Garoo Solar Farm and BESS

Land and Agricultural Impact Assessment Report

PREPARED FOR
GreenPulse Solar Farm and BESS Unit Trust

DATE
4 November 2025

REFERENCE
0751705

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Garoo Solar Farm and BESS

Land and Agricultural Impact Assessment Report

0751705

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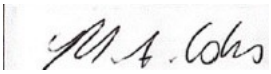

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Name	Description
Terminologies	
Applicant or Greenpulse	GreenPulse (trading as The Trustee for GreenPulse Solar Farm and BESS Unit Trust)
Project	Garoo Solar Farm and BESS
Project Area	The area to which the development application applies, including temporary and permanent Project infrastructure and areas excluded from development during both construction and operation.
Development Footprint	Represents the land that is directly impacted by the Project, including all temporary and permanent disturbance areas.
Temporary Disturbance	The area of land that will be temporarily disturbed during construction of the Project and later rehabilitated.
Permanent Disturbance	The area of land that will be subject to permanent disturbance because of construction and operation of the Project until decommissioning.
Acts	
EP&A Act	*Environmental Planning and Assessment Act 1979*
Regulations	
EP&A Regulation	Environmental Planning & Assessment Regulations 2021
EPBC Regulations	Environment Protection and Biodiversity Conservation Regulations 2000
Management Plans	
BFRMP	Bush Fire Risk Management Plan
BMP	Biosecurity Management Plan
CEMP	Construction Environmental Management Plan
ESCP	Erosion and Sediment Control Plan
OEMP	Operational Environmental Management Plan
VMP	Vegetation Management Plan
SWMP	Soil and Water Management Plan
TMP	Traffic Management Plan
Guidelines, Manuals and Policies	
LUCRA Guide	Land Use Conflict Risk Assessment Guide
Solar Guidelines	Large Scale Solar Energy Guidelines 2022
SSD Guidelines	The State Significant Development Guidelines
SRLUP	Strategic Regional Land Use Policy 2011
T&I SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
Tamworth LEP	Tamworth Regional Local Environmental Plan 2010
Yellow Book	Australian Soil and Land Survey Handbook

Name	Description
Acronyms and Abbreviations	
°C	Celsius degrees
ABS	Australian Bureau of Statistics
AC	Alternating current
AHD	Australian Height Datum
APZ	Asset Protection Zones
ASC	Australian Soil Classification
BESS	Battery Energy Storage System
BDAR	Biodiversity Development Assessment Report
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CA:Mg	Ratio of exchangeable calcium to exchangeable magnesium
CEC	Cation Exchange Capacity
cmol/kg	Centimoles of positive charge per kilogram of soil
DPIRD	NSW Department of Primary Industries and Regional Development
du	Soil landscape - Duri
EAT	Emerson Aggregate Test
EC	Electrical conductivity
EIS	Environmental Impact Statement
ERM	Environmental Resources Management Australia Pty Ltd
EMS	Environmental Management System
ESP	Exchangeable Sodium Percentage
fh	Soil landscape - Fullwoods Hill
GDE	Groundwater Dependent Ecosystems
GreenPulse	The Applicant - GreenPulse Solar Farm and BESS Unit Trust
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
kV	Kilovolt
LGA	Local Government Area
LSC	Land and soil capability
LVIA	Landscape and Visual Impact Assessment
m	Metre
mn	Soil Landscape - Moan

Name	Description
MW	Megawatt (Alternating Current)
MWh	Megawatt hour
NAN4	Nandewar Peel IBRA subregion
NATA	National Association of Testing Authorities
NIA	Noise Impact Assessment
NSW	New South Wales
O&M	Operation and Maintenance
pl	Soil landscape - Parnell
PHA	Preliminary Hazard Analysis
PV	Photovoltaic
rh	Soil landscape – Round hill
SB	Soil bore
SCADA	Supervisory Control and Data Acquisition
SEARs	Secretary’s Environmental Assessment Requirements
SEED	Sharing and Enabling Environmental Data
SQV	Suggested Quantity Values
SSD	State Significant Development
TIA	Traffic Impact Assessment
wn	Soil landscape - Wangarang

EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by the GreenPulse Solar Farm and BESS Unit Trust (GreenPulse / the Applicant) to prepare a Land and Agricultural Impact Assessment (LAIA) report for the proposed Garoo Solar Farm and Battery Energy Storage System (the 'Project'), a renewable energy development located in Garoo, New South Wales (NSW). The LAIA Report will support a State Significant Development (SSD) application under Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (EP&A Act) (SSD- 79747209).

The Project

The Project proposes to construct, operate, and decommission a 133.76 Megawatt (MW) solar facility, 360 MW / 1,440 Megawatt hour (MWh) Battery Energy Storage System (BESS), and associated infrastructure, and proposes to connect into the national grid via the existing 330 kilovolt (kV) Liddell-Tamworth overhead transmission line. Located entirely in the Tamworth Regional Local Government Area (LGA), the Project Area extends across 369 hectares (ha). The Development Footprint, which reflects the area that would be subject to permanent disturbance during construction and operation, is approximately 305.43 ha.

Regional Context and Site Characterisation

Agriculture is a key industry in the region, accounting for approximately 88% of land use and contributing over $305 million per annum in the Tamworth Regional LGA. The Project Area is zoned as RU1 – Primary Production under the Tamworth Regional Environmental Management Plan 2010, and is currently utilised for livestock grazing and small-scale cropping. Existing NSW soil mapping indicated that the Project Area comprises chromosols and dermosols (Australia Soil Classification; ASC), and is classified as Class 4 (Moderate capability land), Class 5 (moderate-low capability land), and Class 6 (Low capability land) under the NSW Land and Soil Capability (LSC) Assessment Scheme.

A soil verification survey was undertaken on 03 July 2024 to ground truth the soil conditions within the Project Area. A total of 16 sites were surveyed across the Project Area. Soils were classified in accordance with The Australian Soil Classification Guide, and samples from each site were subjected to a suite of laboratory analysis by a National Association of Testing Authorities Accredited laboratory (GSG Laboratories). Verification of LSC was also conducted in accordance with the Land and Soil Capability Assessment Scheme.

It was determined that the Project Area contains four ASC soil types (brown vertosol, grey chromosol, brown chromosol, and red dermosol), with brown vertosol presenting as the dominant soil type. Result of the laboratory analysis identified that risks associated with salinity, acidity, and soil erodibility are limited, and that the Project Area contains good soil fertility. LSC verification determined that the main hazards/limitations across the Project Area include soil depth and wind erosion, with the Project Area comprising three LSC Classes:

- LSC Class 4: moderate capability land, covering 263 ha;
- LSC Class 5: moderate-low capability land, covering 19 ha; and
- LSC Class 6: low capability land, covering 87 ha.

Land Use Conflict Risk Assessment

A Land Use Conflict Risk Assessment (LUCRA) was also conducted (as per the Large-Scale Solar Energy Guideline 2022) to identify and assess the potential for land use conflict to occur between neighbouring land uses. This identified that, following implementation of proposed risk reduction measures, there are five possible land use conflicts that may require further management: visual amenity, bushfire risk, decreased biodiversity value, biosecurity, and property devaluation. These topics are addressed in further in the Environmental Impact Assessment (EIS) and relevant supporting technical documents.

Impact Assessment & Mitigation Measures

Project infrastructure will result in the temporary loss of agricultural land, which will not be available for agricultural practices during the Projects life. However, the Applicant is committed to implementing agrisolar practices, limiting loss of agricultural land and ensuring continuation of agricultural practices. Following decommissioning, it is anticipated the Project Area will be rehabilitated to return the primary land use to agriculture.

Construction activities may result in soil displacement, disrupted soil structure, increased erosion risks, and sediment pollution of watercourses. However, theses impacts are anticipated to minimal, and predominantly limited to the construction phase. Mitigation measures have been developed to manage issues associated with soil disturbance, which will include progressive rehabilitation of the Project Area to manage erosion and sedimentation. A Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan will be developed to implement these measures.

Construction activities and intensified vehicle movements may also increase biosecurity risks, which could reduce the efficacy of site rehabilitation and future agricultural practices. The Applicant will prepare a Biodiversity Management Plan (BMP) and Vegetation Management Plan (VMP) to manage and implement mitigative measures.

The traffic, noise, and air emissions (predominantly dust) associated with the Project could also impact agricultural enterprises. However, specialist technical assessments (refer to the Traffic Impact Assessment, Noise Impact Assessment and EIS) have determined that impacts are anticipated to be relatively low, and implementation of management measures would mitigate impacts to surrounding agricultural enterprises.

Given the small footprint of the Project, it is considered unlikely that the loss of agricultural productivity would have a material impact on the agricultural enterprises in the wider region. Cumulative impacts are also considered negligible due to the scale and nature of the agricultural industries within the region, and the applicability of agrisolar.

Conclusion

Based on the findings of this report, Project impacts can be managed appropriately through the implementation of appropriate mitigation measures, and the land can be rehabilitated following decommissioning. Therefore, there are not anticipated to be any permanent impacts to land, soil or agriculture as a result of the Project.

1. INTRODUCTION

GreenPulse Solar Farm and BESS Unit Trust ('GreenPulse' or the 'Applicant') proposes to construct, operate, maintain and decommission the Garoo Solar Farm and Battery Energy Storage System (BESS) (the 'Project'), a renewable energy development situated in the rural locality of Garoo, New South Wales (NSW). Environmental Resources Management Australia Pty Ltd (ERM) was engaged by GreenPulse to conduct a Land and Agricultural Impact Assessment for the Project in order to support a State Significant Development (SSD) application under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (SSD- 79747209).

1.1 PROJECT OVERVIEW

The Project will involve the construction, operation and decommissioning of a Photovoltaic (PV) solar facility with a targeted electricity generating capacity of up to 133.76 Megawatt (MW) Alternating Current (AC), a centralised large-scale BESS with a capacity of up to 360 MW / 1,440 Megawatt hour (MWh), and associated infrastructure. The Project proposes to connect to the national grid via the existing 330 kilovolt (kV) Liddell-Tamworth overhead transmission line.

The Project is located in the rural locality of Garoo, approximately 40 kilometres (km) (by road) south of Tamworth and 370 km northwest of Sydney. The Project Area is situated entirely within the Tamworth Regional Local Government Area (LGA). The Project Area and its surrounds are zoned as RU1 – Primary Production under the Tamworth Regional Local Environmental Plan 2010 (Tamworth LEP) and has been historically utilised for agricultural practices. Current land use is predominantly comprises the grazing of livestock and small scale cropping.

