located on Lot 2 DP 807412 and accessed by the Crown road that essentially bisects the eastern and western portions of the development site. The landowner advised that it was views east of his house that were valued and requested that a row of screen plantings be established, on his land, along the eastern boundary of his property.

RED has agreed to this, and scattered plantings immediately north of his house. The landowner indicated that the composition and density of these plantings on the northern side of his house could be finalised in consultation with RED after detailed design was completed. The screen plantings along the eastern boundary would comprise three rows of staggered native trees and shrubs extending along the boundary (~450 m).

Drawing EV04 shows the existing view. **Drawing EV05** shows this view with the solar farm, with the infrastructure 550 m distant. **Drawing EV06** shows the solar farm with established screen plantings.

These images were provided to the land owner who indicated, in follow up conversations, that they adequately identified his expectations.

View Location 1
Existing view

Photomontage created by:

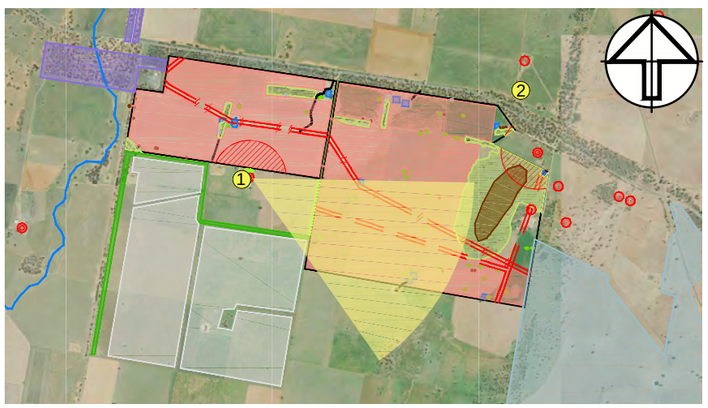
James Buckley - B.Arch(Hons) A.I.A
NSW Board of Architects registration No 8504

Photomontage Image created using:

AutoCAD 2016, Sketchup 2016, Thea Render, Adobe photoshop

Base photograph details:

Camera:	Canon EOS 400D
Focal Length	35mm
Exposure:	1/320 sec
ISO Speed:	ISO-400
F-Stop:	f/14
Photo taken:	10.38am on 22/08/2016
Location of photo:	E: 601068 N :6335986
Height above ground:	1.6 m



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REV.	DATE	DFTD.	APPD.	DETAILS
A	01/09/2016	AJD	AGB	FOR DEVELOPMENT APPLICATION
B	05/09/2016	BSH	AGB	ADDITIONAL INFORMATION - FOR DEVELOPMENT APPLICATION
C	26/09/2016	BSH	AGB	MINOR AMENDMENTS - FOR DEVELOPMENT APPLICATION

DRAWING SCALE

0 500 1000 1500 2000 2500

APPROXIMATE SCALE 1:25000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

VIEW_01_EXISTING

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV04 OF EV08	

View Location 1
Just Panels (no screening)

Photomontage created by:

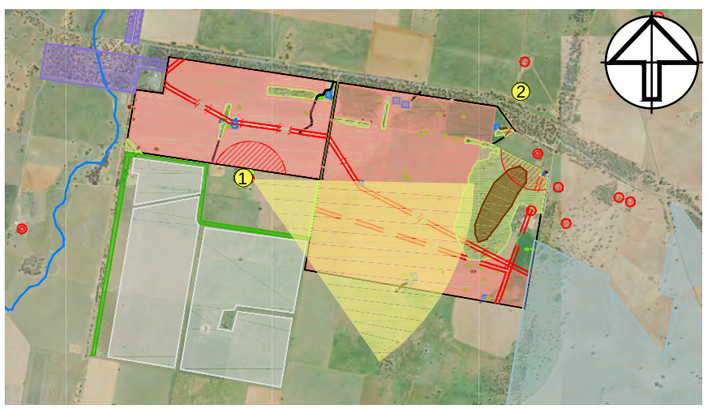
James Buckley - B.Arch(Hons) A.I.A
NSW Board of Architects registration No 8504

Photomontage Image created using:

AutoCAD 2016, Sketchup 2016, Thea Render, Adobe photoshop

Base photograph details:

Camera:	Canon EOS 400D
Focal Length	35mm
Exposure:	1/320 sec
ISO Speed:	ISO-400
F-Stop:	f/14
Photo taken:	10.38am on 22/08/2016
Location of photo:	E: 601068 N :6335986
Height above ground:	1.6 m



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REV.	DATE	DFTD.	APPD.	DETAILS
A	01/09/2016	AJD	AGB	FOR DEVELOPMENT APPLICATION
B	05/09/2016	BSH	AGB	ADDITIONAL INFORMATION - FOR DEVELOPMENT APPLICATION
C	26/09/2016	BSH	AGB	MINOR AMENDMENTS - FOR DEVELOPMENT APPLICATION

DRAWING SCALE

0 500 1000 1500 2000 2500

APPROXIMATE SCALE 1:25000 (A3)

DO NOT SCALE FROM THESE DRAWINGS. ALL MEASUREMENTS SHALL BE CONFIRMED ON SITE AND WITH GEOLYSE PTY. LTD. PRIOR TO CONSTRUCTION

APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

VIEW_01_JUST PANELS

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV05 OF EV08	

View Location 1
Panels and Screen Planting

(Screen Planting in Affected Neighbour's property)

Photomontage created by:

James Buckley - B.Arch(Hons) A.I.A
NSW Board of Architects registration No 8504

Photomontage Image created using:

AutoCAD 2016, Sketchup 2016, Thea Render, Adobe photoshop

Base photograph details:

Camera:	Canon EOS 400D
Focal Length	35mm
Exposure:	1/320 sec
ISO Speed:	ISO-400
F-Stop:	f/14
Photo taken:	10.38am on 22/08/2016
Location of photo:	E: 601068 N :6335986
Height above ground:	1.6 m

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REV.	DATE	DFTD.	APPD.	DETAILS
A	01/09/2016	AJD	AGB	FOR DEVELOPMENT APPLICATION
B	05/09/2016	BSH	AGB	ADDITIONAL INFORMATION - FOR DEVELOPMENT APPLICATION
C	26/09/2016	BSH	AGB	MINOR AMENDMENTS - FOR DEVELOPMENT APPLICATION

DRAWING SCALE

0 500 1000 1500 2000 2500

APPROXIMATE SCALE 1:25000 (A3)

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APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

VIEW_01_PANELS AND SCREENING

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET
STATUS FOR APPROVAL	SHEET EV06 OF EV08	03C

9.2.4 MOTORISTS

From Condobolin Road there is just one isolated section where the roadside vegetation on the southern side of the road is broken and fleeting glimpse of part of the development site is visible from Condobolin Road. The location of this section and view available of the north eastern corner of the development site is shown on **Drawing EV07**. **Drawing EV08** shows the visual impact from this point with the proposed solar farm.

The following is also noted. This view is really restricted to west bound motorists and with the posted speed limit of 100 km/hr at this location, this 150 m section is passed in less than 6 seconds. The orientation of the road at this location is also towards the north-west, meaning that the solar farm infrastructure would not be in motorist's line of sight, but rather briefly in field of peripheral vision.

9.2.5 SIGNIFICANCE

No scenic or significant vistas would be impacted by the GSF.

9.2.6 GLARE

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 14**) and why there is no prospect that a third party would be subject to either nuisance or hazardous impacts resulting from glare. Glare is a continuous source of excessive brightness relative to ambient lighting (Ho, 2009).

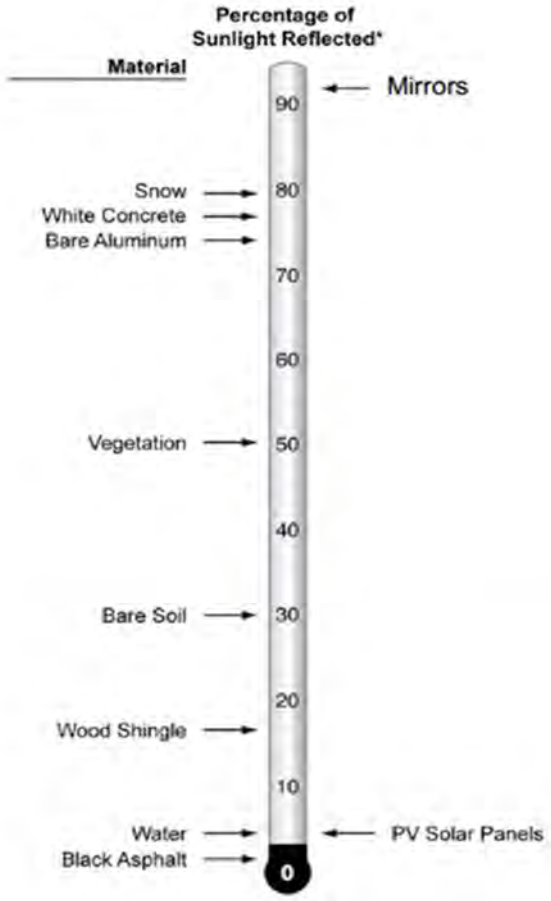


Figure 14: Comparative Reflection (Sandia National Laboratories)

View Location 2
Existing

Photomontage created by:

James Buckley - B.Arch(Hons) A.I.A
NSW Board of Architects registration No 8504

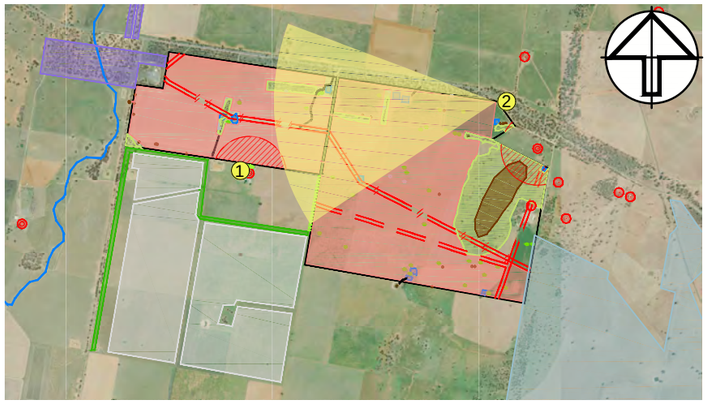
Photomontage Image created using:

AutoCAD 2016, Sketchup 2016, Thea Render, Adobe photoshop

Base photograph details:

Camera:	Canon EOS 400D
Focal Length	35mm
Exposure:	1/320 sec
ISO Speed:	ISO-400
F-Stop:	f/14
Photo taken:	11.00am on 22/08/2016
Location of photo:	E: 603140 N :6335587
Height above ground:	1.6 m

LOCATION FROM WHERE PHOTOGRAPH FOR PHOTOMONTAGE TAKEN



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APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

VIEW_02_EXISTING

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV07 OF EV08	

View Location 2
Panels & Fence

Photomontage created by:

James Buckley - B.Arch(Hons) A.I.A
NSW Board of Architects registration No 8504

Photomontage Image created using:

AutoCAD 2016, Sketchup 2016, Thea Render, Adobe photoshop

Base photograph details:

Camera:	Canon EOS 400D
Focal Length	35mm
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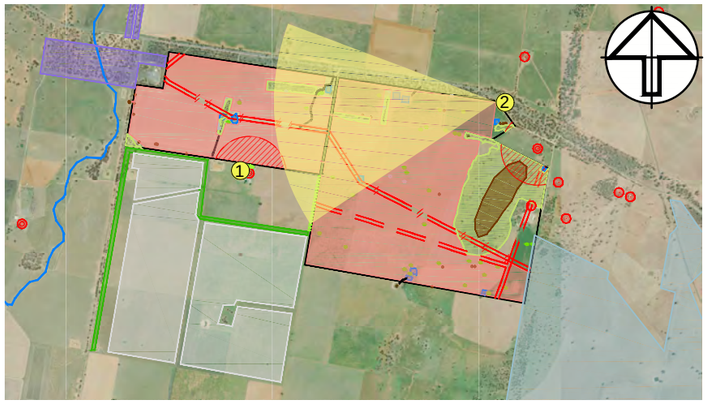
LOCATION FROM WHERE PHOTOGRAPH FOR PHOTOMONTAGE TAKEN



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APPROXIMATE SCALE 1:25000 (A3)

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APPROVAL AUTHORITY

NSW GOVERNMENT Planning & Environment

CLIENT

RENEWABLE ENERGY DEVELOPMENTS

PROJECT

GOONUMBLA SOLAR FARM

DRAWING

VIEW_02_PANELS AND FENCE

PROJECT NUMBER 215416	DRAWING FILE 215416_03C_EV01-EV08.dwg	ORIGINAL A1
DATA SOURCE		
IMAGE SOURCE		SET 03C
STATUS FOR APPROVAL	SHEET EV08 OF EV08	

In addition to the non-reflective nature of the PV panels the following considerations provided added confidence that the GSF would not cause glare impacts.