The Project is anticipated to be constructed within a period of 18 months, and be operational for up to 30 years, although decommissioning will be determined closer (i.e. within 5 years) to the decommissioning date. A Project summary is provided in **Table 1-1**, with the Projects regional setting and layout presented in **Figure 1-1** and **Figure 1-2**, respectively.

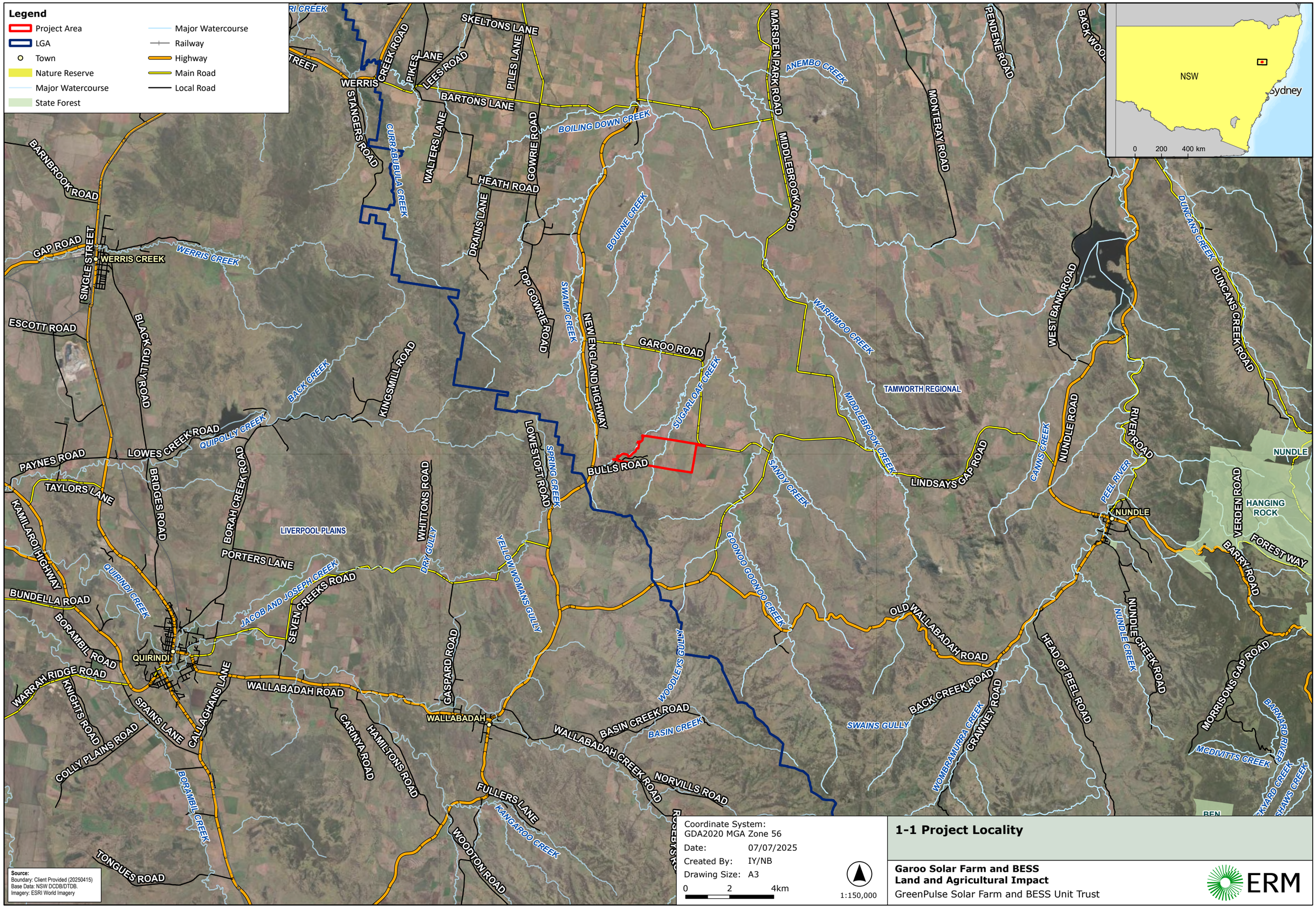
TABLE 1-1 PROJECT SUMMARY

Project Terminology	Summary
Project Details	
Project	Garoo Solar Farm and BESS.
Applicant	GreenPulse Solar Farm and BESS Unit Trust.
Project Area	The Project Area extends over approximately 369 hectares (ha) and includes 17 freehold lots and one parcel of Crown Land. This area encompasses temporary and permanent Project infrastructure, and additional areas that have been excluded from the project design.
Development Footprint	Maximum directly impacted area by Project construction and operation up to 305.43 ha. The Development Footprint will be subject to permanent disturbance as a result of construction and operation of the Project until decommissioning.

Project Terminology	Summary
Project Elements	
Solar Panels	• Approximately 234,000 Solar PV Modules with expected power of 635 watts each; • Maximum generation capacity of 133.76 MW AC; and • Mounted arrays installed on single axis tracking structures.
BESS	• Lithium-ion battery; and • Storage capacity of approximately 360 MW / 1,440 MWh.
Power Conversion Units (PCUs)	• Up to 38 PCU for the solar farm and 142 PCUs for the BESS • Approximate dimensions: 2.8 m (W) x 1.5m (H) x 1.5 m (D).
Electrical Reticulation Infrastructure	• Two onsite substations (330 kV), including switching station, transformers and associated structures; and • Approximately 16.6 km of underground electrical reticulation connecting solar panels to the substations and associated infrastructure. • Conduits housing electrical reticulation will be attached to the Tamarang Creek bridge crossing
Access	• The Project will be accessed via Garoo Road, at the northwest corner of the Project Area (refer **Figure 1-2**); and • There is an additional emergency access via Bulls Road from the southwest corner of the Project Area.

On-site Supporting Infrastructure	• Permanent Operations & Maintenance (O&M) compound, including
	  ◦ A control room;
	  ◦ Storage facilities;
	  ◦ Supervisory Control and Data Acquisition (SCADA) facilities;
	  ◦ Basic office amenities; and
	  ◦ Car parking area.
	• Laydown area;
	• New or upgraded access roads;
	  ◦ Single bridge across Tamarang Creek (Lot 1 and Lot 2, DP 755341);
	• New or upgraded drainage system; and
	• Security fencing (approximately 2.4 m high) and lighting.

On-site Temporary Infrastructure	• Temporary construction compounds with offices, car parking and amenities; • Temporary workers accommodation camp (capacity 250 FTE), which will be occupied for approximately 15 months (refer **Figure 1-3**); and • On-site borrow pits, laydown and storage areas, fencing, and access.
Off-site Supporting Infrastructure	• Waste and wastewater disposal facilities; and • Existing public road and communications network.



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Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56

Date: 07/07/2025

Created By: IY/NB

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1-1 Project Locality

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R0.aprx

SUGARLOAF CREEK

R5

R3

GAROO ROAD

Liddell to Tamworth

Muswellbrook-330 to Tamworth

R1

TAMARANG CREEK

BULLS ROAD

R4

R2b

R2a

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Preferred access point
- Emergency Access point
- Transmission Lines (existing)
- Maintained Existing Water Dams
- Avoidance Area
- Associated Dwelling
- Non-Associated Dwelling
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Parking and Laydown Area
- Customer Substation Area
- Transgrid Substation Area
- Inverters
- Bridge
- PCS Station
- OHL Interconnection
- BESS Container
- Strategic Road Upgrade
- Fence
- O&M Building
- Bridge Piers
- Noise Walls - PCS Stations
- Noise Wall - High Voltage Transformer
- Mitigation Planting Areas
- Local Road
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025

Created By: NB

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F1-2 Project Layout
Map 1 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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Muswellbrook-330 to Tamworth

R1

TAMARANG CREEK

BULLS ROAD

R2b

R2a

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Transmission Lines (existing)
- Maintained Existing Water Dams
- Avoidance Area
- Associated Dwelling
- Non-Associated Dwelling
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Inverters
- Bridge
- PCS Station
- OHL Interconnection
- BESS Container
- Fence
- Bridge Piers
- Mitigation Planting Areas
- Local Road
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025

Created By: NB

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F1-2 Project Layout
Map 2 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Preferred access point
- Emergency Access point
- Strategic Road Upgrade
- Local Road
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025
Created By: NB
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F1-2 Project Layout
Map 3 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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GAROO ROAD

Liddell to Tamworth

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Transmission Lines (existing)
- Avoidance Area
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Parking and Laydown Area
- Customer Substation Area
- Transgrid Substation Area
- Inverters
- Strategic Road Upgrade
- Fence
- O&M Building
- Noise Wall - High Voltage Transformer
- Local Road
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025
Created By: NB
Drawing Size: A3

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F1-2 Project Layout
Map 4 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

Liddell to Tamworth

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Transmission Lines (existing)
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Parking and Laydown Area
- Customer Substation Area
- Transgrid Substation Area
- Inverters
- PCS Station
- OHL Interconnection
- BESS Container
- Fence
- O&M Building
- Noise Walls - PCS Stations
- Noise Wall - High Voltage Transformer
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025

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F1-2 Project Layout
Map 5 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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TAMARANG CREEK

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Parking and Laydown Area
- Customer Substation Area
- Transgrid Substation Area
- Inverters
- Bridge
- PCS Station
- OHL Interconnection
- BESS Container
- Fence
- O&M Building
- Bridge Piers
- Noise Walls - PCS Stations
- Noise Wall - High Voltage Transformer
- Local Track-Vehicular

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025

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F1-2 Project Layout
Map 6 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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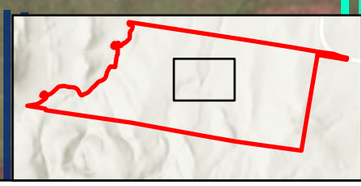
TAMARANG CREEK

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Legend

- Project Area
- Development Footprint
- Maintained Existing Water Dams
- Avoidance Area
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Inverters
- Bridge
- Fence
- Bridge Piers
- Local Track-Vehicular



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F1-2 Project Layout
Map 7 of 7

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R1.aprx

Muswellbrook 330 to Tamworth

Liddell to Tamworth

Legend

- Project Area
- Development Footprint
- Transmission Lines (existing)
- PV (Mounting Structure - Half Table)
- PV (Mounting Structure - Full Table)
- Internal Road
- Parking and Laydown Area
- Customer Substation Area
- Transgrid Substation Area
- Inverters
- Bridge
- PCS Station
- OHL Interconnection
- BESS Container
- Fence
- Temporary Workers Accommodation Camp

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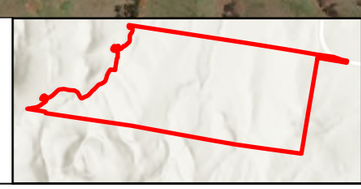

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Date: 14/08/2025

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F1-3 Workforce Accommodation Camp Location

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R1.aprx

Legend

- Project Area
- Development Footprint
- Transmission Lines (existing)
- Internal Road
- Admin & First Aid
- Verandah
- Fire Hydrant
- Loading Area
- Accommodation Area
- Amenities & Services
- Smoking Area
- Potable Water
- WWTP
- Car Parking
- Fence
- Accommodation Area
- Waste Area

Machinery Area

- Fire Suprpression
- Gas hazard area
- Generators and fuel store
- Maintenance containers

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56

Date: 14/08/2025
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F1-3 Workforce Accommodation Area

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

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1.2 OBJECTIVES

This Land and Agricultural Impact Assessment report has been prepared to:

- Address the Secretary's Environmental Assessment Requirements (SEARs);
- Describe the existing soil conditions across the Project Area;
- Describe the existing agricultural activities and land uses across the Project Area;
- Assess the impact of the development throughout the construction, operation and decommissioning on the Project Area; and
- Identify appropriate mitigation and management measures to ensure that the development of the Project would not create an unacceptable environmental impact.

1.2.1 SEARS REQUIREMENT

The Relevant SEARS concerning impacts on land are detailed in **Table 1-2**. The technical assessments referred to in the table are appended to the EIS.

TABLE 1-2 SEARS RELATING TO LAND

Requirement	Reference
A detailed justification of the suitability of the site and that the site can accommodate the proposed development having regard to its potential environmental impacts, land contamination, permissibility, strategic context and existing site constraints	• EIS; • Water Resources Impact Assessment; and • Preliminary Site Investigation
An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including: • Agricultural land, flood prone land, nearby drinking water catchments, Crown lands, mining, quarries, mineral or petroleum rights (if relevant); • A soil survey to determine the soil characteristics and consider the potential for salinity, acid sulfate soils, and erosion to occur; and • A cumulative impact assessment of nearby developments	• Section 3; and • Section 5
An assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including: • Consideration of the zoning provisions applying to the land, including subdivision (if required); • Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industries Land Use Conflict Risk Assessment Guide (if required); • An assessment of impact on agricultural resources and agricultural production on the site and region; and • Details of how the proposed development would implement and achieve agrisolar activities on the site.	• Section 4; • Section 5; and • Section 6
A preliminary investigation into potential contamination across the site, in accordance with the State Environmental Planning Policy (Resilience and Hazards) 2021 (Hazards SEPP) (as required).	• EIS; and • Preliminary Site Investigation

1.2.2 AGENCY ADVICE

Agency advice relating to land and agricultural impacts were provided by the Department of Primary Industries and Regional Development (DPIRD) and Tamworth Regional Council. This was received alongside SEARs, and is summarised in **Table 1-3**. The technical assessments referred to in the table are appended to the EIS.

Tamworth Regional Council expressed support for the preparation of a LAIA and investigation into possible agrisolar opportunities that are compatible with a Project.

TABLE 1-3 AGENCY ADVICE

Requirement	Where addressed
DPIRD	
Detailed information on livestock grazing concurrent with the Project.	• **Section 6.1**
Groundcover to be maintained at a minimum of 70% to prevent erosion of the site	• **Section 6.2**
The EIS to justify site selection of productive agricultural land, particularly if the site is a significant distance from the New England Renewable Energy Zone.	• The EIS
Biosecurity Issues during and post construction to be addressed as part of Biosecurity Management Plan	• **Section 6.3**; • The EIS; and • Biodiversity Development Assessment Report
Rehabilitation Plans for all infrastructure during and after construction with appropriate groundcover management to limit potential for land use conflict, with any use of sheep grazing to be fully explained*	• **Section 5.1.1**; and • **Section 6.4**
Any subdivision of the site due to the Project is not to result in any additional dwelling opportunities. This also applies to temporary worker's accommodation	• The EIS
Recognising the potential for land use conflict in relation to temporary worker's accommodation on RU1 Primary Production zoned land and recommending that any such development to be relocated to Wallabadah	• **Appendix A** • The EIS • Social Impact Assessment Report
Tamworth Regional Council	
The cumulative impact assessment of nearby developments needs to include the (potential) cumulative loss of agricultural land in the locality from renewable projects.	• **Section 5.6**

* Rehabilitation plans will be further developed during detailed design

1.3 RELEVANT GUIDANCE

This assessment has been completed in a manner consistent with the guidance provided in the following documents:

- Large Scale Solar Energy Guideline 2022 (DPE, 2022);
- The land and soil capability assessment scheme: second approximation (OEH, 2012);
- Land Use Conflict Risk Assessment Guide (DPI, 2011);
- Infrastructure Proposals on Rural Land (DPI, 2013);
- Australian Soil and Land Survey Handbook (the 'Yellow Book') (CSIRO, 2009);

- Guidelines for Surveying Soil and Land Resources (CSIRO, 2008); and
- Biosecurity Risk Management in Land Use Planning and Development (DPI, 2020)

1.4 ASSESSMENT APPROACH

This assessment been conducted in accordance with Appendix A of the Solar Guideline, which comprises of:

- Desktop review of the publicly available mapping of the current land and soil capability (LSC), Biophysical Strategic Agricultural Land (BSAL);
- Advancement of hand-augered soil bores to a minimum depth of 600 mm and collection of representative soil samples;
- Soil sample verification;
- Conduct a land use conflict risk assessment; and
- Data validation and reporting.

The Land and Soil Capability (LSC) Mapping data for NSW (DPIE, 2021) suggests that the Project Area is predominantly located on land mapped as Class 4 (Moderate to Severe Limitations) and Class 5 (Severe Limitations), with a small patch of Class 6 (Very Severe Limitations) in the southern section (refer **Figure 3-3**).

The LSC across the Project Area was verified through soil sampling (refer **Section 3.5**), which determined that a Level 2 - Reduced Agricultural Impact Assessment was required, as per the Solar Guideline. The requirements for this level of assessment, and where these items are addressed in this report, are presented in **Table 1-4**.

TABLE 1-4 LEVEL 2 – REDUCED AGRICULTURAL IMPACT ASSESSMENT REQUIREMENTS

Assessment	Content and Form	Reference
Project description	• Project description; • Location; • Duration; and • Areas of the site that would be disturbed or temporarily removed from agricultural use	**Section 1.1**
Regional Context	• Zoning of the project site; • Climate and rainfall; • Regional landform; and • Regional land use including any significant agricultural industries and/or infrastructure	**Section 2**
Site characteristics and land use description	• Description of land within the Project Area; • Historic and current agricultural land use / practice; • Soil type, fertility, and land and soil capability; • Maps showing LSC Class and topography; and • Agricultural productivity	**Section 3**
LUCRA Assessment	• Land use compatibility and conflicts; • compatibility of the development with the existing land uses on the Project Area and adjacent land (during operation and after decommissioning); and • Completed in accordance with LUCRA Guide (DPI, 2011)	**Section 4** **Appendix A**
Impact on Agricultural Land	• Impacts on agricultural lands and productivity; • Project potential to permanently remove agricultural land and/or fragment or displace existing agricultural industries; and	**Section 5**

Assessment	Content and Form	Reference
	• Cumulative impacts of multiple solar energy projects on agriculture in the region.	
Mitigation Strategies	• Strategies to mitigate project impacts on agricultural land; and • Investigate potential of co-location with existing agricultural practices and feasibility of agrisolar.	**Section 6**

2. REGIONAL CONTEXT

2.1 CLIMATE AND RAINFALL

The Project Area is located within the Nandewar Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and the Peel IBRA subregion (NAN4). The climate across the bioregion is mostly warm and dry, however temperature varies with elevation (NSW NPWS, 2003). Mean annual temperatures range from 10-18 °C, with central areas of high elevation, such as the Liverpool Ranges and Nandewar Ranges, experiencing cooler temperatures and warmer temperatures corresponding to lowlands around main river catchments (NSW NPWS, 2003). Rainfall in the bioregion is characterised by frequent high intensity rains that follow a summer dominant pattern, with areas of higher altitude receiving more rainfall (NSW NPWS, 2003).

An understanding of the existing climatic context of the Project Area was developed through available data from the Australian Government's Bureau of Meteorology (BOM). The closest BOM weather station with rainfall data is Gowrie (Lallybroch) (055195), located approximately 760 metres (m) southwest of the Project Area at an elevation of 638 m Australian Height Datum (AHD) (BOM, 2024a). This station has rainfall data from September 1958 to January 2023, which is presented in **Table 2-1**.

The closest BOM weather station with temperature data is the Quirindi Post Office (055049), located approximately 21.9 km southwest of the Project Area at 390 m AHD. This station has a data range from 1882 to present (BOM, 2024b) (BOM, 2024c). Mean maximum and minimum temperatures are detailed in **Table 2-2**.