- For motorists, exposure is restricted to approximately six seconds (~150 m) for west bound motorists on the Condobolin Road, with a travelling orientation north-west (ie. facing away from the solar farm infrastructure), with the solar farm appearing only briefly in the motorist's field of peripheral vision.
- Consultation with the CASA has confirmed that at 13 km from the Parkes Airport, CASA does not consider the proposed GSF to be a potential hazard to aircraft operations and has no objection to the proposal (M Windebank, Aerodrome Engineer, Air Navigation, Airspace & Aerodromes Branch, CASA\Aviation Group, 11 August 2016).
- Landscape plantings on the eastern boundary of the property "Velvedere" will screen infrastructure that at its closest, would be 550 m to the east of the dwelling.

9.2.7 NIGHT LIGHTING

The only night lighting associated with the GSF would be security lighting. Such 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.

It is also noted that the solar farm is located further than 200 km from the Siding Spring Observatory and pursuant to considerations under s.115ZM(e) of the *Environmental Planning and Assessment Act 1979*, falls outside the Dark Sky Region covered by the NSW Government's *Dark Sky Planning Guideline* (DPE, June 2016).

9.3 MITIGATION MEASURES

The rationale behind the need or not for vegetation buffers to provide screen plantings and mitigate visual impacts, as determined by the DPE for the PSF, is whether the development is visible from a landowner's dwelling.

Consultation with the three landowners for which parts of the GSF development site are visible from the curtilage of their homes has established that only one of these landowners considers visual impact an issue and has asked for screen plantings at select locations on his property. RED has committed to undertake these plantings in consultation with this landowner. Photomontages provided to this landowner showing the location and impact of these screen plantings has established that the measures proposed are considered satisfactory by the landowner.

Consequently, targeted and strategically located plantings (refer **Drawing EV03**) will adequately mitigate visual impacts for the only landowner that will be affected by the GSF.

Beyond this, full perimeter landscape plantings are not proposed for the following reasons.

- It is not required in terms of screening views of the solar panels and ancillary infrastructure on site from surrounding residences.
- Unnecessary landscape plantings effectively sterilise portions of the site in terms of shading and compromise generation efficiencies through diminishing the harvestable solar resource.

9.4 CONCLUSION

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

For this reason all landowners within 2 km of the development site were written to and invited to discuss the GSF if they had any concerns or wanted to know more about the development. For all but three of these landowners either topography or existing vegetation block views of the development site from their homes. Whilst it is speculation, it is possible that this consideration explains why no neighbouring landowners have raised any issues during the consultation.

For the one resident with views of the development site from his home, the screen plantings requested by this landowner have been agreed to.

Noise

10.1 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 E**. Provided below is a summary of the methodology, results and conclusions of the noise and vibration impact assessment.

10.2 SENSITIVE RECEPTORS

The nearest off-site residential receptors include 8 single dwellings located within 1 km to the east and north-east of the proposed GSF. Beyond this, there are a further 10 residential dwellings that have been identified in the area between 1 km and 2 km from the site boundary.

Table 10.1 and **Figure 15** below provide a summary of the nearest receptors considered in the noise assessment.

Table 10.1 – Potentially Sensitive Receptors

Receptor	Distance to Development Site
R 1	120 m
R 2	70 m
R 3 (associated with development)	200 m
R 4	750 m
R 5	570 m
R 6	500 m
R 7	670 m
R 8	1,050 m
R 9	1,600 m

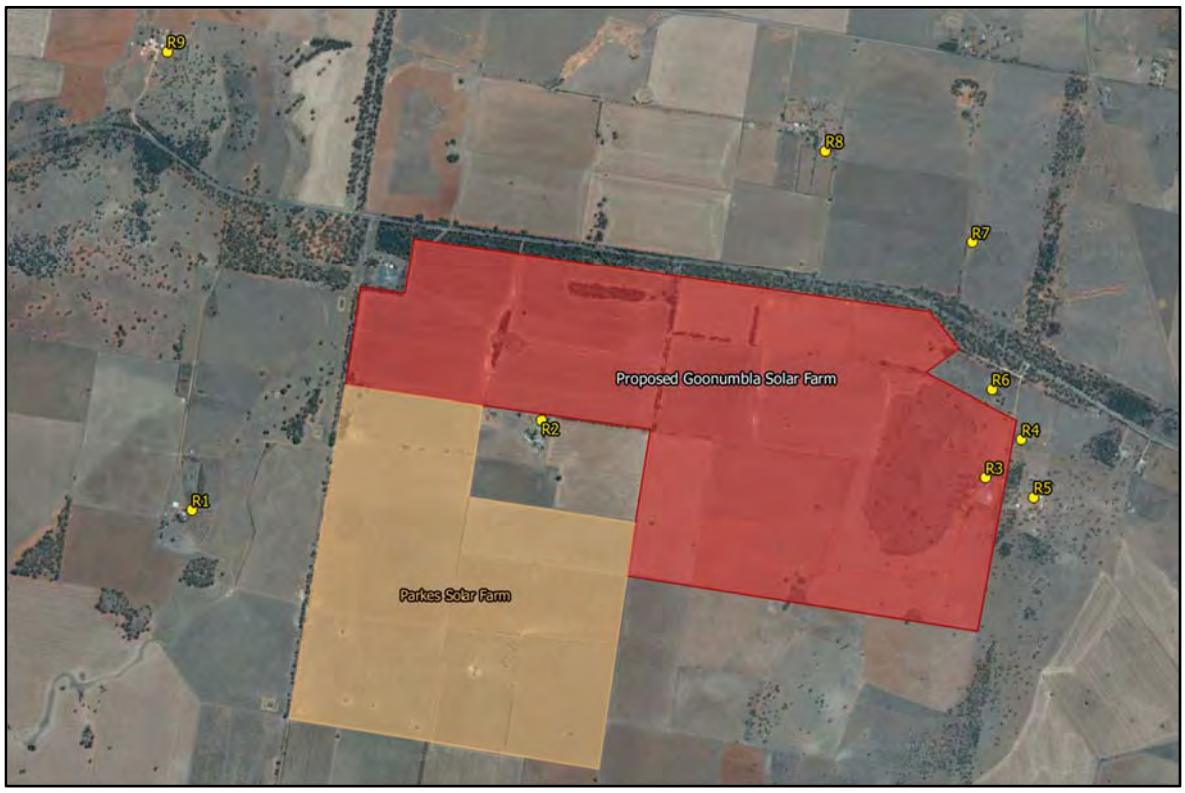

Figure 15: Potentially Sensitive Receptors

10.3 CONSTRUCTION NOISE ASSESSMENT

10.3.1 DURATION OF CONSTRUCTION WORKS

The construction of the GSF is expected to take approximately 12 months with a number of different activities undertaken over that time. **Table 10.2** below presents an overview of each of the construction tasks along with their expected duration.

For all phases of the project construction works would be undertaken during normal construction hours only. That is, works would be undertaken between 7am and 6pm Monday to Friday and 8am to 1pm Saturday.

Table 10.2 – Construction Phases and Expected Duration

Construction Phase	Duration
Site preparation and construction of site substation	18 – 26 weeks
Installation of solar PV modules & inverter assemblies	16 – 26 weeks
Installation of cabling	12 – 16 weeks
Commissioning	6 – 8 weeks
Construction restoration and completion	2 weeks

10.3.2 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. **Table 10.3** 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 10.3 – 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 RB + 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.

10.3.3 CONSTRUCTION NOISE SOURCES

In terms of noise emissions, the site preparation activities and installation of the solar PV modules are expected to represent those with the most significant potential for adverse impacts. For the purposes of the assessment, the cumulative impacts of these two activities have been considered.

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. Given this, the potential for adverse impacts at any one receptor is expected to only occur for a short period of time.

Table 10.4 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.

Table 10.4 – Construction Phases and Expected Duration

Construction Phase	Plant Item	Sound Power Level, dB(A)	Acoustical Usage Factor, %
Site preparation and construction of site substation	Wheeled Loader	107	40
	Excavator	106	40
	Truck and Dog	108	40
Installation of solar PV modules & inverter assemblies	Piling Drill Rig	111	20
	Franna Crane	107	16
	Delivery Truck	105	40
	Powered Hand Tools	110	20

10.3.4 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 were 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.

For the construction phase of the GSF, predictive noise modelling has considered the range of potential impacts, noting that noise generating activities will progressively move across the site. 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 (eg. piling drill rig) is at the closest point to the receptor.

Table 10.5 presents the predicted receptor noise levels during the construction phase.

Table 10.5 – Predicted Receptor Noise Levels – Construction Phase, dB(A)

Receptor	Description	Predicted Construction Noise Levels, LAeq 15min	Noise Management Level	Comply (Y/N)
R1	1129 Condobolin Road	15	40	Y
R2	Velvedere	24 – 45	40	Partial
R3	Existing dwelling on GSF Site	19 – 26	40	Y
R4	43 Millers Lookout Road	0 – 27	40	Y
R5	65 Millers Lookout Road	0 – 25	40	Y
R6	8 Millers Lookout Road	19 - 31	40	Y
R7	629 Henry Parkes Way	19 - 29	40	Y
R8	1071 Back Trundle Road	22 - 28	40	Y
R9	1195 Back Trundle Road	0 - 10	40	Y

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 with the exception of R2 (Velvedere). Given this, reasonable and feasible mitigation measures have been considered for this receptor.

10.3.5 MITIGATION OF CONSTRUCTION NOISE LEVELS

Receptor R2 dwelling is located within approximately 70 m from the nearest potential construction activities. As noted previously, the construction works expected to generate the highest noise levels are not anticipated to be in close proximity to this receptor for an extended period. Given this, the construction of physical noise controls (eg. temporary acoustic barriers) is not considered to be feasible.

Controls available to the construction contractor would include:

- Consultation with R2 landholder throughout the construction process to inform the landowner on the duration and timing of potentially noisy activities;
- Staging construction such that activity at the nearest point to this receptor is undertaken in isolation (with other noise generating construction works being undertaken at distances of more than 500 m from this receptor);
- 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 and checking the condition of mufflers.

Overall, given that only short duration elevated noise levels could be expected at receptor R2, the implementation of the above controls is considered to represent the reasonable and feasible mitigation measures available to the project.

10.3.6 POTENTIAL CUMULATIVE IMPACTS

A recent approval has been granted for the construction of the PSF adjacent to the proposed Goonumbla development site. Given this, there is potential for cumulative noise associated with emissions from the adjacent solar farms to impact on residences.

It is noted that the current schedule for the PSF targets construction completion in September 2017. The GSF construction is scheduled to commence no sooner than October 2017. Simultaneous construction is therefore not anticipated, however the potential does exist.

Despite this, the potential for cumulative impacts are only expected to be significant where construction activities for both solar farm projects are undertaken in close proximity to a receiver at the same time. Given this, the potential for cumulative impacts is expected to be able to be effectively managed by coordinating work across the two project sites such that noisy activities are only undertaken at the nearest point to Receptor R2 on one site at a time.

10.4 OPERATIONS NOISE ASSESSMENT

10.4.1 OPERATIONAL NOISE CRITERIA

10.4.1.1 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 metres from the house, then the criteria applies at the most affected point within 30 m of the house.

10.4.1.2 Intrusiveness Criteria

Intrusive noise refers to noise that exceeds background noise levels (as defined by the Rating Background Level) by more than 5 dB. For the purposes of the assessment reference was made to the baseline noise monitoring undertaken during preparation of the Noise Impact Assessment for the adjacent solar farm development[2]. The results of this baseline noise monitoring confirms that existing noise levels in the area are below the minimum background noise levels provided for in the INP. Therefore, **Table 10.6** presents the derivation of the intrusiveness criteria based on the minimum background noise level established by the INP.

Table 10.6 – Derived Intrusiveness Noise Criteria

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

a) Receptor noise limit applies at a location 30 m from the dwelling façade.
b) Minimum background noise level established by the INP (30dB(A)) + 5 dB.

10.4.1.3 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 10.7** presents ANL values for residential receivers in rural areas.