TABLE 2-1 MONTHLY RAINFALL DATA, GOWRIE (LALLYBROCH) WEATHER STATION, 1958-2023 (MM)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	93.7	66.5	60.7	36.9	50.1	55.3	46.9	47.2	57.4	68.2	77.2	89.1	752.7
Lowest	3.6	0.0	0.0	0.0	0.0	6.6	1.8	0.0	1.6	7.0	0.6	5.6	320.5
Median	75.5	52.9	50.3	29.2	45.4	43.4	40.9	47.0	45.0	68.4	63.4	84.8	720.4
Highest	267.8	202.6	228.2	127.9	172.0	202.0	175.9	122.3	171.1	169.9	235.9	226.5	1265.9

TABLE 2-2 MAXIMUM AND MINIMUM TEMPERATURES, QUIRINDI POST OFFICE WEATHER STATION,1882 – PRESENT (°C)

Statistic		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Maximum	*Mean*	32.4	31.4	29.3	25.0	20.5	16.6	16.0	18.1	21.7	25.4	28.6	31.3	24.7
	Lowest	23.7	23.7	25.4	22.4	16.6	13.2	13.7	14.4	17.5	21.0	24.2	26.9	22.7
	Median	32.4	31.6	29.2	24.8	20.7	16.7	16.0	18.0	21.6	25.3	28.6	31.3	24.7
	Highest	38.5	36.9	33.1	28.8	23.1	19.3	18.9	22.2	25.9	29.7	33.7	36.0	27.5
Mean Minimum	*Mean*	16.6	16.1	13.6	9.1	5.1	2.9	1.6	2.5	5.1	8.8	12.1	14.8	9.0
	Lowest	12.4	11.2	9.1	5.0	0.7	-3.1	-4.2	-1.1	1.8	3.8	6.8	11.2	5.5
	Median	16.6	16.1	13.9	8.9	5.3	2.9	1.8	2.4	5.2	8.9	11.9	14.7	9.2
	Highest	22.4	19.5	16.7	14.3	9.6	8.3	5.7	6.0	9.6	12.8	18.6	17.8	11.0

2.2 REGIONAL LANDFORM

The Nandewar Bioregion encompasses 2,701,977 ha, of which 77% is situated in NSW. It is formed on Palaeozoic sedimentary rocks on the western edge of the New England Tablelands with tertiary basalts of Inverell and Kaputar (NSW NPWS, 2003). The bioregion features ranges, tablelands, dry rainforest, but is characterised by box woodlands (agriculturally productive areas) and ironbark/cypress pine communities (less productive areas).

The Project Area is situated in the Peel subregion, which is comprised of fine-grained Silurian to Devonian sedimentary rocks that are strongly folded and faulted with marked northwest alignment. Areas of sub-horizontal carboniferous shales and sandstones, basalt caps and outcrops of Serpentine and limestone are also present. Characteristic landforms in this subregion include low peaked hills, basalt caps with dissected flows, moderate slopes and flat river valleys, with karst landscapes present areas with limestone geology. Soils vary across the subregion dependent on geology and landform, with shallow stony soils on ridges, texture contrast soils on all slopes (red brown on upper slopes, yellow on lower slopes), black earths on basalt, and fertile alluvial loams and clays (NSW NPWS, 2003).

Part of the MacIntyre, Gwydir and Namoi catchments are located in the Nandewar bioregion and the Peel, Macdonald, McIntyre, Namoi, Severn and Gwydir rivers flow through it. The Project Area is located within the Namoi Catchment, which occupies an area of 42,000 km^2, or 4% of the Murray-Darling Basin (MDBA, 2023). The catchment features seven major tributaries, three major distributaries, and three major dams, supporting a range of water uses including irrigated agriculture, urban water supply, stock and domestic, mining.

2.3 REGIONAL LAND USE

The New England and North West region has an area of 98,000 km^2, and is considered an agricultural powerhouse with highly fertile soils (NSW Government, 2024). As such, the predominant land use in the region is primary agriculture, however urban areas, operational mines, forestry, national parks and state forests are also present.

The region encompasses 12 LGAs, including Tamworth Regional LGA, in which the Project is located. Tamworth Regional LGA aligns with the pattern seen in the New England and North West Region, with agriculture representing dominant land use. Agricultural land use is discussed in further detail below.

2.3.1 AGRICULTURAL LAND USE

As discussed, agriculture is a key industry in the region, with fertile soils facilitating a diverse range of livestock and cropping practices. The Tamworth Regional LGA has a total area of 9,884 km^2, of which 8,712 km^2 (88%) is used for agricultural production (NSW DPIRD, 2024).

Livestock grazing is the most extensive agricultural commodity with regard to land use area, with cattle, sheep, and lamb farming common across Tamworth Regional LGA. Poultry and pig farming is also common but represents a more limited agricultural land use by area. Land use for cropping also represents a much smaller area, and is dominated by cereals, including wheat, oats, and barley for grain. Cotton, oilseeds (canola), legumes (lentils, lupins), hay and sileage are also present. **Table 2-3** summarises the broad land use in the Tamworth Regional LGA. The Project Area has been historically cleared for agricultural purposes and is currently utilized for the grazing of cattle and stock horses.

TABLE 2-3 BROAD LAND USE CATERGORIES, TAMWORTH REGIONAL LGA

Agricultural Land Use	Area (ha)	% Total Area	% Agricultural land
Livestock Production	755,100	76	87
Grazing native vegetation	*532,400*	*54*	*61*
Grazing modified pasture	*221,600*	*22*	*25*
Cropping	115,700	12	13
Nature conservation	62,500	6	-
Forestry (native and plantation)	25,500	3	-
Urban and infrastructure	18,200	<2	-
Water	11,100	<1	-
Horticulture	347	<1	-

Source: AgTrack – Agricultural and Land Use Dashboard. Dataset obtained from NSW Landuse 2017 v1.2.

2.3.2 AGRICULTURAL ENTERPRISES

Agriculture is the primary industry in the Tamworth Regional LGA, with an estimated gross value of $305,462,242 in 2021 (ABS, 2022b) (NSW DPIRD, 2024). This is comprised of over 700 businesses and 1,440 employed persons, which accounts for 26% of the registered businesses and approximately 5% of employment within the LGA (NSW DPIRD, 2024).

Traditionally, the region was strongly associated with the wool industry, however the decline in this sector has led to an increase in cropping and cattle production. Beef cattle is now the dominant agricultural industry in the region, contributing significantly to the local economy. The total gross value of agricultural sectors is highlighted in **Table 2-4**.

TABLE 2-4 GROSS VALUE BY COMMODITY, TAMWORTH REGIONAL LGA 2021-2022

Agricultural Enterprise	Gross value	
	$	%
Livestock Slaughter	230,394,999	75
Cattle and Calves	*120,620,367*	*39*
Poultry	*96,168,155*	*31*
Sheep and Lambs	*13,460,356*	*4*
Pigs	*96,604*	*<1*
Other	*49,517*	*<1*
Cropping	41,987,458	14
Livestock Products	33,079,785	11
Milk	*14,800,000*	*5*
Wool	*10,000,000*	*3*
Total	**305,462,242**	**100**

Source: ABS, Value of Agricultural Commodities Produced, Australia 2020-2021

2.3.3 AGRICULTURAL INFRASTRUCTURE

The region is well serviced by transport infrastructure, which is critical in ensuring agricultural commodities can reach national and international markets without incurring heavy freight costs. There are two major highways in the region, the New England Highway and Newell Highway, both of which have been significantly upgraded in the past 30 years to support increased agricultural freight. The region is also serviced with rail access to the main NSW bulk shipping port in Newcastle. The region is also well-serviced with energy infrastructure (gas and electric), water and wastewater infrastructure, crucial for agricultural practice.

The Project Area is in close proximity to the New England Highway (<2 km west by road), which provides direct access to the city of Tamworth (40 km north by road), and a large agricultural service centre containing a range of agricultural businesses. Tamworth Regional Livestock Exchange is located 53.3 km (by road) north of the Project Area and is one of NSW's strongest store markets.

3. SITE CHARACTERISTICS AND LAND USE DESCRIPTION

3.1 ZONING

The Project Area encompasses 17 freehold individual lots and one Crown land lot (refer **Table 3-1**), and is entirely zoned as RU1 – Primary Production under the Tamworth LEP. The objectives of this zone are:

- *"To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area;*
- *To minimise the fragmentation and alienation of resource lands;*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones;*
- *To permit subdivision only where it is considered by the Council to be necessary to maintain or increase agricultural production;*
- *To restrict the establishment of inappropriate traffic generating uses along main road frontages;*
- *To ensure sound management of land which has an extractive or mining industry potential and to ensure that development does not adversely affect the extractive industry; and*
- *To permit development for purposes where it can be demonstrated that suitable land or premises are not available elsewhere."*

Under the provisions (Clause 2.36) of *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&I SEPP), electricity generating works' (Clause 2.35 of the T&I SEPP) can be carried out with development consent on land within a prescribed rural zone. Under the T&I SEPP RU1 is a prescribed rural zone. The Project is therefore permissible with consent.

TABLE 3-1 LAND TITLES WITHIN THE PROJECT AREA

Lot	DP	Tite
1, 2, 14, 15, 16, 17, 19, 20, 22	755341	Freehold
2, 3, 4, 5, 6, 7	1108524	Freehold
3, 4	114643	Freehold

3.2 PROJECT LANDSCAPE

The Project Area generally comprises flat open plains with gentle undulations, transitioning into low-lying hills and ridges. The elevation ranges from approximately 640 m near the south-west boundary, to approximately 566 m in the northern area around Tamarang Creek, which runs through the centre of the Project Area. The land slopes up from Tamarang Creek to low-lying ridges present on the eastern and western boundaries. The topography of the Project Area is displayed in **Figure 3-1**.

Tamarang Creek is the only named watercourse within the Project Area, flowing north to its confluence with Sugarloaf Creek, which traverses the western boundary of the Project Area. Man-made dams and a range of intermittent, ephemeral streams are also present (refer **Figure 3-1)**

There is a single existing dwelling and ancillary structures located at the western section of the Project Area, with two existing 330 kV overhead transmission line traversing the Project Area, running in a north-south alignment on both the eastern and western boundaries. Bulls Road (unsealed council road) and access tracks used for current farming activities are also present. **Figure 1-2** above identifies the existing infrastructure within and surrounding the Project Area.

3.3 AGRICULTURAL LAND USE

3.3.1 EXISTING

A review of the NSW Landuse 2017 v1.2 mapping from the NSW Government Central Resource for Sharing and Enabling Environmental Data (SEED) Portal (DPE, 2017) identified the following land uses within the Project Area:

- Grazing modified pastures; and
- Cropping.

The Project Area is utilised for the grazing of cattle and horses as its primary land use, with areas of small scale cropping also observed during the survey. General agricultural improvements are also present within the Project Area, including cattle yards and sheds, troughs, unsealed access tracks, stock fencing and gates, man-made dams, erosion banks and water pumps.

NSW Landuse data and satellite imagery indicates that neighbouring land uses also primarily comprise of grazing and cropping, with agricultural improvements (particularly fencing) observed throughout the locality during the survey.

There were no intensive plant or livestock agricultural practices observed within the immediate vicinity of the Project Area.

3.3.2 HISTORIC

A review of the NSW Landuse 2007 mapping identified that the Project Area was exclusively utilised for grazing purposes, indicative that cropping may be a recently introduced farming practice. Based on observations whilst on-site, regional agricultural trends and soil and land capability, it is determined that land within the Project Area has been historically cleared for livestock grazing. This is further supported by the findings from the Preliminary Biodiversity Assessment undertaken as part of the Scoping Report for the project (ERM, 2025), which characterised the vegetation as fragmented and highly typical of land that has been historically cleared and grazed.

3.4 EXISTING SOILS INFORMATION

An online review of soil characteristics was undertaken to identify the mapped characteristics of the Project Area. Information was extracted from the NSW SEED Portal (DPE, 2017), including the following datasets:

- The IRBA; which provides classification of bioregions and subregions across Australia and its external territories (excluding Antarctica);
- The Australia Soil Classification (ASC) Soil Type map of NSW, which provides soil types across NSW using the ASC at Order level;
- The LSC mapping of NSW, which depicts the capability and limitations of land for sustaining certain land uses; and
- The BSAL, which presents land with high quality soil and water resources for sustaining agriculture.

A desktop investigation of soil profile and soil map information by:

- Search of eSPADE data for NSW (DPIE, 2024), including Soil Profiles and Hydrologic Soil Groups.

3.4.1 SOIL TYPES

A search of the ASC Soil Type Map of NSW via SEED and eSPADE indicates that the Project Area is dominated by chromosols, with dermosols also present (refer **Figure 3-2**).There are no existing soil profiles within the Project Area. However, there are four soil profiles on sites within 5km of the Project Area. These soil profiles are described in **Table 3-2.**

TABLE 3-2 EXISTING SOIL PROFILES WITHIN 5KM OF PROJECT AREA

Soil Profile	Survey Date	Distance	Horizons	Physiography	ASC Soil Type	Surface pH
1000493-4	13/01/93	1.9 km N	4	Footslope in hills under woodland grass understorey on siltstone/mudstone lithology and used for improved pasture. Slope 3% (measured), local relief low (30-90 m), elevation 538.0 m, aspect east. Surface condition is hard set, profile drainage is poorly drained, erosion hazard is high, and no salting evident.	Chromosol	5.5
1000493-5	13/01/93	3.0 km N	2	Hillcrest in hills under woodland grass understorey on siltstone/mudstone lithology and used for voluntary/native pasture. Slope 4% (measured), local relief low (30-90 m), elevation 510.0 m, aspect east. Surface condition is hard set, profile drainage is mod. well drained, erosion hazard is high, and no salting evident)	Chromosol	6.0
1000493-6	13/01/93	4.3 km N	3	Fan in low hills under woodland grass understorey on siltstone/mudstone lithology and used for voluntary/native pasture.	Chromosol	6.0

Soil Profile	Survey Date	Distance	Horizons	Physiography	ASC Soil Type	Surface pH
				Slope 1% (measured), local relief low (30-90 m). Surface condition is hard set.		
1000493 - 3	13/01/93	3.6 km SW	3	Plain in alluvial plain under woodland grass understorey on siltstone/mudstone lithology and used for improved pasture. Slope 2% (measured), local relief high (90-300 m), elevation 590.0 m, aspect east. Surface condition is hard set, profile drainage is imperfectly drained, erosion hazard is high, and no salting evident	Sodosol	6.0

Source: NSW eSPADE (DPIE, 2024)

3.4.2 LAND AND SOIL CAPABILITY

The NSW Land and Soil Capability Assessment Scheme describes and maps eight LSC classes (OEH, 2012). The classification is based on the biophysical features of the land and soil (including landform position, slope gradient, drainage, climate, soil type and soil characteristics) and susceptibility to hazards (including water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement), and is presented in **Table 3-3**.

The Project Area is predominantly located on land mapped as Class 4 (Moderate capability land) and Class 5 (moderate-low capability land), with a small patch of Class 6 (Low capability land) in the southern section (refer **Figure 3-3**).

TABLE 3-3 LAND AND SOIL CAPABILITY SCHEME CLASSIFICATION

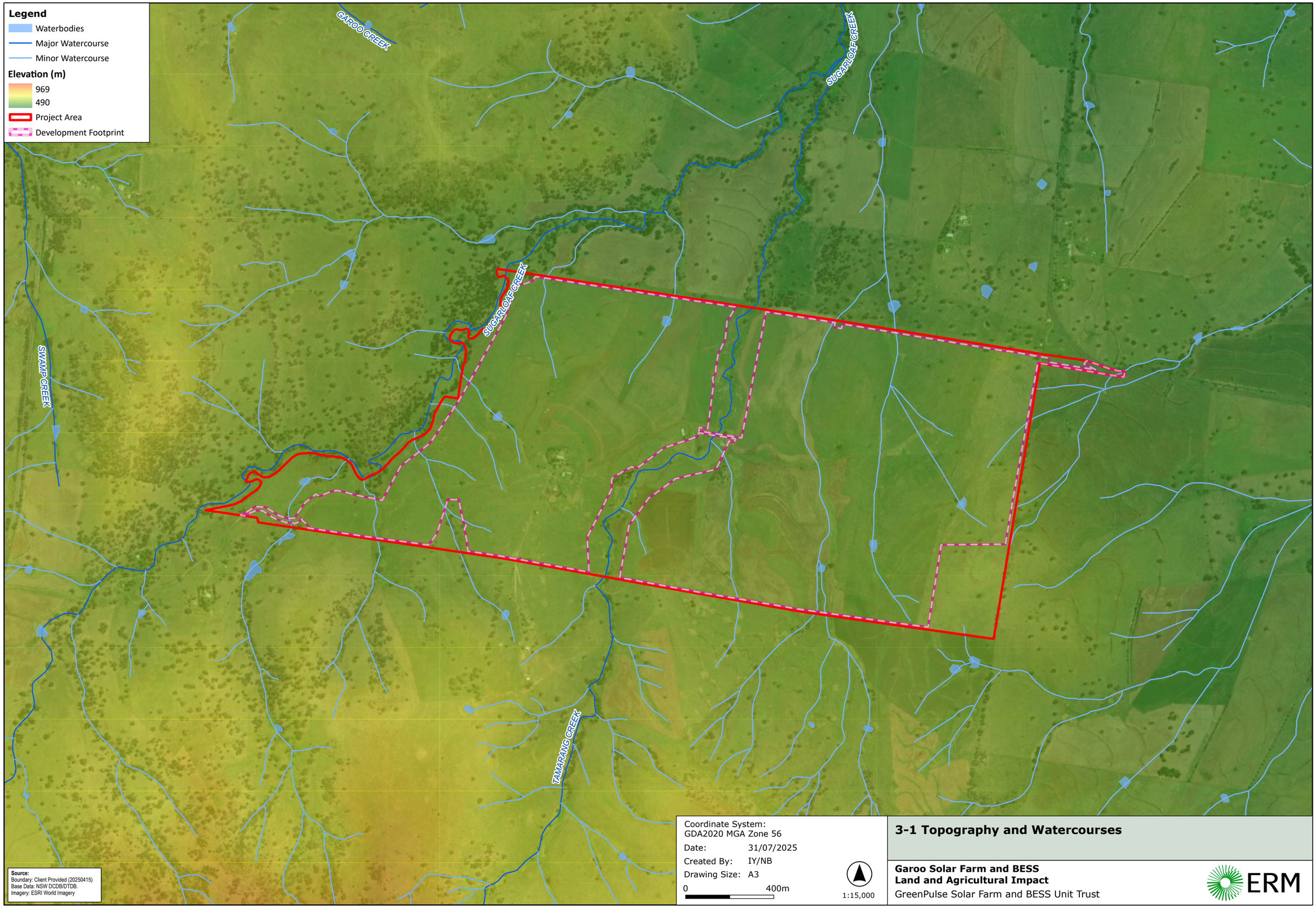
LSC Class	General Definition
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation).	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping and cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.

LSC Class	General Definition
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, gazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. Onsite and offsite impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

3.4.3 STRATEGIC REGIONAL LAND USE POLICY MAPPING

The NSW Government's Strategic Regional Land Use Policy designates strategic agricultural land throughout the state. This includes Biophysical Strategic Agricultural Land (BSAL), which is distinguished by unique natural resource characteristics.

There is no BSAL mapped within the Project Area, with the closest BSAL area located 2.3 km east.



Coordinate System:
GDA2020 MGA Zone 56

Date: 31/07/2025

Created By: IY/NB

Drawing Size: A3

0 400m

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3-1 Topography and Watercourses

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R0.aprx

Legend

- Project Area
- Development Footprint
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse

Regionally Mapped Soil Types

- Chromosols (CH)
- Dermosols (DE)
- Ferrosols (FE)
- Vertosols (VE)

GAROO CREEK
SUGARLOAF CREEK
SUGARLOAF CREEK
NEW ENGLAND HIGHWAY
SWAMP CREEK
GAROOROAD
BULLSROAD
TAMARANG CREEK

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DTDB, NSW SEED.
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56
Date: 31/07/2025
Created By: IY/NB
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3-2 Australian Soil Classification- NSW Mapping

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R0.aprx

Legend

- Project Area
- Development Footprint
- Primary Road
- Road
- Track-Vehicular
- Major Watercourse

Land Capability Classification

- 3 - Moderate limitations
- 4 - Moderate to severe limitations
- 5 - High limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations

GAROO CREEK
SUGARLOAF CREEK
TAMARANG CREEK
SUGARLOAF CREEK
NEW ENGLAND HIGHWAY
SWAMP CREEK
BULLS ROAD
GAROO ROAD

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DTDB, NSW SEED.
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56
Date: 31/07/2025
Created By: IY/NB
Drawing Size: A3
0 400m
1:15,000

3-3 Land and Soils Capability - NSW Mapping

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R0.aprx

3.4.4 MAPPED SOIL LANDSCAPE

The soil landscapes mapped across the Project Area are summarised in **Table 3-4**.