Table 10.7 – 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

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, the only other industrial noise sources in the area are expected to be related to the operation of the PSF. Further, given the scale of both the solar farms (encompassing a significant area) the on-going development of the area to incorporate additional industrial noise sources with the potential to impact on nearby sensitive receptors is considered unlikely.

In view of this, the amenity criteria are considered to be equivalent to the ANL for a rural residence being 50 dB(A) for day periods, 45 dB(A) for evening periods and 40 dB(A) during the night. The amenity

[2] Renzo Tonin & Associates (2 March 2016) 'Parkes Solar Farm – Construction & Operational Noise & Vibration Assessment) prepared on behalf of NRG Environmental

criteria have been used in the assessment of the potential cumulative impacts of the two adjacent solar farms.

10.4.1.4 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 GSF, 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.

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. Where compliance can be demonstrated with the intrusive noise criteria established for the development, compliance with the sleep disturbance provisions would also be expected.

10.4.2 NOISE SOURCES

The GSF is to consist of solar PV plant and associated infrastructure producing up to 70 MWac of electricity for supply into the grid. It is expected that, at completion, infrastructure installed on site will incorporate:

- A total of approximately 214,000 solar panels;
- 28 solar inverters with integrated transformers; and
- A high-voltage step-up transformer.

The PV panels are expected to be mounted onto fixed support structures in one of two manners, these being:

- Single axis tracking panels which track the suns movement across the day through the use of small motors which rotate the panel arc of the sun to maximise the solar effect; or
- Fixed panels tilted to face either the north or east dependent on detailed design.

The selection of the panel mounting option to be adopted will be determined during detailed design. For the purposes of the noise impact assessment however it has been assumed that single axis tracking panels will be installed. This represents a worst-case assumption with noise emissions from the tracking motors expected to occur for approximately one minute out of each 15-minute period (providing for up to five degrees rotation per hour) during day periods.

Based on the size of the GSF it is expected that approximately 2,800 NexTracker tracking motors would be required. For the purposes of the assessment it is assumed that these tracking motors would be evenly distributed across the development area.

Placement of the required inverters is also expected to be finalised during the detailed design phase of the project. For the purposes of the assessment, the 28 inverters expected to be required have been located at approximately even spacing across the site with all inverters located a minimum of 300 m from any sensitive receptor. The provision of this inverter buffer effectively represents a design constraint (refer **Drawing EV03**) to protect acoustic amenity values for residence R2.

A single transformer is expected to be required for the proposed solar farm to allow connection of the solar farm to the power grid. At this stage the location of the transformer has not been confirmed

however, it is considered likely that it would be located near to the existing Parkes substation to minimise the costs associated with cabling.

Table 10.8 – Source Noise Levels

Source	Sound Power Level (dB(A))
NexTracker	58 (each)
Sunny SC2500 Inverter	92 (each)
Transformer	75
Light Vehicle	88

a) 1/3rd octave band frequency data provided by the manufacturer indicates a tonal component presented at 3 kHz for this source. Therefore, in accordance with the INP, a +5 dB penalty has been applied to this source.

10.4.3 NOISE MODELLING METHODOLOGY

For the purposes of predicting impacts associated with noise emissions from the GSF 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.

10.4.4 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.

10.4.5 PREDICTED NOISE LEVELS

Table 10.9 presents predicted receptor noise levels during the operational phase of the GSF. 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 both day and night periods under worst-case meteorological conditions.

Table 10.9 – Predicted Receptor Noise Levels – Operational Phase, dB(A)

Receptor	Description	Predicted Operational Noise Levels, $L_{Aeq, 15min}$		Intrusive Noise Criteria	Comply (Y/N)
		Day Periods	Night Periods		
R1	1129 Condobolin Road	17	17	35	Y
R2	Velverdere	35	35	35	Y
R3	Existing dwelling on GSF site	20	20	35	Y
R4	43 Millers Lookout Road	20	20	35	Y
R5	65 Millers Lookout Road	19	19	35	Y
R6	8 Millers Lookout Road	23	23	35	Y
R7	629 Henry Parkes Way	21	21	35	Y
R8	1071 Back Trundle Road	22	22	35	Y
R9	1195 Back Trundle Road	10	10	35	Y

a) Intrusive noise criteria for day, evening and night periods

Given the predicted compliance with the noise limits derived in accordance with the INP no further noise mitigation, apart from the 300 m inverter buffer, is considered necessary.

10.4.6 POTENTIAL CUMULATIVE IMPACTS

There is potential for cumulative noise impacts as a result of the combined noise emissions from the PSF and the GSF. In order to determine the potential for cumulative impacts the maximum predicted receptor noise levels for the PSF[3] have been combined with the maximum predicted levels provided for the GSF.

It is noted that for both predicted noise datasets the potential impacts assume source to receptor winds. As wind in a single direction is unlikely to represent a source to receptor wind for both solar farms concurrently, this is considered to represent a conservative assumption.

Table 10.10 below presents predicted cumulative receptor noise levels based on the worst-case assumptions detailed above. Review of the predicted cumulative noise levels confirms that for all receptors noise levels are expected to remain well below the amenity noise criteria for a rural area for day, evening and night periods.

[3] Renzo Tonin and Associates (2 March 2016) 'Parkes Solar Farm – Construction & Operational Noise & Vibration Assessment' prepared on behalf of NGH Environmental

Table 10.10 – Predicted Receptor Noise Levels – Operational Phase, dB(A)

Receptor	Predicted Operational Noise Levels, $L_{Aeq, 15min}$						Amenity Noise Criteria a)	Comply (Y/N)
	Goonumbla Solar Farm		Parkes Solar Farm		Cumulative Noise Level			
	Day	Night	Day	Night	Day	Night		
R1	17	17	30	30	30	30	Day: 50	Y
R2	35	35	35	35	38	38	Evening: 45	Y
R3	20	20	22	22	24	24	Night: 40	Y

10.4.7 MITIGATION OF OPERATIONAL NOISE LEVELS

Design of the GSF will provide for a 300 m inverter assembly buffer from residence R2.

10.5 ROAD TRAFFIC NOISE ASSESSMENT

10.5.1 INTRODUCTION

Noise impacts associated with vehicle movements during the operational phase of the GSF are expected to be negligible given the small number of movements expected (maximum of 4 per day).

During the construction phase of the project however significantly higher traffic volumes are expected for the duration of the construction works. **Table 10.11** presents expected average and peak traffic volumes (ie. total vehicle movements) for the duration of the construction works.

Table 10.11 – Construction Phase Traffic Generation

Vehicle Type	Peak Traffic Volume (Jan – June)		Off-peak Traffic Volume (Jul – Sep)	
	Average	Peak	Average	Peak
Light Vehicles	50	70	25	40
Utility Vehicles	14	20	8	12
Buses (12 seater)	12	12	6	6
HGV	28	40	8	40
Total	104	142	50	98

The assessment has considered the potential impacts associated with noise emissions from the maximum expected 142 vehicle movements accessing/egressing the site entry on Pat Meredith Drive and Condobolin Road.

It is noted that traffic movements along Pat Meredith Drive would not pass by any residences. As such the assessment of potential traffic noise impacts considers only vehicle movements along Condobolin Road.

10.5.2 ASSESSMENT CRITERIA

Based on the NSW *Road Noise Policy* (RNP) and road type, **Table 10.12** presents the applicable road traffic noise criteria for existing residences affected by traffic on existing roadways generated by land use developments.

Table 10.12 – Applicable Road Traffic Noise Criteria

Road Category	Type of Project & Land Use	Assessment Criteria – Day Periods
Freeway / arterial / sub-arterial road	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15\ hour}$ 60 dB(A) (external)

10.5.3 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 predictions of -1.7 dB for façade-corrected levels (Samuels and Saunders, 1982).

Table 10.13 presents predicted noise levels for the nearest potential receptor to Condobolin Road assuming a minimum setback distance of 20 m. It should be noted that this is considered to represent a conservative assumption with the majority of dwellings along Condobolin Road noted to be setback further than this.

Review of the predicted noise level presented in **Table 10.13** confirms that compliance with the RNP is predicted by a considerable margin. Adverse amenity impacts as a result of peak traffic levels generated by the construction works is considered unlikely.

Table 10.13 – Predicted $L_{Aeq,15\ hour}$ Noise Levels – Road Traffic Noise

Setback from Roadway	Criteria	Peak Traffic Movements	Vehicle Speed	Predicted Noise Level	Comply (Y/N)
20 m	60 dB(A)	142 vehicles per day	100 km/hr	47 dB(A)	Y

10.6 VIBRATION ASSESSMENT

10.6.1 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.

10.6.2 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 (eg. road traffic, continuous construction activity);
- Impulsive vibration includes less than 3 distinct vibration events in an assessment period (eg. occasional dropping of heavy equipment); and

- Intermittent vibration includes interrupted periods of continuous vibration (eg. drilling), repeated periods of impulsive vibration (eg. pile driving) or continuous vibration that varies significantly in amplitude.

Table 10.14 and **Table 10.15** present the criteria for continuous and impulsive vibration and intermittent vibration respectively.

Table 10.14 – Continuous & Impulsive Vibration Criteria for Residence – 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 10.15 – 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 10.16** presents vibration criteria for assessing the potential for building damage.

Table 10.16 – 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

10.6.3 POTENTIAL VIBRATION SOURCES

Table 10.17 identifies the construction activities and associated equipment that are to be used for the construction of the GSF. Equipment with the greatest potential to contribute to vibration levels include excavators, trucks and piling equipment.

Table 10.17 – Construction Activities and Equipment Used

Construction Activity	Potential Source of Vibration
Site Preparation	Excavator
	Truck
Panel Installation	Piling Rig
	Crane

Table 10.18 presents vibration source levels for this equipment.

Table 10.18 – Vibration Source Levels – Peak Particle Velocity

Equipment Item	PV at 10 Metres (mm/s)	Sources
Piling	1 – 2	Rockhill D.J et. al. [b)]
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'

10.6.4 ASSESSMENT OF POTENTIAL IMPACTS

Based on the vibration source levels at 10 metres, peak particle velocities have been predicted at various separation distances. The NSW DECCW indicates that in predicting vibration levels, it can be assumed that the vibration level is inversely proportional to distance.

Using the US Department of Transportation's *Transit Noise and Vibration Impact Assessment* (May 2006) PPVs have been calculated at various distances from construction equipment. **Table 10.19** presents PPV predictions for the various construction equipment.

Table 10.19 – Predicted Peak Particle Velocity at Sensitive Receptors (mm/s)

Distance from Source (m)	Predicted Peak Particle Velocity (mm/s)			
	Excavator	Piling	Loaded trucks (rough surface)	Loaded trucks (smooth surface)
10	4.00	0.35 - 0.71	5.00	1 – 2
20	1.41	0.19 - 0.38	1.77	0.35 – 0.71
30	0.77	0.13 - 0.25	0.96	0.19 – 0.38
40	0.50	0.09 - 0.18	0.63	0.13 – 0.25
50	0.36	0.07 - 0.14	0.45	0.09 – 0.18
60	0.27	0.05 - 0.11	0.34	0.07 – 0.14
70	0.22	0.04 - 0.09	0.27	0.06 – 0.11
80	0.18	0.04 - 0.07	0.22	0.05 – 0.09
90	0.15	0.03 - 0.06	0.19	0.04 – 0.07
100	0.13	0.02 - 0.03	0.16	0.03 – 0.06
150	0.07	0.35 - 0.71	0.09	0.02 – 0.03
Type	Continuous	Intermittent	Intermittent	Intermittent
Nuisance Criteria	0.28 (Preferred) 0.56 (Maximum)	0.2 (Preferred) 0.4 (Maximum)		
Building Criteria	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 10.19** indicate compliance with the continuous preferred vibration nuisance criteria for locations at a separation distance of 50-60 metres. Compliance with the building damage criteria is predicted at 10 metres from construction for each source.

It is noted, however, that the piling PPV at distances of 70 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).

10.7 CONCLUSION

The area surrounding the proposed development is sparsely populated with dominant activities including a range of agricultural and rural uses. Adjoining the proposed development site to the south is the proposed PSF which recently received development approval by the DPE.

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

For the construction phase, significant amenity impacts are considered unlikely where the following management measures are implemented during the construction phase of the project:

- Staging construction such that activity at the nearest point to Receptor R2 is undertaken in isolation (with other noise generating construction works being undertaken at distances of more than 500 m from this receptor);
- Using broad-band reversing alarms on all mobile plant and equipment;
- Selection of 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.

For the operational phase of the project adverse amenity impacts are considered unlikely providing the final site layout adopted for the development maintains a minimum separation distance of 300 m between any sensitive receptor and solar inverter plant items. This 300 m buffer has been identified as a recognised constraint (refer **Drawing EV03**) and detailed design of the GSF will ensure this buffer is provided and by so doing, not compromise acoustic amenity values for any neighbours.

Based on the overall results of the assessment, the risk of adverse impacts as a result of the GSF (including consideration of the cumulative impact associated with the neighbouring PSF), has been determined to be low. Hence, from an acoustic perspective the proposed development site is considered acceptable for the proposed use.

Traffic

11.1 INTRODUCTION

Once built the GSF would generate insignificant ongoing traffic. The farm will not be permanently staffed and visitation restricted to periodic routine maintenance and infrequent plant and equipment replacements. It would be during the construction of the farm that traffic movements would be significant.

11.2 TRAFFIC GENERATION

11.2.1 CONSTRUCTION

Construction would be completed over a 12 month period commencing no earlier than October 2017.

For all phases of the project construction works would be undertaken during normal construction hours only. That is, works would be undertaken between 7 am and 6 pm Monday to Friday and 8 am to 1 pm Saturday.

There would be a distinct six month peak and non-peak period. The peak period would extend from January to June 2018, coinciding with the bulk of delivery of farm infrastructure and the installation of panels. The non-peak period would be broken into an initial three months from October – December 2017 during site preparation works, and July – September 2018 during final installation of cabling and commissioning.

During the peak construction period a workforce of up to 100 would be on-site, dropping back to a workforce of 50 during the off-peak periods. The expected average and maximum daily vehicle movements in these periods is shown in **Table 11.1**. Traffic is categorized as light and heavy, with a movement covering both arrival and departure from the site.

Heavy vehicles would include trucks delivering plant and equipment (modules, piles and tracking systems, cabling, inverters, substation equipment etc.) as well as construction materials (gravel, sand and concrete). With the possible exception of the transformer for the substation, there would not be a need for any overmass/oversize deliveries.

Table 11.1 – Construction Vehicle Movements[1] (Daily)

Vehicle Type	Peak (Jan to June)		Off-Peak (Oct to Dec & July to Sep)	
	Average	Maximum	Average	Maximum
Light Vehicles				
Cars	50	70	28	40
Utilities	14	20	8	12
Bus (12 seater)	12	12	6	6
Heavy Vehicles	28	40	8	40

Note 1: For clarity, one delivery = 2 movements (i.e. arrival and departure).

The maximum number of heavy vehicles accessing the site during the peak of the construction period would capped to 20 (ie. generating a total of 40 heavy vehicle movements in a day).

11.2.2 OPERATIONS

Once commissioned and operational the GSF will generate negligible traffic. The farm will operate independently and no permanent employees will be stationed on-site. The farm will be monitored remotely from an off-site location and operations staff will visit for scheduled maintenance and respond to performance issues as required.

11.3 HAULAGE ROUTES

Until equipment supply contracts are executed it is not possible to specify haulage routes. It is reasonable to assume however that farm infrastructure will be transported to the site by road from either Brisbane, Sydney or Melbourne.

Parkes is not an isolated town that is difficult to access. To the contrary, the GSF site shares part of its boundary with the Parkes National Logistics Hub (Hub). The history of the Hub is that PSC, with the active support and approval from the NSW State Government and the RMS, designed the Hub to function as a multi-modal transport facility with 24 hour a day, seven day a week operational capacity. The Hub was created to capitalise on Parkes strategic location to existing transport networks (both road and rail) with the objective of promoting freight connections between most major capital cities. Parkes has ready access to all major cities in Australia through the National Highways network and accessible rail connections to all major seaports. It is located at the intersection of the Transcontinental and Parkes-Narromine railway lines (linking the eastern seaboard to Perth) and on the Newell Highway connecting Brisbane and Melbourne. The Great Western Highway and Mitchell Highway provides access from Sydney. Suitable transport infrastructure exists to deliver all solar farm infrastructure to Parkes.

Based on the State's road network all solar farm infrastructure would arrive at the Goonumbla site from the east (ie. through Parkes). With the possible exception of road base and sand suppliers (contingent on local supply options), it would be highly unlikely that heavy vehicles would come in from the west.

Traffic data supplied by RMS Services Journey Information provides a summary of the average daily traffic for Henry Parkes Way (Condobolin Road). The data was sourced from a RMS logger installed for a period of 13 days in 2014 and located 100 metres west of the intersection of Moulden Street and Henry Parkes Way (ie. approximately 2 km west of the Parkes central business district and 8 km east of the development site). The traffic logger data available is summarised in **Table 11.2**. It is not anticipated that traffic volumes on Henry Parkes Road would have changed significantly in the intervening period.

Table 11.2 – Traffic count data Henry Parkes Way

	Light Vehicles (class 1 & 2)	Heavy Vehicles (class 3 – 12)	Total	Proportion Light/Heavy (%)
RMS Logger Aug 2014 (total)	1097	190	1287	85/15
RMS Logger Aug 2014 (weekday)	1106	229	1335	83/17
RMS Logger Aug 2014 (weekend)	1072	94	1166	92/8

Source: Roads and Maritime Services Journey Information

Hourly peaks during the period counted were identified as AM peak – 1115 – 1215 (AM peak) and 1545-1645 (PM peak).

11.4 SITE ACCESS

11.4.1 INTERSECTION TREATMENT

Access to the GSF site would be off Pat Meredith Drive, consistent with RMS advice given at the PFM. Pat Meredith Drive is a local road with essentially no regular traffic and is not used as the main access for any properties. Apart from the existing access treatment with Henry Parkes Way (Condobolin Road) and a seal treatment to the TransGrid zone substation, the road is essentially a gated, gravel track.

Pat Meredith Drive is the proposed access for the recently approved PSF (SSD 6784). As part of the assessment, determination and approvals for this solar farm that applicant (Neoen Australia Pty Ltd) is required to undertake road works prior to construction commencing on the PSF.

Specifically, these works include:

- Upgrading the intersection of Henry Parkes Way and Pat Meredith Drive to the satisfaction of the RMS and PSC, and in accordance with the *Austroads Guide to Road Design* (as amended by RMS supplements); and
- Upgrading Pat Meredith Drive in consultation with the CWLLS and to the satisfaction of PSC, to allow two-way construction traffic, including paving and widening of the road to 8.4 metres.

These upgrades were predicated on the following Conditions of Approval (CoA):

- No more than 40 heavy vehicle movements a day during construction, upgrading or decommissioning; or 20 heavy vehicle movements a day during operations.
- The length of any vehicle used for the development cannot exceed 19 metres unless otherwise agreed by the Secretary.
- The Applicant shall keep accurate records of the number of heavy vehicles entering or leaving the site each day.
- All vehicular traffic associated with the development shall travel to and from the project site via Henry Parkes Way and Pat Meredith Drive, and the approved site entry point.
- Prior to the commencement of construction, upgrading or decommissioning, the Applicant shall temporarily fence the Pat Meredith Drive road reserve to the satisfaction of the CWLLS. This fencing shall remain in place until the relevant stage of the development is completed.

Neoen Australia's project schedule is for construction to commence in January 2017 with the PSF to be completed in nine (9) months: ending in September 2017. The timeline for the GSF is for construction to commence no earlier than October 2017.

The implication of the above is that an upgraded access treatment to Pat Meredith Drive will be in place before the GSF construction commences. The treatment will be adequate because the GSF would not exceed the construction traffic movement limits that will have dictated the treatment specification. That is, the GSF would not generate more than 40 heavy vehicle movements a day during construction and, with the construction schedules for the PSF and GSF, there is no simultaneous construction effort that would create a cumulative impact.

11.4.2 ROAD UPGRADE

The approved access to the PSF site off Pat Meredith Drive is located further to the south (approximately 350 m) than the proposed access options to the GSF site. Again, the implication is that an upgraded Pat Meredith Drive will be in place before the GSF construction commences, and that the upgrade will be adequate because the GSF would not exceed the construction traffic movement limits that have dictated the treatment specification.

Two options are being considered for accessing the GSF site off Pat Meredith Drive. The first is located approximately 500 m from Condobolin Road where there is a break in the road side vegetation that would permit site access without clearing any trees. The second is through TransGrid's substation site access road located approximately 200 m from Condobolin Road. Discussions with TransGrid have commenced with regards to this option and would be subject to TransGrid's consent.

11.5 LIKELY IMPACTS

Using the national highway network to access Parkes by road will not impact on the capacity, condition, safety or efficiency of the State road network.

Similarly, restricting maximum daily heavy vehicle movements to 40 during construction, utilising an upgraded Henry Parkes Way/Pat Meredith Drive intersection treatment approved by RMS and PSC on the basis of these traffic numbers, would not compromise the safety or efficiency of the local road network. RED would be using an upgraded road designed to accommodate the same number of vehicle movements it would generate.

Both the intersection and road treatment that will exist when the GSF starts construction will be fit for purpose. It is for this reason that the DPE has flagged the requirement for both proponents of the solar farms to consult about potential cost sharing arrangements in relation to the road upgrades.

RED has a requirement to consult with Neoen Australia as specified in the SEARs. Neoen Australia has a requirement for cost sharing with RED included in the Minister's conditions of approval for the PSF – reproduced below.

> *6. If the Applicant of the Goonumbla Solar Farm Project (SSD 7618) pays for the road upgrades required …. the applicant proceeds with the construction of this development, then the Applicant shall pay the Applicant of the Goonumbla Solar Project half the cost of the relevant road upgrades.*

It is also noted that Neoen Australia's project schedule is for construction to commence in January 2017 with the PSF to be completed in nine (9) months: ending in September 2017. The timeline for the GSF is for construction to commence no earlier than October 2017. There will be no simultaneous construction activity occurring and hence no cumulative traffic impact. To this end, a mechanism for ensuring potential cumulative impacts are avoided is the inclusion in the Minister's consent for the PSF the requirement that the Traffic Management Plan prepared by Neoen Australia include consideration of potential interaction with the GSF in consultation with RED.

RED has initiated consultation with Neoen Australia in respect of the above and discussions are expected to progress to mutually agreed outcomes on cost sharing upon securing consent for the GSF and finalising engineering, procurement and construction contracts for PSF.

11.6 MITIGATION MEASURES

11.6.1 HEAVY VEHICLE RESTRICTIONS

RED would ensure that the development does not generate more than 40 heavy vehicle movements a day during construction, recommissioning or decommissioning on the local road network, and that the length of any vehicles used for the development does not exceed 19 metres unless otherwise agreed by the RMS.

11.6.2 COST SHARING

RED will continue to consult with Neoen Australia with regards to potential cost sharing for road upgrades.

11.6.3 ROAD UPGRADES

If the proposed PSF does not proceed, prior to the commencement of construction of the GSF the:

- Intersection of Henry Parkes Way and Pat Meredith Drive would be upgraded to the satisfaction of the RMS and PSC; and
- Pat Meredith Drive would be upgraded in consultation with the CWLLS and to the satisfaction of PSC.

11.6.4 SITE ACCESS

- All vehicular traffic associated with the development would travel to and from the site via Henry Parkes Way and Pat Meredith Drive.
- Prior to the commencement of construction the site entry point off Pat Meredith Drive would be constructed to the satisfaction of PSC with a Rural Property Access type treatment to cater for the largest vehicle accessing the site, in accordance with the *Austroads Guide to Road Design* and PSC *Engineering Guidelines - Subdivisions and Development Standards*.

11.6.5 TEMPORARY FENCING

Prior to the commencement of construction temporary fencing of the TSR would be erected in consultation with the CWLLS. This fencing would remain in place until construction is complete.

11.6.6 TRAFFIC SUB-PLAN

A traffic management sub-plan would form part of the Construction Environmental Management Plan (CEMP) to be prepared prior to construction of the GSF commencing.

This sub-plan would include details of the measures that would be implemented to minimise traffic safety issues and disruption to local users of the road network, including

- Consideration of potential interaction with PSF in consultation with Neoen Australia;
- Temporary traffic controls, including signage;
- Notifying the local community about project-related traffic;
- Scheduling of haulage vehicle movements to minimize convoy lengths or platoons;
- Protocols for minimising the potential for conflict with school buses and rail services as far as practicable;
- Ensuring all vehicles are loaded and unloaded on site and enter and leave the site in a forward direction;
- Ensuring vehicles leaving the site are in a clean condition and do not result in dirt being tracked onto the public road network;
- 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, particularly if using local roads through Parkes.
- 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; and
- Procedures for maintaining accurate records of the number of heavy vehicles entering or leaving the site each day.