TABLE 3-4 MAPPED SOIL LANDSCAPE WITHIN THE PROJECT AREA

Soil Landscape	Soil Distribution	Dominant Soil Materials	Limitations
Fullwoods Hill (fh)	Soils can be highly variable depending on geology. Crests are generally dominated by moderately well drained Haplic Red Chromosols (non-calcic brown soils), slopes by shallow, moderately well-drained Vertic Red Chromosols (red-brown Earths) and lower slopes by poorly drained Yellow and Brown Sodosols (Solodic Soils). Deep, well-drained Red Ferrosols (Euchrozems) can grade into very deep, moderately well-drained Black and Brown Vertosols (Black Earths; Brown Clays) in areas where soils derive from clay mineral-rich rocks.	• **fh1** - Hardsetting silty loam topsoil (A1, A2 horizons); • **fh 2**—Hardsetting structured clay loam topsoils (A1 horizons); • **fh 3**—Seasonal cracking silty clay loam (A1 horizons); • **fh 4**—Yellowish brown heavy clay subsoils (B2, B22 horizons); • **fh 5**— Brown heavy clay subsoils (B1, B2, C horizons); and • **fh 6**—Yellowish red structured clay subsoils (B2, B3 horizons)	• Erosion risks (inherent and sheet); • Localised poor moisture availability; and • Shallow soils.
Round Hill (rh)	The landscape features various soil types, including very deep, moderately well-drained Brown Chromosols (Non-calcic Brown Soils), moderately deep, moderately well-drained Red Chromosols (Non-calcic Brown Soils), and moderately deep, moderately well-drained Red Ferrosols (Euchrozems). Crests and certain outcrop areas typically have shallow, well-drained Paralithic Leptic Rudosols (Lithosols), while lower slopes are characterized by deep, imperfectly drained Brown Sodosols (Soloths).	• **rh1**—Hardsetting loamy topsoils (A1 horizons); • **rh2** - Hardsetting heavy clay topsoil (A1 horizons); • **rh3** - Bleached silty A2 horizons (A2e horizons); • **rh4** - Brown structured clay subsoils (B2, B22, 2B2 horizons); and • **rh5** - Reddish structured clay subsoils (B2 horizons).	• Poor moisture availability; • High run on; • Shallow soils; and • Sheet erosion risk.
Parnell (pl)	Rounded crests and gentler upper slopes are primarily covered by moderately deep, moderately well-drained Red Chromosols (Non-calcic Brown Soils). Rocky crests and outcrop areas typically feature shallow, moderately well-drained loamy Tenosols and Rudosols (Lithosols).	• **pl1**—Loose red brown topsoil (A1 horizons); • **pl2**—Hardsett ing red and brown topsoils (A1 horizons); • **pl3**—Seasonal cracking, brown topsoil (A1 horizon).; • **pl4**—Massive brown subsoil (B2 horizon);	• Localised dieback; • Erosion risk (inherent, gully, sheet); • High run-on; and • Shallow soils.

Soil Landscape	Soil Distribution	Dominant Soil Materials	Limitations
	Mid to lower slopes are mainly dominated by moderately deep, moderately well-drained Red Chromosols (Non-calcic Brown Soils) or moderately deep, imperfectly drained Brown Vertosols (Brown Clays), depending on the prevailing geology.	• **pl5**—Moderately pedal red brown subsoil (B2 horizons); • **pl6**—Strongly pedal brown subsoil (B2, B3 horizons); and • **pl7**—Yellow subsoil (Bb, B22 horizons	
Wangarang (wn)	Upper foot slopes are generally dominated by deep to giant, well-drained Red Dermosols (Euchrozems) with occasional Red Chromosols (Non-calcic Brown Soils). Mid to lower slopes are dominated by deep to giant, imperfectly drained Brown Sodosols (Soloths; Solodic Soils).	• **wn1**—Hard setting clay loamy topsoils (A1, Ap horizons); • **wn2**—Light coloured loamy A2 horizons (A2e horizons); • **wn3**—Yellowish brown structured subsoils (B2 horizons); and • **wn4**—Structured reddish brown subsoils (B2, 2B2 horizons)	• Localised dieback; • Erosion risk (inherent, gully, sheet); • High run-on; and • Localised dryland salinity.
Duri (du)	Extremely complex due to rapid changes in the underlying lithology. It is primarily dominated by duplex soils, such as moderately deep, moderately well-drained Red and Brown Chromosols (Non-calcic Brown Soils; Red-brown Earths), with occasional shallow, very well-drained Rudosols (Lithosols) around rock outcrops. Along drainage lines and on sodic bedrock, deep, imperfectly drained Red Vertosols (Red Clays) and deep to very deep, imperfectly drained Red and Brown Chromosols (Non-calcic Brown Soils), along with some Sodosols (Solodic Soils), are also present	• **du1**—Hard setting brown clay loams (A1 horizons); • **du2**—Structured heavy clay topsoils (A1 horizons); • **du3**—Bleached silty clay (A2, A2e horizons); • **du4**—Brown light to medium clay (B1, B2, B22 and BC horizons); • **du5**—Red medium heavy clay (B2, B22 horizons); and • **du6**—Red heavy clay (B2 horizon).	• Erosion risk (inherent, gully, sheet, wind); • Localised dieback; • Poor drainage; • High water tables; • High run-on; • Localised dryland salinity; • Seasonal waterlogging; and • Shallow soils •
Moan (mn)	Exhibits predictable soil distribution based on landform elements. Upper slopes and mid slopes are predominantly feature shallow moderately well drained Haplic Eutrophic Red (or black) Chromosols. Haplic Self-mulching Black Vertosols (Black Earths) dominate lower slopes, with Red Ferrosols (Euchrozems) also present.	• **mn1** - Black crumbly clay loams and clays (A11, A1 horizons); • **mn2** - Reddish brown crumbly clay loams and clays (A11, A1 horizons); • **mn3 -** Reddish brown polyhedral clay subsoils (B2 horizons); and • **mn4 -** Reddish brown prismatic clay subsoils (B2 horizons).	• High run on; • Potential saline aquifer recharge zone; • High water erosion hazard; • Shallow soisl; • Sporadic rock outcrop; and

Soil Landscape	Soil Distribution	Dominant Soil Materials	Limitations
	Isolated occurrences of Black Dermosols (Chocolate Soils/Prairie Soils) has been observed on slopes adjacent to rock outcrops, with isolated rock outcrop areas featuring Rudosols and Tenosols.		• Soil materials may have high plasticity, low wet bearing strength, high foundation hazard, high organic content, and localised stoniness.

Source: NSW eSPADE (DPIE, 2024)

3.4.5 ADDITIONAL SOIL DATA

Additional soil characteristics and soil mapped information within the Project Area, obtained from the NSW eSpade datasets, are summarised in **Table 3-5**.

TABLE 3-5 ADDITIONAL SOIL CHARACTERISTICS WITHIN THE PROJECT AREA

Characteristic	Description
Soils Hydrologic Groups	Hydrological Grouping of soils in NSW is a four class system, which identifies the soils infiltration and permeability characteristics. Across the Project Area, the soils are assigned a rating of C, representing the soils having slow infiltration. This soil class can be described as: • C –soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate for water transmission.
Soil Regolith Stability	The Project Area is not currently mapped for Soil Regolith Stability (aka. soil erodibility) and therefore is not assigned a classification.
Modelled Soil Erosion Hazard	The modelled soil erosion (bare) across the Project Area is <20 -500 t/ha/year, presenting a moderate to high erosion potential and potentially significant limitations.
Soil Acidity	Soil acidity modelling demonstrates that across the Project Area, surface soil acidity ranges between a pH of 5 and 6.0 in the 0-30 cm layer. These soil pH characteristics are not considered to be restrictive to construction activities or any revegetation activities that may be required.
Inherent Soil Fertility	The modelled inherent soil fertility across the Project Area is predominantly mapped as Moderate (3), with a small patch of Moderately high (4) in the south-west corner.
Acid Sulfate Soils	The Project Area is not mapped within a known area of acid sulphate soils. Therefore, the probability of encountering acid sulphate soils within the locality is low.
Great Soil Groups	The Project Area is mapped as: • Non-calcic Brown soils; • Red-brown Earths/Euchrozems; and • Chocolate soils
Soil Hazard Features	
Acidification	• 3 – Moderate limitations.
Mass Movement	• 1 - Very slight to negligible limitations; and • 5 – Severe limitations.
Water erosion	• 3 – Moderate limitations; • 4 – Moderate to Severe limitations; and • 5 – Sever limitations
Waterlogging	• 1- Very slight to negligible limitations; and • 2 – Slight but significant limitations
Wind erosion	• 1 - Very slight to negligible limitations

Source: NSW eSPADE (DPIE, 2024)

3.5 SOIL VERIFICATION SURVEY

ERM undertook a soil verification survey on 3 December 2024. A total of 16 sites were tested within the Project Area, 15 of which were located within the proposed Development Footprint (refer **Figure 3-4**). The locations of the sample sites were selected to gain representative spatial coverage across the Project Area. As the proposed Development Footprint is approximately 305.43 ha, the sampling density equates to 1 sample per 20.2 ha, which satisfies the required sampling requirements from the Solar Guideline (1 per 25 ha). Photographs of the soil profile and descriptions are included for each sampling site (refer to **Appendix B**).

At each location, a hand auger was used to advance a Soil Bore (SB) to a minimum depth of 600 millimeters (mm). Where 600 mm could not be reached, the SB was bored until practical refusal.

3.5.1 AUSTRALIAN SOIL CLASSIFICATION

Soils were classified in accordance with the ASC Guide (Isabell, 2021). The characteristics of the soil were logged during the field visit, with lithology descriptions and photographs presented in **Appendix B**.

Based on the sampling undertaken, the Project Area contains three distinct orders of soil, as shown in **Figure 3-4**:

- Vertosols, covering approximately 186.3 ha;
- Chromosols, covering approximately 176.2 ha; and
- Dermosols, covering approximately 6.5 ha.

The soil types, as per the ASC guide, at each sampling location is detailed in **Table 3-6**.