Water

12.1 EXISTING ENVIRONMENT

12.1.1 SURFACE WATER

A key feature of the development site that makes it suitable for a solar farm is its very flat topography and the absence of any watercourse. The site is not mapped as Flood Prone Land nor has any known history of localised flooding or inundation.

The closest mapped watercourse (non-perennial) is Ridgey Creek, located (at its closest point) approximately 80 m from the western boundary of the site, on the western side of Pat Meredith Drive. Ridgey Creek flows south west into Goobang Creek a tributary of the Lachlan River. The development site sits within the Goobang and Billabong Creeks Water Source of the Water Sharing Plan (WSP) for the *Lachlan Unregulated and Alluvial Water Sources 2012*.

A sign-posted floodway exists where Ridgey Creek passes under the Condobolin Road, approximately 500 m west of Pat Meredith Drive.

Surface flow patterns over the development site have been shaped by past contouring works undertaken by the (then) Soil Conservation Service. These works were undertaken over 20 years ago with the objective of collecting water in the farm dams that are scattered over the site (refer **Drawing EV02**). The flat topography and high infiltration characteristics of the soil landscape have, historically, made collection of surface water difficult.

Existing surface flows over the site fall predominantly to the west. Flow paths and key contour banks are shown on **Drawing EV02** with the following considerations noted. Three dams (annotated 1, 2 and 3) on both the neighbouring properties to the south receive and rely on inflows from run-off emanating from within the development site. Shallow contour banks currently push overflow from dams within the development site into these off-site dams.

12.1.2 GROUNDWATER

The development site is located within the *Lachlan Unregulated and Alluvial Water Sources 2012* and *NSW Murray Darling Basin Fracture Rock Groundwater Sources 2011* groundwater source. Neither of these water sharing plans list high priority Groundwater Dependent Ecosystems (GDE) near the development site.

The Bureau of Meteorology's (BOM) *Groundwater Dependent Ecosystems Atlas* also indicates that the site does not contain any GDE that are reliant on surface expression of groundwater (rivers, springs, wetlands) or subsurface groundwater (vegetation). There are some GDE reliant on subsurface groundwater adjacent to the site and the location of these are provided in the georeferenced extract from the GDE Atlas in **Figure 16**.

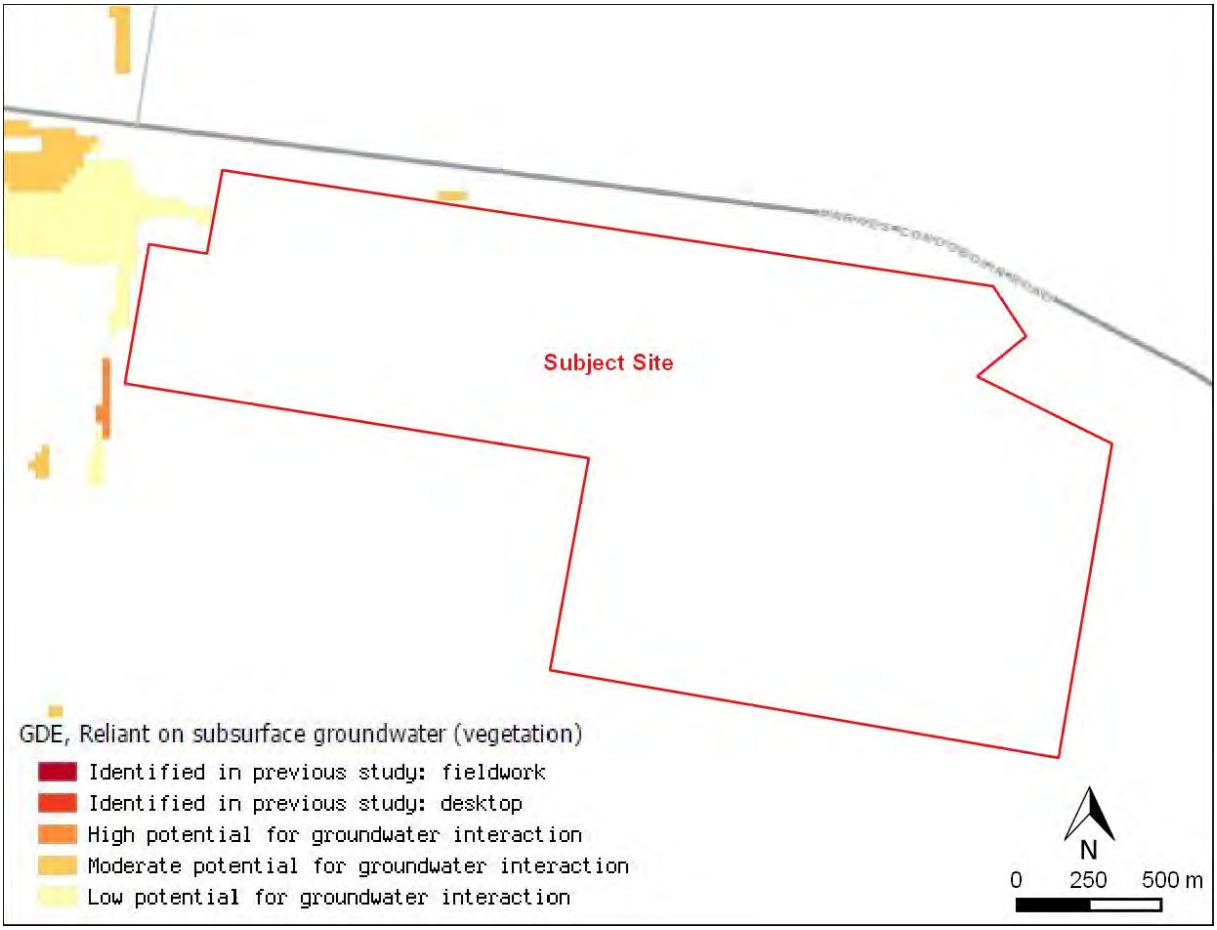

Figure 16: Groundwater Dependent Ecosystems

Whilst the development site does not contain any groundwater bores, a review of the NSW Office of Water (NOW) online *All Groundwater Map* identifies 12 bores within a 2 km radius of the site. Three of these bores have groundwater level data and indicate that groundwater levels are relatively deep, with the depth to the upper limit of the groundwater bearing zone ranging from 37.00 – 79.20 metres. Groundwater in these bores is hosted in hard rock such as limestone, basalt and granite.

It is also noted that previous attempts by the existing landowner to locate groundwater across the property have failed to find any water bearing zone.

12.2 POTENTIAL IMPACTS

Neither the construction nor operation of the GSF would have an adverse impact on surface water or groundwater resources.

12.2.1 SURFACE WATERS

The flat topography of the site will permit construction of the solar farm without the need for significant earthworks or any fundamental changes to landform: all to be undertaken in a very low risk environment in terms of erosion and sediment control.

The GSF does not require any works on waterfront land.

Localised surface flow drainage patterns would not be impacted, and the proposed development footprint (refer **Drawing EV03**) provides for the retention of a number of the existing on-site farm dams.

Of the eleven small farm dams on the development site six will be definitely retained. It is possible, but not certain, that the other five dams (all located in the eastern portion of the solar farm, east of the Crown

road) will be infilled. The development will reduce not increase surface water harvesting from the development site.

Detailed design will ensure key flow paths off-site would not be compromised. Contour banks and formed drainage swales currently collect and convey water to on-site dams, with overflow from these directing water to two neighbours' farm dams to the south. The GSF can and would be constructed so that these flow paths and water sources are preserved. Detailed design of the GSF will specify the measures proposed to ensure inflows to neighbouring dams are not impacted.

SAT removes the potential for potential formation of concentrated drip lines under fixed arrays and, given the flat topography, minimises the potential for any localised scouring. The arrays are off-ground, will not create an impermeable surface, and therefore not discernibly change infiltration or run-off over the development site. There is no potential for the GSF to create flooding impacts on any watercourse, or be adversely impacted by flooding from Ridgey Creek.

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

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 can be relatively less grazing pressure, and there would be less herbicide/pesticide/fungicide applications compared to dryland cropping.

There is no intent or need for any volumetric water licencing requirement. No water entitlement is needed or required to be purchased.

Consultation with PSC has confirmed an ability and willingness for PSC to provide a supply of non-potable water for dust suppression during construction. Estimating accurately the volume of water that will be needed during construction is limited. The extent, frequency or duration in which climatic conditions determine the need for strategic watering is speculative. It is also noted that there are a suite of mitigation measures that can and would be employed to manage dust that do not involve watering. These include scheduling of particular works outside the summer period, limiting construction activity to localised areas across the site, and restricting vehicle movements and speeds during dry and windy conditions.

The PSF immediately to the south was approved on the basis that a 9 month construction program on a 240 ha site would require 109 ML. GSF is a 295 ha site with a construction program of 12 months. A comparable demand volume has been assumed for GSF. PSC has a supply of non-potable water available at the 'brick pit' (a large flooded abandoned brick pit with reliable recharge rates). In extended dry weather the water level can drop but available volume stays good. PSC has agreed to allow access to this water for the construction of the PSF scheduled for completion by September 2017. GSF is not scheduled to start construction until October 2017.

Consultation has confirmed that PSC is amenable to allowing access to this water for construction of the GSF, noting that ultimately the water level in the brick pit is rainfall dependent and PSC cannot make any guarantees on the availability of this water in the future.

Post construction water demand would be limited to washing of the panels: if required (refer **Section 2.5.2)**. Water for this purpose would be delivered to the farm in a water truck from a supplier accessing an authorised source. No surface water monitoring is proposed, or warranted.

12.2.2 GROUNDWATER

Subsurface works would be limited to trenching (typically one metre depth), shallow excavation for foundation and hardstand for the substation and inverter assemblies, and driving array posts (<3 m) into the ground. 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 GSF.

The development does not involve any aquifer interference activity pursuant to the *NSW Aquifer Interference Policy.*

No groundwater monitoring is proposed, or warranted.

12.3 MITIGATION MEASURES

12.3.1 CONSTRUCTION

Prior to works commencing a CEMP will be prepared. Notwithstanding that the very flat nature of the site negates the need for extensive earthworks, and the absence of any mapped waterway or drainage line within the development site, the CEMP will include a soil and water sub-plan that will provide detail on the erosion and sediment controls that will be employed throughout the construction phase.

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

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

The soil and water sub-plan would be prepared in consultation with DPI – Water.

In addition to the above, the following measures would be implemented during construction.

- Storage, handling and use of any potentially hazardous materials (eg. 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 farm dams and a suitable spill response and containment kit will be available on site whenever and wherever this type of higher risk activity is undertaken.

12.3.2 OPERATIONS

Prior to operations an OEMP will be prepared. A key sub-plan within the OEMP will be procedures for maintaining a groundcover across the farm.

The absence of groundcover would increase the potential for sediment laden run-off leaving the site. Whilst managing the fuel load (ie. groundcover) will be important for managing bushfire risk, overgrazing and creating areas denuded of any vegetative cover need to be avoided.

The long term performance measure is to establish a healthy, self-sustaining, noxious weed free groundcover over the entire 385 ha property 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.

Adaptive management principles will, however, be driven by the performance measure of maintaining a groundcover rather than agricultural production. That is, in a bad run of seasons when vegetative growth may be negligible and fuel load reduction is not needed, stock grazing would not be undertaken.

Bushfire

13.1 RISK

The development site is not mapped as bushfire prone land although the locality does have a relatively recent history of bushfire.

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 GSF will be addressed through three stages, covering farm design, construction and operation.

13.2 DESIGN

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

13.2.1 EQUIPMENT SELECTION

The equipment to be used at the GSF will be selected to be resilient in external conditions for 30-35 years. This includes fire resistance. Top tier equipment suppliers comply with relevant certification and standards (refer **Table 13.1**).

Table 13.1 – Module Certifications

Certification	Purpose
ISO 14001, ISO 9001, OHSAS 18001	Environmental management, Quality & Design, Occupational Health & Safety
IEC 61646, IEC 61730, IEC 61701, IEC 60068	Design qualification & approval, Safety qualification, Salt mist corrosion, Desert sand resistant
UL 1703	PV Module Safety & Reliability
UL, CEC, Golden Sun, MCS	Regional standards: North America, Australia, China, U.K
Thresher Test & Long-Term Sequential Test	Long-term reliability under prolonged exposure to harsh environments
Atlas 25+ Durability Testing	Rigorous series of long-term combined-stress environmental exposure tests
VDE Quality Tested	Certifying entire PV power plant systems for quality & reliability

Generally accepted industry standards for electrical equipment, cabling and buildings will be complied with and the farm will be designed to comply with relevant requirements of the NSW Rural Fire Service's (RFS) *Planning for Bush Fire Protection*, pertaining to Asset protection zones, appropriate site access/egress and emergency evacuation procedures.