TABLE 3-6 SOIL TYPES (AS PER AUSTRALIAN SOIL CLASSIFICATION)

Sample Site	Soil Depth (m)				Soil Type - Australian Soil Classification
	A1	A2	B1	B2	
SB01	0.0-0.2	0.2-0.7	-	-	Brown Vertosol
SB02	0.0-0.2	-	0.2-0.5	0.5-0.8	Brown Chromosol
SB03	0.03-0.2	0.2-0.4	0.4-0.8	-	Brown Vertosol
SB04	0.02-0.5	-	-	-	Brown Vertosol
SB05	0.0-0.3	0.3-1.0	-	-	Brown Vertosol
SB06	0.0-0.3	0.3-0.8	-	-	Brown Vertosol
SB07	0.0-0.2	0.2-0.6	-	-	Brown Vertosol
SB08	0.05-0.15	0.15-0.3	0.3-0.65	-	Brown Chromosol

Sample Site	Soil Depth (m)				Soil Type - Australian Soil Classification
	A1	A2	B1	B2	
SB09	0.0-0.2	-	0.2-0.5	-	Brown Chromosol
SB10	0-0.15	0.15-0.3	-	-	Red Dermosol
SB11	0.0-0.1	0.1-0.35	-	-	Brown Vertosol
SB12	0.01-0.05	0.05-0.2	0.2-0.6	-	Yellow Chromosol
SB13	0.05-0.15	-	-	-	Brown Chromosol
SB14	0.0-0.2	0.2-0.5	0.5-0.7	-	Grey Chromosol
SB15	0.05-0.2	0.2-0.5	0.5-0.6	-	Grey Chromosol
SB16	0.1-0.3	0.3-0.5	-	-	Brown Vertosol

Chromosols are soils that have a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2t horizon if it is <0.3 m thick) is not sodic or strongly acid (Isabell, 2021). The Chromosols exhibited sandy/sandy-clay properties.

Vertosols are clayey (>35% clay) soils throughout with shrink-swell properties that exhibit strong cracking when dry, and have slickensides and/or lenticular peds at depth (Isabell, 2021).

Red Dermosol were also present in the central - southern section (refer **Figure 3-4**). Dermosols are characterized as soils with a uniform texture and do not meet the diagnostic requirements of a Ferrosol, Chromosol or Vertosol. The Dermosols observed are red throughout, indicating the presence of free iron oxide potentially indicating the presence of Ferrosols (Isabell, 2021), however previous soil surveys in the area have identified these soil - landscapes as Red Dermosols as they do not meet the 5% free iron requirement which has to be specially tested. The discrepancy between these ASC classes does not change the land capability in this case.

Legend

- Project Area
- Development Footprint
- Primary Road
- Road
- Track-Vehicular

Dominant ASC - Order

- Chromosols (CH)
- Dermosol (DE)
- Vertosols (VE)

Sample

- Chromosol
- Dermosol
- Vertosol

NEW ENGLAND HIGHWAY

BULLSROAD

BULLSROAD

GAROOROAD

SB01 VE
SB02 CH
SB03 VE
SB04 VE
SB05 VE
SB06 VE
SB07 VE
SB08 CH
SB09 CH
SB10 DE
SB11 VE
SB12 CH
SB13 CH
SB14 CH
SB15 CH
SB16 VE

Source:
Boundary: Client Provided (20250415)
Base Data: NSW DCDB/DTDB.
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56

Date: 31/07/2025

Created By: IY/NB

Drawing Size: A3

0 400m

1:15,000

3-4 Australian Soil Classification – Field Verified Mapping

Garoo Solar Farm and BESS
Land and Agricultural Impact
GreenPulse Solar Farm and BESS Unit Trust

ERM

0751705_SolarAndBESS_LAI_G003_R0.aprx

3.5.2 LABORATORY ANALYSIS

Samples were collected from the topsoil (A horizon) and subsoil (B horizon). Each sample was submitted to GSG Laboratories, a National Association of Testing Authorities (NATA) Accredited laboratory, for analysis. Laboratory certificates are included in **Appendix C.** Each sample was submitted for the suite of analysis detailed in **Table 3-7**.

TABLE 3-7 SOIL LABORATORY ANALYSIS

Analyte	Methodology
pH[1] ($CaCl_2$ and 1:5 $H_{2O)}$	Rayment & Lyons 2011-4A1 / 4B2
Electrical Conductivity	Rayment & Lyons 2011-3A1
Chloride	Rayment & Lyons 2011-5A2
Cation exchange capacity[2]	Rayment & Lyons 2011-15A1
Exchangeable sodium percentage	
Ca:Mg Ratio	
Particle Size Analysis	SSS Hydrometer plus 0.2 and 2.0 mm Sieving (CSIRO 'Yellow Book')
Emerson Aggregate Test	AS1289.3.8.1-2017

The results from the laboratory analysis provide insight into the chemical and physical properties of the soil, with key analytes summarised in **Table 3-8** and discussed further in the following sections. The full laboratory results from GSG Laboratories is provided in **Appendix C**.

[1] pH ($CaCl_2$) is the preferred measure of acidity, as per DPIs resources on interpreting soil health (DPIRD, 2022). The report considers this value for interpretation of soil acidity
[2] Includes Exchangeable Sodium Percentage (ESP) and Cation Exchange Capacity (CEC), which are indicators of sodicity and soil fertility, respectively.

TABLE 3-8 SUMMARY OF SOIL LABORATORY ANALYSIS – KEY ANALYTES

Sample Site	Horizon	EC (dS/m)	pH ($CaCl_2$)	CEC (cmol/kg)	ESP (%)	EAT		Ca:Mg
						Class	Dispersion Risk	
SB01	A1	0.08	4.95	13.2	1.60	5	Negligible	2.82
	A2	0.04	6.97	38.4	4.20	5	Negligible	1.51
SB02	A1	0.04	5.35	14.0	1.41	5	Negligible	3.80
	B1	0.15	5.62	25.8	3.15	3b	Moderate	3.81
	B2	0.06	7.18	33.5	3.77	5	Negligible	4.59
SB03	A1	0.08	4.90	12.6	1.79	7	Negligible	2.81
	A2	0.30	6.45	39.3	2.40	5	Negligible	2.40
	B1	0.06	7.55	49.7	2.91	4	Negligible	3.04
SB04	A1	0.20	5.91	31.6	1.56	5	Negligible	2.72
SB05	A1	0.18	7.44	42.0	1.64	5	Negligible	3.19
	A2	0.18	7.49	47.2	3.13	5	Negligible	1.66
SB06	A1	0.08	5.25	17.9	1.17	5	Negligible	3.07
	A2	0.06	6.06	30.0	4.61	3b	Moderate	1.57
SB07	A1	0.10	6.87	42.7	0.84	5	Negligible	3.83
	A2	0.06	6.90	40.6	0.93	5	Negligible	2.70
SB08	A1	0.26	7.09	38.0	0.42	7	Negligible	8.59
	A2	0.15	7.49	35.9	0.48	4	Negligible	7.49
	B1	0.17	7.64	49.4	1.08	4	Negligible	4.26
SB09	A1	0.04	4.78	13.4	0.82	5	Negligible	3.92
	B1	0.04	6.27	32.4	0.88	5	Negligible	5.41

Sample Site	Horizon	EC (dS/m)	pH ($CaCl_2$)	CEC (cmol/kg)	ESP (%)	EAT		Ca:Mg
						Class	Dispersion Risk	
SB10	A1	0.04	5.00	9.62	1.35	3b	Moderate	2.93
SB11	A1	0.07	5.01	19.7	1.06	7	Negligible	3.52
	A2	0.04	5.45	21.0	1.00	3b	Moderate	3.54
SB12	A1	0.04	4.61	7.02	2.19	7	Negligible	3.12
	A2	0.04	6.03	19.0	5.15	3a	Moderate	1.09
	B1	0.02	5.32	6.89	3.20	3b	Moderate	2.15
SB13	A1	0.04	5.22	19.3	1.74	7	Negligible	3.73
SB14	A1	0.09	5.38	15.3	1.23	5	Negligible	2.78
	A2	0.04	5.06	15.6	0.98	7	Negligible	3.05
	B1	0.03	5.84	16.8	0.96	3b	Moderate	3.72
SB15	A1	0.06	5.21	17.4	0.90	5	Negligible	2.90
	A2	0.05	6.59	29.6	1.38	5	Negligible	2.90
	B1	0.09	7.09	28.7	1.77	5	Negligible	2.85
SB16	A1	0.11	5.18	22.0	0.67	3b	Moderate	3.31
	A2	0.21	7.36	42.6	0.50	4	Negligible	8.80

For EAT Class Risk: 3a - severe dispersion of the remould; 3b - moderate to slight dispersion of the remould.

3.5.2.1 ACIDITY

The pH was assessed within the A and B horizons for each sample (refer **Table 3-8**).

Within the topsoil, the pH values ($CaCl_2$) ranged from 4.61 (SB12) to 7.64 (SB05). In the subsoil, pH ranged from 5.32 (SB12) to 7.64 (SB08). This is representative of slightly acidic to slightly alkaline conditions, with a larger proportion displaying acidic properties. There does not appear to be any geographical pattern associated with acidity.

Acidic soils can limit the availability of key nutrients, increase toxicity and increase leaching. This may result in lower productivity of the soils within that area. As a large amount of the Project Area was covered by slightly acidic soils, alkalinity levels are not anticipated to present a significant constraint to the agricultural productivity, or to the construction materials.

3.5.2.2 SALINITY

The salinity of the soils was measured through the electrical conductivity (EC), which found that the majority of soils across the Project Area, in both the A and B horizons, were non saline (i.e. EC <0.2 dS/m). Three A horizon samples, SB03, SB08 and SB16, had salinity that was slightly above an EC level of 0.2 dS/m (refer **Table 3-8**); however, the marginal exceedance of this value and sporadic occurrence indicates that the soils remain non-saline. Therefore, risk of salinity within the Project Area is considered to be negligible.

3.5.2.3 SOIL ERODIBILITY

Soil erodibility can be assessed through sodicity and soil aggregate stability. Sodicity represents the dispersity of soil, with sodic soils susceptible to dispersion and waterlogging. Exchangeable Sodium Percentage (ESP) provides a measure of the proportion of cation exchange sites occupied by sodium, with soils considered sodic when ESP exceeds 6%. Soil aggregate stability refers to the stability of soil structure when immersed in water, which is classified using the Emerson Aggregate Test (EAT).

The ESP values and EAT classification (refer **Table 3-8**) indicate that the soils across the Project Area are non-sodic, and are mainly well aggregated with some moderate dispersive soil present. Low sodicity and dispersivity generally indicate that the erosion risk is low and does not present limitations to the activities proposed for the Project Area (i.e. agriculture and construction). On-site observations identified minimal sheet gully erosion throughout the Project Area, suggesting that there is potential for limited erosion to occur.

The ratio of exchangeable calcium to exchangeable magnesium (Ca:Mg ratio) can also be used as an indicator of dispersion, as calcium has a higher affinity for clay particles. Generally, a ratio of 2:1 or greater (which all the sites display) tend to be less prone to dispersion. However, it must be noted that variation in dispersivity across Ca:Mg ratios have been observed across NSW. The Ca:Mg ration observed in the samples further indicate that the soils across the Project Area have low dispersion risk.