13.2.2 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 around all inverter assemblies and spacing between the module rows will be wide enough for vehicle access

13.3 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.
- Two (2) 10 kL tanks, being Static Water Supplies dedicated exclusively for fire fighting 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. 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, RED (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 (eg. 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.

13.4 OPERATIONS

13.4.1 FUEL REDUCTION

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

The fuel load over the entire GSF property 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 (sheep). Procedures for ensuring this outcome will be specified in the OEMP.

Hazard reduction burning is not proposed.

13.4.2 EMERGENCY RESPONSE PLAN

Should a fire occur it will be important that the first responders have ready access to information which enables effective control measures to be rapidly implemented. The first responders are likely to be the RFS and/or Fire and Rescue NSW (FRNSW).

Given the potential for electrical hazards associated with an energy generating facility, and potential risks to firefighters, the OEMP will include an Emergency Response Plan (ERP). The ERP will detail appropriate risk control measures that would need to be implemented in order to safely mitigate potential risks (including electrical hazards) to firefighters. These measures would include a safe method of shutting down and isolating the farm, either in its entirety or partially.

A copy of the ERP would be provided to both the RFS and FRNSW and a copy would be stored in a prominent 'emergency information cabinet' located in a position directly adjacent to the GSF access.

Air

14.1 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 on soil 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.

14.2 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 (inclusive of bed preparation, sowing and harvesting) 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 broad acre 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 GSF, with a maximum capacity of 70 MWac, will generate 168,000 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's (DoE) 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 0.84 $kgCO_{2\text{-}e}/kWh$ (DoE, August 2015).

Generating 168,000 MWh/year of electricity equates to a savings of 141,120 tonnes of GHG a year.

Socio-Economic

15.1 RENEWABLES INDUSTRY

The *Draft Central West and Orana Regional Plan* (DPE April 2016) presents a vision for a sustainable future for the Central West and Parke's region by growing and diversifying the economy over the next 20 years.

Managing the region's energy resources sector in a sustainable way is identified as a key strategy for attaining the goal of a growing and diverse regional economy; where renewable energy industries are a sector that has significant economic and employment benefits for the region.

Renewable energy is identified as an industry linked to the Central West's future prosperity, and over the coming decades it is expected that the region will continue benefiting from economic and employment flow-on effects through the development of new industries that can provide alternative energy supplies for the State.

The proposed GSF is a large-scale renewable energy project that represents this industry and future.

15.2 EMPLOYMENT

The GSF will generate local employment opportunities. At its peak construction will require up to 100 staff. Roles will vary from highly skilled electricians able to work with solar PV (LV and HV) to general labourers.

The project will bring economic benefits to Parkes in the form of new investment, ongoing revenue from operations, business opportunities for local suppliers and skills development opportunities for local workers.

Parkes is a prosperous and growing regional service centre that can readily accommodate the GSF development without straining existing services or infrastructure. The GSF would not increase demand on PSC's public amenities or services.

Post construction the GSF would employ one full time equivalent position.

Waste Management

16.1 INTRODUCTION

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

16.2 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.

16.3 OPERATIONS

The farm will operate independently and no permanent employees will be stationed on-site, apart from routine maintenance program operators that will only visit the farm when responding to performance issues.

16.4 RECOMMISSIONING/DECOMMISSIONING

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.

Recommissioning would involve removal of any obsolete equipment such as modules and inverters. 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.

Decommissioning would entail removing the grid connection infrastructure, including the interconnecting cable and substation equipment. Again, 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.

The site control room and facilities would be lifted off their foundations and transported off site on flatbed trucks.

16.5 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 of.

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). For comparative purposes, the overhead 132 kV transmission cables which currently cross the GSF site emit both electrical and magnetic fields well under acceptable limits when measured underneath the line. EMF emissions at 25 m from the line reduce to similar levels experienced near a television in the home.

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 they refer 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 GSF the various EMF generating components would be the PV panels (1000-1500 V DC), the interconnecting buried cables (400 V), the direct to AC inverters (1000 V DC to 400 V AC), step up transformers to 33 kV AC, the buried 33 kV cables in the collection system, the 66 kV/33 kV substation equipment, potentially large scale batteries and the short section of overhead or underground 66 kV cable connecting to the TransGrid substation.

Underground cables produce magnetic fields only as the electric field is shielded by the earth and is not detected at ground level. Above ground equipment will produce both magnetic and electric fields.

The components of GSF that will emit the highest EMF are the 66 kV site substation (including batteries) and the 66 kV line connecting to the TransGrid substation (if overhead). However, the substation will not produce a significant electric field outside its boundary because of screening provided by the perimeter fence. UK National Grid reports this screening effect occurs even to substations up to 400 kV which contain equipment emitting far higher levels of EMF than the 66 kV substation at GSF[4].

Equipment inside the substation will produce magnetic fields, however the field falls with distance quite rapidly, and at the perimeter fence or a few metres outside it, the magnetic field from inside the substation is usually approaching background levels. The largest magnetic fields round the perimeter of the substation almost certainly come from the overhead lines and underground cables entering it[5].

UK National Grid demonstrate that the magnetic field levels emitted from a 132 kV substation are well below the relevant limit identified above at all locations in and around the substation. The GSF substation will emit lower magnetic fields because its voltage is lower, at 66 kV.

Figure 17 demonstrates the low level of magnetic field emitted by the 66 kV overhead line. This curve is for the heaviest line design, the maximum current and the minimum ground clearance allowed of 7 m.

[4] http://www.emfs.info/sources/substations/substations-ng
[5] http://www.emfs.info/sources/substations/substations-ng

The figure shows that even the maximum magnetic field level is 30 µT immediately under the line which is well under the limit identified above. The typical field level will be more likely to be less than 2µT[6].

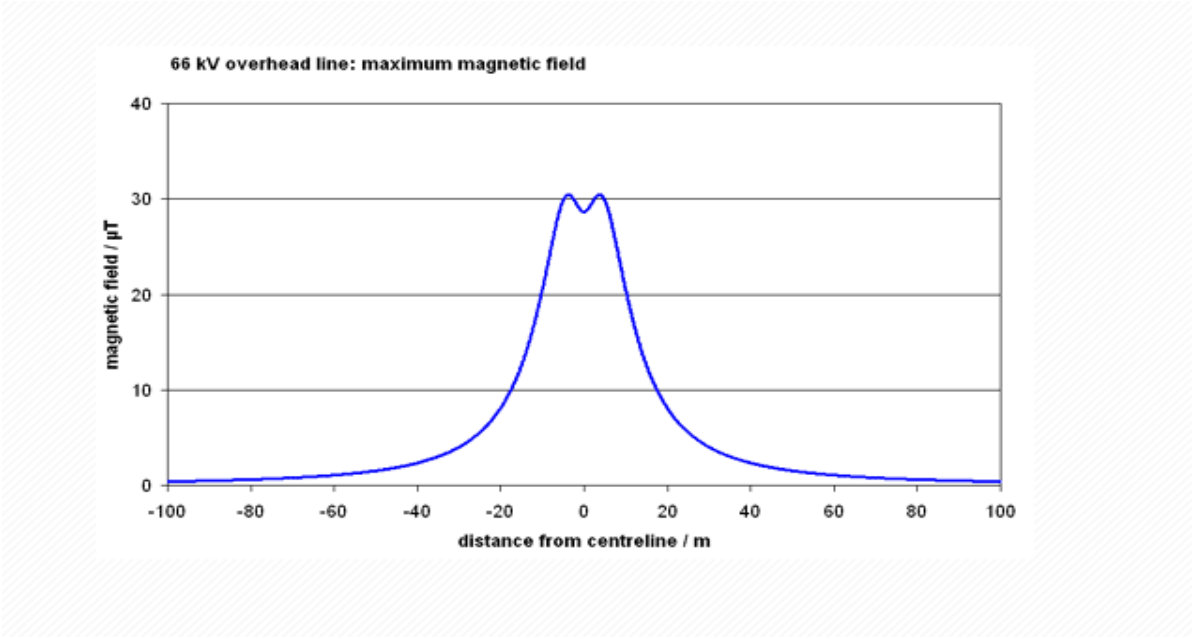

Figure 17: Maximum Magnetic Field (66 kV overhead line)

Figure 18 demonstrates the low level of electric field emitted by the 66 kV overhead line. This figure shows the maximum electric field for the heaviest cable with the maximum current and minimum ground clearance of 7 m. The maximum electric field level is 1.75 kV/m immediately under the line and the typical level is less than 1 kV/m. These levels are far below the 5 kV/m limit identified above.[7]

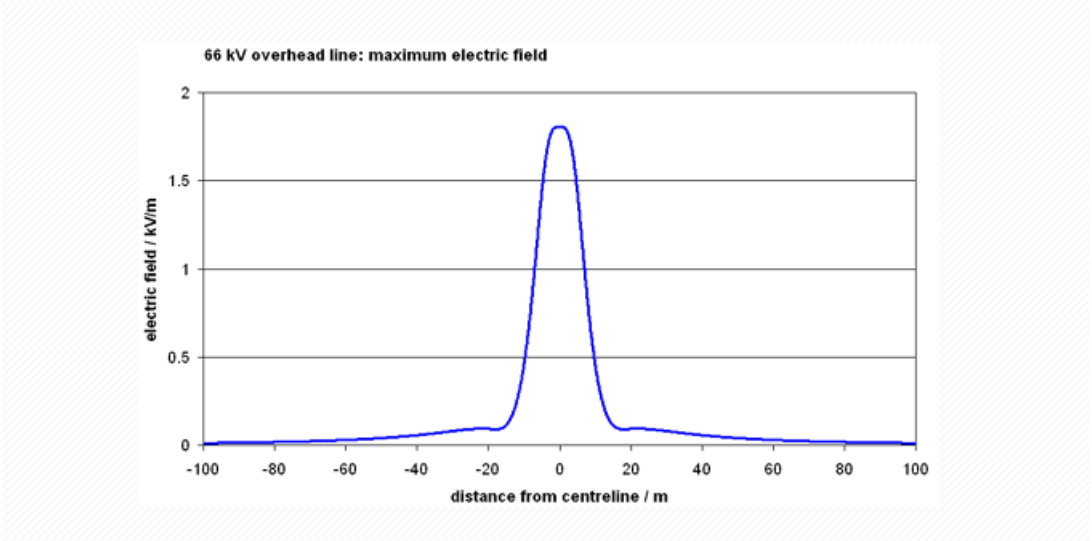

Figure 18: Maximum Electric Field (66 kV overhead line)

The GSF will be operated as a commercial power generation facility. It will not be open to the general public. The closest houses are several hundred metres distant from the electrical equipment, and at that distance EMF emission levels will be no higher than what currently exist. Workers on the site will be appropriately trained notwithstanding that emission levels are extremely low.

[6] http://www.emfs.info/sources/overhead/specific/66-kv/
[7] http://www.emfs.info/sources/overhead/specific/66-kv/

Cumulative Impact

18.1 INTRODUCTION

This EIS has considered the potential for cumulative impacts associated with the proposed adjacent PSF. The potential for cumulative impacts cover visual amenity, loss of agricultural land, traffic, noise and the capacity of the electricity transmission network.

18.2 VISUAL AMENITY

Consultation with the two landowners for which parts of the GSF and PSF development sites are visible from the curtilage of their homes has established that only one of these landowners considers visual impact an issue and has asked for screen plantings at select locations on his property. RED has committed to undertake these plantings in consultation with this landowner. Photomontages provided to this landowner showing the location and impact of these screen plantings has established that the measures proposed are considered satisfactory by the landowner. Targeted and strategically located plantings will adequately mitigate cumulative visual impacts for the only landowner who will be affected by both solar farms.

18.3 LOSS OF AGRICULTURAL LAND

Changing the land use of the development site from an agricultural use (whether it be for 30 years or forever) will not diminish the productivity of the region in terms of primary production capabilities. In considering the cumulative impact of both the GSF and the PSF on agricultural land, the DPE, the DPI – Agriculture and PSC recently determined that the operation of both these solar farms would not compromise the long-term use of the land for agricultural purposes.

Further, the DPE concluded that with an assumed combined size of 625 ha, this is a relatively small size and the combined loss of agricultural cropping land from the two solar farms would result in a negligible reduction in the overall productivity of the region. The inherent agricultural capability of the land would not be affected by the solar farms due to the relatively low scale of the developments, and the lands can be used for grazing during operations and could be returned to agricultural uses after the solar farms are decommissioned.

It should also be noted that above determination was predicated on the GSF occupying 385 ha. Pursuant to further site investigations the development footprint for the GSF is 295 ha – some 25 % smaller.

18.4 NOISE

18.4.1 CONSTRUCTION

The construction schedule for the PSF targets construction completion in September 2017. The GSF construction is scheduled to commence no sooner than October 2017. Simultaneous construction is therefore not anticipated, however the potential does exist. Accordingly, the construction noise assessment considered a circumstance where simultaneous construction activities are occurring on both the PSF and GSF.

The cumulative impact would only expected to be significant where construction activities for both solar farm projects are undertaken in close proximity to a receiver at the same time. Given this, the potential for cumulative impacts is expected to be able to be effectively managed by coordinating work across the two project sites such that noisy activities are only undertaken at the nearest point to the property “Velvedere” on one site at a time.

Receptor R2 dwelling is located within approximately 70 m from the nearest potential construction activities. The construction works expected to generate the highest noise levels are not anticipated to

be in close proximity to this receptor for an extended period and reasonable and feasible mitigation measures are available to effectively manage these temporary potential impacts (refer **Section 10.3.5**).

18.4.2 OPERATION

There is potential for cumulative noise impacts as a result of the combined noise emissions from the PSF and the GSF. In order to determine the potential for cumulative impacts the maximum predicted receptor noise levels for the PSF have been combined with the maximum predicted levels provided for the GSF.

It is noted that for both predicted noise datasets the potential impacts assume source to receptor winds. As wind in a single direction is unlikely to represent a source to receptor wind for both solar farms concurrently, this is considered to represent a conservative assumption.

The results of this assessment demonstrate that cumulative noise levels from both solar farms, assuming provision of a 300 m buffer around inverters for the GSF, for all potentially affected receptors, remain well below the applicable amenity noise criteria for a rural area in day, evening and night periods.

18.5 TRAFFIC

Based on the project schedules for both developments (GSF and PSF) there should be no simultaneous construction activity occurring and hence no cumulative construction impact. Notwithstanding, project schedules can slide and as such, while simultaneous construction is not considered likely, it is a possibility.

In the event that circumstances arise whereby there is a likelihood of some simultaneous construction, RED will consult with both RMS and PSC in advance of this occurring and provide an updated traffic management sub-plan.

18.6 NETWORK CAPACITY

Trans Grid's 132 kV Parkes substation is located on a strong part of the HV transmission network and has significant capacity to accommodate new generation. TransGrid recently published information on the capacity to connect at various substations on their network. This information identified Parkes as one of eight opportunities. At 132 kV, TransGrid forecasts 260 MW-390 MW capacity to connect. At 66 kV TransGrid forecasts 140 MW capacity to connect.

The GSF has been sized to take advantage of available capacity at 66 kV taking into account the PSF. Combined, the two projects will have less than 140 MW capacity.

Network studies are currently underway to design the connection and to identify the technical requirements for the operation of the GSF. These studies may have some impact on the final capacity of the project. However neither RED nor TransGrid expects these studies will conclude that less than 70 MWac, as is proposed for the GSF, is capable of being connected.

Mitigation Measures

19.1 INTRODUCTION

This section of the EIS 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 EIS and includes a description of the measures that would be implemented to monitor and report on the environmental performance of the development.

19.2 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; and
- Either decommissioning or recommissioning.

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

- Final Layout Plans;
- Construction Environmental Management Plan (CEMP);
- Operations Environmental Management Plan (OEMP);
- Decommissioning Management Plan (DMP); and
- Recommissioning Management Plan (RMP).

These management plans will include, but may not be restricted to, inclusion of all relevant safeguards and environmental mitigation measures identified in this EIS (and any associated Conditions of Approval). The timing and scope of these management plans is detailed below.

19.3 FINAL LAYOUT PLANS

Prior to the commencement of construction, RED will submit to DPE plans of the final layout of the GSF, including details on the siting of solar panels and all ancillary infrastructure.

The final layout will avoid impacts to the stands of native vegetation identified as a site constraint and accommodate the 300 m inverter buffer to the dwelling on “Velvedere”.

In identifying the development footprint and extent of buildable area, RED has considered all biodiversity values identified by the ecology specialists and has nominated a development footprint that avoids all direct impacts to the identified biodiversity values. As a result, no removal of native vegetation will be required.

Over time RED may upgrade the solar panels and ancillary infrastructure within the approved development footprint. Prior to carrying out any such upgrades, RED will provide revised layout plans of the development to DPE incorporating the proposed upgrades. It is noted that while the capacity of the solar farm may increase over time as technology improves, the development footprint would not increase.

19.4 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Prior to construction commencing a CEMP will be prepared and submitted to DPE 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, handled, responded to and recorded.

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 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 EIS, are detailed below.

19.4.1 LANDOWNER CONSULTATION

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

19.4.2 TRAFFIC MANAGEMENT

19.4.2.1 Heavy Vehicle Restrictions

RED would ensure that the development does not generate more than 40 heavy vehicle movements a day during construction, recommissioning or decommissioning on the local road network, and that the length of any vehicles used for the development does not exceed 19 metres unless otherwise agreed by the RMS.

19.4.2.2 Cost Sharing

RED will continue to consult with Neoen Australia with regards to potential cost sharing for road upgrades.

19.4.2.3 Road Upgrades

If the proposed PSF does not proceed, prior to the commencement of construction of the GSF the:

- intersection of Henry Parkes Way and Pat Meredith Drive would be upgraded to the satisfaction of the RMS and PSC; and
- Pat Meredith Drive would be upgraded in consultation with the CWLLS and to the satisfaction of PSC.

19.4.2.4 Site Access

- All vehicular traffic associated with the development would travel to and from the site via Henry Parkes Way and Pat Meredith Drive.
- Prior to the commencement of construction the site entry point off Pat Meredith Drive would be constructed to the satisfaction of PSC with a Rural Property Access type treatment to cater for the largest vehicle accessing the site, in accordance with the *Austroads Guide to Road Design* and PSC *Engineering Guidelines - Subdivisions and Development Standards*.

19.4.2.5 Traffic Management

- Consideration of potential interaction with PSF in consultation with Neoen Australia.
- Temporary traffic controls, including signage.
- Notifying the local community and the CWLLS about project-related traffic.
- Scheduling of haulage vehicle movements to minimize convoy lengths or platoons.
- Protocols for minimising the potential for conflict with school buses as far as practicable.
- Ensuring all vehicles are loaded and unloaded on site and enter and leave the site in a forward direction.
- Ensuring vehicles leaving the site are in a clean condition and do not result in dirt being tracked onto the public road network.
- 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, particularly if using local roads through Parkes.
- 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; and
- Procedures for maintaining accurate records of the number of heavy vehicles entering or leaving the site each day.

19.4.3 SOIL AND WATER MANAGEMENT

A Soil and Water Management sub-plan that complies with *Managing Urban Stormwater: Soils and Construction, 4th Edition* (Landcom, 2004) will be prepared.

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

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

The soil and water sub-plan would be prepared in consultation with DPI – Water.

Four principle measures must be adhered to during construction.

- At all times, in all locations, the area of ground disturbance should be limited to that which is the smallest possible footprint that is practicably possible.
- Erosion and sediment controls must 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.

19.4.4 SOIL BASELINE

- Prior to construction activity commencing representative soil samples will be collected from across the site to establish baseline data on the pre-existing agronomic characteristic of the soil resource. This would include sampling for soil texture and structure, nutrients, acidity and organic matter.

19.4.5 INCIDENT MANAGEMENT

- Adequate procedures would be established including notification requirement to the Appropriate Regulatory Authority and other relevant authorities for any incident that causes or has the potential to cause material harm to the environment.

19.4.6 WEED MANAGEMENT

Weed management principles must include:

- Stabilisation measures must be planned to optimise establishment of a healthy groundcover devoid of weeds.
- All machinery, equipment and vehicles brought onto a property would be free of soil, seed or plant material. All soil and organic matter should be removed, including under the vehicle and in the cabin or trays.
- Restrict access of vehicles and personnel to areas of known noxious weed infestation. Vehicles exiting such areas may need to be re-cleaned.
- Declared noxious weeds must be managed according to the requirements stipulated by the *Noxious Weeds Act 1993*.
- Evidence of compliance with weed biosecurity requirements would be documented.

19.4.7 BIODIVERSITY

- Installation of appropriate exclusion fencing around trees and vegetation to be retained in the study area.
  - The radius of the tree protection zone (TPZ) is calculated for each tree by multiplying its diameter at breast height (DBH) by 12. (*TPZ = DBH x 12*) in accordance with the Standards Australia Committee (2009).
  - A TPZ should not be less than 2 metres nor did greater than 15 metres, except where crown protection is required (Standards Australia Committee 2009).
  - This would include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'.
  - Identify the location of any 'No Go Zones' in site inductions and a Construction Environmental Management Plan.
- All material stockpiles, vehicle parking and machinery storage will be located within cleared areas proposed for clearing, and not in areas of native vegetation that are to be retained.
- All scattered hollow-bearing trees to be removed should be placed in areas of retained vegetation to provide additional fauna habitat.
- Where appropriate native vegetation cleared from the study area should be mulched for re-use on the site, to stabilise bare ground.
- Wet down areas to reduce dust generation during construction.
- Implementation of temporary stormwater controls during construction an to ensure that discharges to the drainage channels are consistent with existing conditions.
- Sediment and erosion control measures should be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect the drainage channels to the west and to the south. These should conform to relevant guidelines, should be maintained throughout the construction period and should be carefully removed following the completion of works.

19.4.8 ABORIGINAL HERITAGE

19.4.8.1 Induction

- All contractors undertaking any works on-site will, before commencing works, will be inducted with regards to their obligations relating to Aboriginal sites. This would include an information poster that describes the most likely site occurrences that might be observed and how to recognise them, as well as associated actions and procedures for reporting any chance find.
- The location of recorded flaked stone Aboriginal artefacts and the multi-function tool within the development site that may not need to be impacted by infrastructure or construction activity (which will be known on completion of detailed design and preparation of the final layout plans) should be left undisturbed and avoided.

19.4.8.2 Management of Known Sites

- Following detailed design and preparation of the final layout plans, those flaked stone artefacts recorded on-site that will not be impacted by infrastructure or construction would be clearly flagged and pegged in the field.
- The known location of site GSF-5 (a multi-function tool) found near the western boundary of the development site would be pegged prior to construction to ensure it remains undisturbed. If this cannot be achieved this site would be collected and the artefact conserved in cooperation with the RAP. If this artefact is moved to a new location on the property the AHIMS site record form for the site must be amended and submitted to the NSW Office of Environment.
- If the road works on Pat Meredith Drive required by the Minister's consent for the PSF have not been constructed before the GSF construction commences, and the proposed access to the Goonumbla site off Pat Meredith Drive is within 20 metres of the recorded location of PIF1 (43-3-0083 Bogan Pick) and Ridgey Creek – Parkes (43-3-0090 artefact) then an attempt to relocate these sites/artefacts would be made before the road works are undertaken, consistent with the Minister's consent (SSD 6784, 16 June 2016).

19.4.8.3 Chance Finds Protocol

- If an isolated artefact is discovered its location would be recorded with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum. A photograph of the artefact would be taken with a scale (eg ruler) and a photograph of the general location noting the orientation (eg, 'looking north' or 'looking east' etc). The artefact would then be moved during work that may harm it and it would be returned to the location immediately the work has concluded.
- If an isolated implement (eg, hammer, hatchet, grindstone, etc) is discovered its location would be recorded with a GPS using Eastings and Northings based on the GDA 94 Zone 55 Datum. A photograph of the implement would be taken with a scale (eg. ruler) and a photograph of the general location noting the orientation). The artefact would be collected and stored securely on site along with labelling that includes the Eastings and Northings.
- Where any other form or cluster of Aboriginal objects is discovered, the location would be recorded with a GPS, a photograph taken and the area isolated with a ~50m buffer and a qualified archaeologist would be contacted for further information/advice on the most appropriate strategy
- Within three months of making a chance finds discovery, OEH would be informed 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.
- If any object is found suspected to be human remains, work at the location would cease and the NSW Police (Parkes Police Station) and OEH (Dubbo Office) would be contacted immediately. The location would be made secure to prevent unauthorised access and work continue no closer than 100 metres from the potential human remains.

19.4.9 FUEL AND CHEMICAL STORAGE AND MANAGEMENT

- Storage, handling and use of any potentially hazardous materials would 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 any of the farm dams and a suitable spill response and containment kit will be available on site whenever and wherever this type of higher risk activity is undertaken.

19.4.10 WASTE MANAGEMENT

- Suitable waste disposal locations would be identified and used to dispose of litter and other wastes on-site. Suitable containers would be provided for waste collection.
- Work sites would be kept free of rubbish and cleaned up at the end of each working day.
- All waste that cannot be recycled would be disposed at a legally operating waste facility.
- No waste would be burnt or buried on-site.
- All opportunities for recycling would be implemented with the goal of minimising the waste generated by construction.
- All waste would be classified in accordance with the EPA's *Waste Classification Guidelines* and stored and handled in accordance with its classification.
- All waste would be removed from the site as soon as practicable, and ensure it is sent to appropriately licensed waste facilities for disposal.

19.4.11 NOISE AND VIBRATION

- All construction activity would be restricted to standard day time hours consistent with the *Interim Construction Noise Guideline*. That is, construction would be limited to:
  - Monday to Friday 7.00 am to 6.00 pm
  - Saturday 8.00 am to 1.00 pm
  - No work on Sundays or Public Holidays
- Potentially impacted receptors would be notified in advance of construction commencing and be provided with contact details for reporting any noise related issue.
- 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.
- 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.
- 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.
- 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.
- Consultation with R2 landholder throughout the construction process to inform the landowner on the duration and timing of potentially noisy activities. Staging construction such that activity at the nearest point to this receptor is undertaken in isolation (with other noise generating construction works being undertaken at distances of more than 500 m from this receptor).
- Use 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.
- Operate 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 and checking the condition of mufflers.

19.4.12 AIR QUALITY

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

- Limit the area of soil disturbance at any one time.
- Place and 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, utilise 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.

19.4.13 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.
- Two (2) 10 kL tanks, being Static Water Supplies dedicated exclusively for fire fighting 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. These measures will be restricted to mechanical slashing or stock crash grazing.
- 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, RED (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 (eg. 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.

19.4.14 TRAVELLING STOCK RESERVE

- Prior to and throughout construction regular consultation will be undertaken with the CWLLS so both parties are fully aware of their uses of Pat Meredith Drive and the TSR.
- RED will provide, as required, temporary fencing to avoid stock/traffic interactions at the Currajong TSR. This fencing will provide for the same segregation of stock and traffic as required for the PSF (refer **Figure 12**).

Figure 12: TSR Temporary Fencing. Source Parkes Solar Farm Submissions Report (May 2016)

- The GSF would not result in anything that would require expansion of existing TransGrid zone substation infrastructure into the TSR, or the need for the removal of any trees in the TSR.
- The TSR will be acknowledged as a working environment, not vacant bushland.
- The TSR would not be used to stockpile any materials associated with the GSF.
- The GSF would not result in any changes to localised drainage off Pat Meredith such that existing flows into the dam located in the TSR is altered.
- Construction work will not take place at night, avoiding the potential for either light or noise impacts on resting cattle at night.

19.4.15 INDUCTION

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

19.5 OPERATIONS ENVIRONMENT MANAGEMENT PLAN

An OEMP will be prepared prior to the GSF commencing operation. The GSF will be operational after commissioning and equipment trials and electricity is being loaded 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 EIS, are detailed below.

19.5.1 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.

19.5.2 INCIDENT MANAGEMENT

- Adequate procedures would be established including notification requirements to the Appropriate Regulatory Authority and other relevant authorities for any incident that causes or has the potential to cause material harm to the environment.

19.5.3 GROUNDCOVER AND WEED MANAGEMENT

Performance Measure

Notwithstanding that the GSF site is essentially flat and is not located in proximity to any sensitive receiving waters, the absence of groundcover would increase the potential for sediment laden run-off leaving the site. Whilst managing the fuel load (ie. groundcover) is important for managing the bushfire risk, overgrazing and creating areas denuded of any vegetative cover need to be avoided.

The long term performance measure is to establish a healthy, self-sustaining, noxious weed free groundcover over the entire 385 ha property that does not create a fuel hazard.

Adaptive Management Principles

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.

Adaptive management principles will, however, be driven by the performance measure of maintaining a groundcover rather than agricultural production. That is, in a bad run of seasons when vegetative growth may be negligible and fuel load reduction is not needed, stock grazing would not be undertaken.

Documentation

Each and every time a fuel reduction measure is undertaken relevant details will be recorded to provide a baseline for informing future management decisions. This will include a record of the details of the grazing regime (ie. when sheep arrived, head numbers and when they were taken off the site) or the date of mechanical slashing and the location of the reduction measure.

Monitoring

The general health of ground cover across the entire site will be monitored regularly, at times in the season that will provide timely information on weed treatment. Indicators of groundcover conditions in will include:

- Vegetative cover and fuel load;
- Whether there are noxious weeds present;
- Whether landscape plantings are healthy;
- Whether there are any areas denuded of groundcover; and
- Whether there are any signs of localised erosion.

This information will be used to inform decisions about the need, timing and location for any impending fuel reduction or weed treatment.

Declared noxious weeds must be managed according to the requirements stipulated by the *Noxious Weeds Act 1993*.

19.5.4 ABORIGINAL HERITAGE

- Ongoing management of the Millers Lookout Quarry would be considered in any overall property planning.

19.5.5 WASTE MANAGEMENT

- Suitable containers would be provided for waste collection.
- All waste that cannot be recycled would be disposed at a legally operating waste facility.
- No waste would be burnt or buried on-site.

19.5.6 BUSHFIRE PREVENTION

- The fuel load over the entire property will need to be constantly monitored and fuel load reduction measures will be implemented as required. These measures will be limited to either mechanical slashing or stock crash grazing (sheep). Prescriptive specification of the frequency of slashing/grazing is not appropriate as seasonal circumstances will vary.

19.5.7 EMERGENCY RESPONSE PLAN

- An Emergency Response Plan will be prepared in consultation with the RFS and Fire & Rescue NSW. This plan will identify the fire risks and controls of the development, and the procedures that would be implemented if there is a fire on site or in the vicinity of the site.

19.6 DECOMMISSIONING/RECOMMISSIONING

19.6.1 TIMING

Either a DMP or a RMP would be submitted to DPE for approval 12 months before the decommissioning or recommissioning is scheduled to occur.

19.6.2 RECOMMISSIONING MANAGEMENT PLAN

Recommissioning would involve removal of any obsolete equipment such as modules and inverters and disposing off-site according to good practice, including recycling wherever possible.

The technology available at that time would be installed using the existing structures and infrastructure to the extent possible and the farm would be recommissioned.

While the capacity of the solar farm may increase due to intervening technological improvements, the development footprint would not increase.

19.6.3 DECOMMISSIONING MANAGEMENT PLAN

19.6.3.1 Objective

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

19.6.3.2 Technique

If the decision in 30 years is to decommission the solar farm the procedure would be to initially disconnect the farm from the TransGrid network. The interconnecting cable and substation equipment would then be removed and disposed of off-site, reusing and recycling materials wherever possible. Foundations would be broken up and removed off site.

Modules and the racking system would be removed and piles would 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 more than 300 mm below ground level, are stable and inert, may be left buried to avoid unnecessary ground disturbance.

At this depth these cables would not impinge on future farming activity.

The site control room and facilities would be lifted off their foundations and transported off site and the security fencing removed.

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

Soil samples would be collected from those same representative sites from which samples were collected prior to construction of the farm (refer **Section 19.4.3**) to validate the health of the soil resource, and associated cropping/grazing productivity of the property.

Justification

20.1 STRATEGIC FIT

In 2014 NSW derived only 10.8% of its energy from renewable sources. The rest was derived from fossil fuels, including 82.3% from coal and 6.9% from gas.

Under the International Paris Agreement, Australia has committed to reducing GHG emissions by 26% to 28% below 2005 levels by 2030. One of the key initiatives to deliver on this commitment is the Commonwealth Government's RET. Under this target more than 20% of Australia's electricity would come from renewable energy by 2020.

At a State level the NSW Government has a Renewable Energy Action Plan (REAP) which promotes the development of renewable energy in NSW.

A regional level the *Draft Central West and Orana Regional Plan* presents a vision for a sustainable future by growing and diversifying the economy over the next 20 years. Managing the region's energy resources in a sustainable way is identified as a key strategy for attaining this goal and renewable energy is identified as an industry linked to the Central West's future prosperity. The proposed GSF is a large-scale renewable energy project that represents this industry and future.

The GSF project is consistent with the Commonwealth's RET, NSW's REAP and the Central West region's vision for a sustainable future.

20.2 SITE SUITABILITY

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

It is immediately adjacent to the substation which connects into TransGrid's transmission network which has sufficient capacity for the output of both the GSF and the PSF. The proximity to the substation offers a lower cost grid connection and avoids the need to build any significant new overhead lines or securing easements from landowners not associated with the development.

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

Importantly, the development of a solar farm at this location is a permissible development, and given surrounding topography, existing vegetation and location of most neighbours' dwellings, would have a very localised and limited impact on visual amenity values. The size of the development site itself has provided the ability to avoid significant ecological impacts, and the flat terrain will enable the farm to be constructed without significant earthworks.

20.3 ALTERNATIVES

The objective of the GSF is to convert sunlight into carbon free electricity which can then be sold into the NEM. PV panels, either on north facing fixed tilt arrays or on east-west single-axis tracking modules, provides the best technological means for achieving this. The technology is proven and the site features will permit ease of construction.

The consequences of not carrying out the development would be to forgo the benefits the solar farm would provide in terms of increased local expenditure and employment opportunities within the Parkes region; as well as production of 168,000 MWh of clean electricity a year, displacing 141,120 tonnes of GHG emissions.

20.4 REASONS FOR APPROVAL

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

Stands of native vegetation providing conservation values were identified in the ecological survey and have been accommodated such that impacts on these areas can be totally avoided. In the assessment of potential noise impacts the need to provide a suitable buffer distance from inverters to dwellings was identified, and has subsequently been mapped as a design constraint such that acoustic amenity values will not be adversely impacted.

The process of refining the buildable footprint has been driven by the precautionary principle. That is, where there has been the possibility of serious or irreversible environmental impact, lack of full scientific certainty has not been used as a reason for not adopting avoidance measures to prevent environmental degradation. The decision to retain these stands of native vegetation has been guided by careful evaluation to avoid, wherever practicable, a potentially serious or irreversible impact. As a consequence of this decision biological diversity has been conserved and ecological integrity maintained.

Similarly, in committing to provision of a buffer to the inverters to protect acoustic amenity values, RED has incorporated environmental factors in the valuation of assets and services. Specifically, the polluter pays principle that underpins ecologically sustainable development (ESD) requires those who may generate pollution (in this instance noise) should bear the cost of containment, avoidance or abatement. The inverter buffer effectively provides avoidance.

Social costs include those impacts on people who could be impacted by the GSF. As detailed in **Section 4.2** there are just three (3) neighbours who have partial views of the development site from the curtilage of their homes. Following meetings with these neighbours it was established that two of them had no concerns regarding potential impacts of the GSF.

The third neighbour, on the property “Velvedere”, is the landowner closest to both the PSF and the proposed GSF. The owner of this residence has the greatest potential to be impacted by the GSF. Two meetings and several discussions were held with this landowner during the preparation of the EIS. Two issues were discussed: visual impact and security of farm dam water supply.

With regards to visual impact the landowner requested that a row of screen plantings be established, on his land, along the eastern boundary of his property, as well as some scattered plantings immediately north of his house. RED has agreed to these and the plantings form part of the proposed development. Photomontages (as presented in this EIS) were provided to the landowner and follow up calls confirmed that they satisfied his expectations.

With regards to water supply, the dams on “Velvedere” rely on directed surface flows emanating from within the development site. The need to retain these inflows was discussed and an assurance given that detailed design of the GSF will not compromise these dam inflows.

The GSF should be approved because the development site is suitable for a solar farm as it has good solar resources and available capacity in the existing electricity network. The site is very flat and has been largely cleared for agricultural uses with remnant native vegetation to be protected. There are few landowners in close proximity to the proposed solar farm and issues raised by the only landowner who has expressed an interest in the development have been included in the proposed development.

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

Transitioning the electricity sector from coal and gas fired power stations to renewable energy sources personifies the ESD principle of inter-generational equity. The GSF should be approved as this will be an outcome whereby the present generation is making a land use decision that will help ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit for future generations. The GSF will generate 168,000 MWh of clean electricity a year, enough to power 28,880 households and displace 141,120 tonnes of GHG emissions a year.

The GSF is a development that is in the public interest and should be approved.

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