3.5.2.4 SOIL FERTILITY

The Cation Exchange Capacity (CEC) can be used as an indicator of soil fertility (Hazelton & Murphy, 2016), as it indicates the soil's ability to hold and supply calcium, magnesium and potassium. Fertile soils usually have a CEC of 10 centimoles of positive charge per kilogram of soil (cmol/kg) or greater (DPIRD, 2022).

The CEC across the Project Area ranged from 6.89 - 49.7 cmol/kg (refer **Table 3-8**), with an mean average value of 26.8 cmol/kg. This is indicative of fertile soils.

Soil fertility is further demonstrated by the quantity of the five exchangeable cations, which all present levels that align with the NSW Department of Primary Industries and Regional Developments (DPIRD) suggested quantity values (SQVs) for fertile soils in NSW (DPIRD, 2022). This indicates the soils are not deficient in key nutrients. As percentages of the CEC, magnesium exchangeable magnesium, sodium and aluminum are elevated above desirable ranges (DPIRD, 2025), although this is not anticipated to impact fertility. **Table 3-9** presents the mean values of five exchangeable cations across the Project Area, and the SQVs and desirable ranges. Detailed values of each individual sample is presented in **Appendix C.**

TABLE 3-9 EXCHANGABLE CATION RESULTS AND SUGGESTED QUALITY VALUES/RANGES

Exchangeable Cation	Mean value (cmol/kg)	SQV (cmol/kg)	Mean % of CEC	Desirable Range (%)
Calcium	19.44	>5	71.6	65-80
Magnesium	6.18	>1.6	23.3	10-15
Potassium	0.67	>0.5	3.1	1-5
Sodium	0.49	<1.0	1.8	0-1
Aluminium	0.03	0	0.2	0

3.6 LSC ASSESSMENT

The 16 soil sampling sites were subject to LSC verification and placed within an LSC class (as outlined in **Table 3-3**). Verification of LSC was conducted in accordance with the *Land and Soil Capability Assessment Scheme* (OEH, 2012), which considers biophysical features of the Project Area, including:

- Water erosion, including sheet, rill and gully erosion;
- Wind erosion;
- Soil structure decline;
- Soil acidification;
- Salinity;
- Waterlogging;
- Shallow soils and rockiness; and
- Mass movement.

The Project Area contains three LSC classes:

- LSC Class 4: moderate capability land, covering 263 ha;
- LSC Class 5: moderate-low capability land, covering 19 ha; and
- LSC Class 6: low capability land, covering 87 ha.

The spatial extent of each LSC class is shown in **Figure 3-5**, and the assessment outcomes for the biophysical features presented in **Table 3-10.**

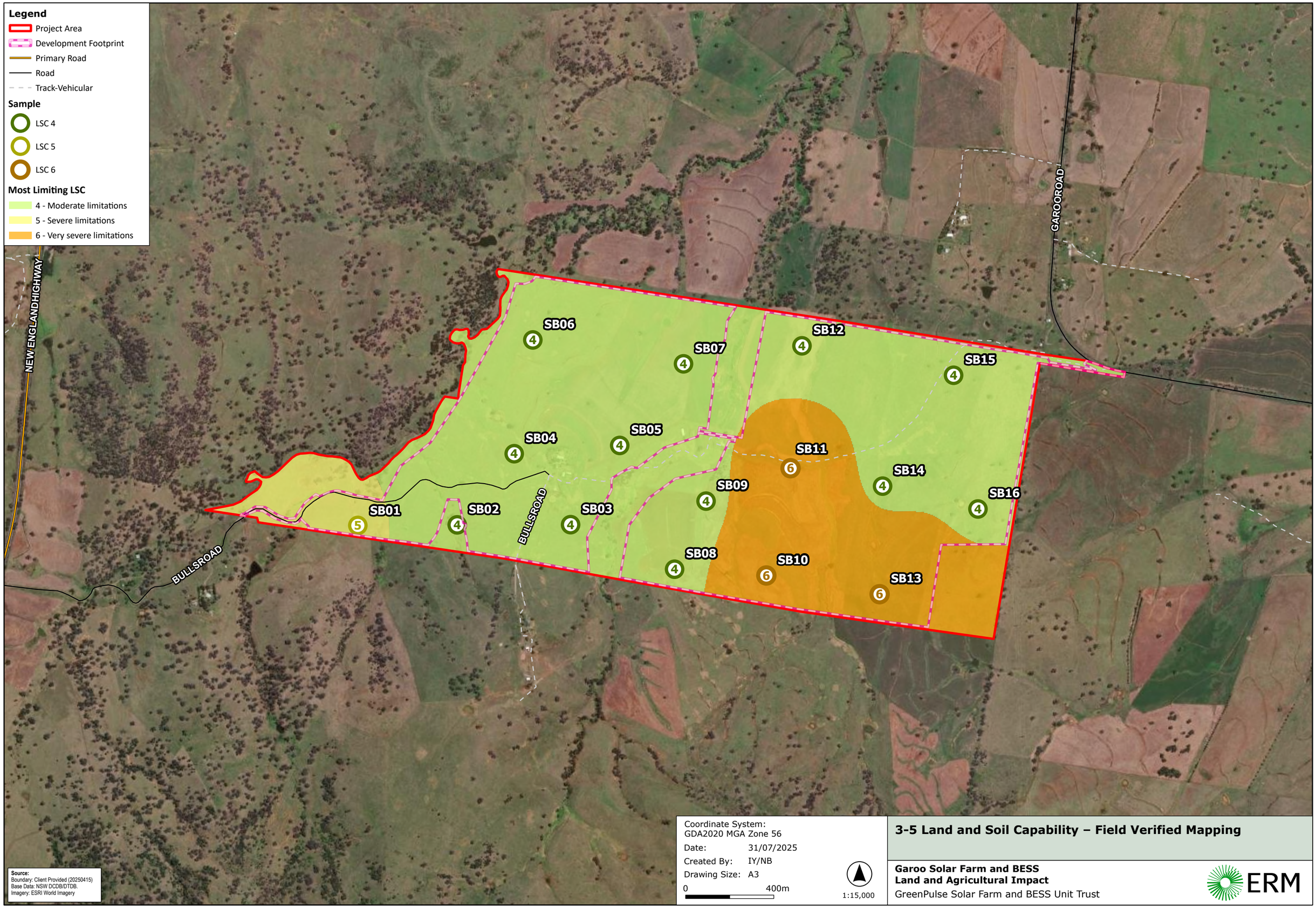
The main hazards/limitations identified across the Project Area include soil depth and wind erosion, which will need to be considered throughout the Project lifecycle to avoid further impacts to these sensitive limiting factors.

Impacts to the LSC classification across the Project throughout the lifetime of the Project are anticipated to be negligible due to the temporary, localized and minimal disturbance that is associated with the construction of the infrastructure. Any changes to the LSC can be managed by respreading stripped topsoil planting native vegetation and other best-practice land rehabilitation efforts, depending on the intended final land use.

TABLE 3-10 LAND AND SOIL CAPABILITY ASSESSMENT OUTCOMES

Sample Site	Water Erosion	Wind Erosion	Soil Structure Decline	Soil Acidification	Salinity	Waterlogging	Shallow Soils & Rockiness	Mass Movement	LSC Class
SB01	3	5	3	3	2	3	4	1*	5
SB02	3	3	4	3	2	2	3	1*	4
SB03	3	4	3	3	2	2	3	1*	4
SB04	3	1	3	3	2	2	4	1*	4
SB05	3	1	4	3	2	2	1	1*	4
SB06	2	3	4	3	2	1	3	1*	4
SB07	2	1	3	3	2	2	4	1*	4
SB08	3	3	1	3	2	1	4	1*	4
SB09	3	3	3	3	2	1	4	1*	4
SB10	3	4	4	2	2	1	6	1*	6
SB11	3	3	3	4	2	2	6	1*	6
SB12	2	3	3	4	2	1	3	1*	4
SB13	3	3	3	4	2	1	6	1*	6
SB14	3	3	3	4	2	1	4	1*	4
SB15	3	3	3	4	2	1	4	1*	4
SB16	3	3	1	4	2	2	4	1*	4

*Mass movement is non-constraining due to the topography of the Project Area



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4. LAND USE CONFLICT RISK ASSESSMENT

A LUCRA is required as part of a Level 2 - Reduced Agricultural Impact Assessment as per the Solar Guideline (DPE, 2022). LUCRA is a system to identify and assess the potential for land use conflict to occur between neighbouring land uses. This process helps land managers and consent authorities assess the possibility for and potential level of future land use conflict, and to identify conflict avoidance or mitigation measures.

The LUCRA is presented in **Appendix A.** This section summarises the objectives, approach and findings of the LUCRA.

4.1 OBJECTIVES

The purpose of this LUCRA is to:

- Accurately identify and address potential land use conflict issues and risk of occurrence before a new land use proceeds or a dispute arises;
- Objectively assess the effect of a proposed land use on neighbouring land uses;
- Increase the understanding of potential land use conflict to inform and complement development control and buffer requirements; and
- Highlight or recommend strategies to help minimise the potential for land use conflicts to occur and contribute to the negotiation, proposal, implementation and evaluation of separation strategies.

4.2 APPROACH

The LUCRA follows the approach stated in the NSW DPI Land Use Conflict Risk Assessment Guide published in October 2011 (DPI, 2011). This process assesses the potential conflicts that may arise between the Project and the surrounding land, whereby each conflict/activity is given a risk ranking according to the probability of occurrence and consequence of the impact. This risk ranking is then re-evaluated following the application of risk reduction management strategies. The key steps in the LUCRA approach are detailed in **Table 4-1**. The methodology, risk reduction strategies, performance targets and monitoring requirements are outlined further in **Appendix A.**

TABLE 4-1 LUCRA APPROACH

Key Steps in LUCRA	Reference
Gather information about proposed land use change and associated activities	**Section 2** and **Section 3**
Identify and evaluate risk level of each activity	**Section 4.3** and **Appendix A**
Identify risk reduction management strategies	**Section 4.3** and **Appendix A**
Record LUCRA findings	**Section 4.3** and **Appendix A**

4.3 KEY FINDINGS

There are 22 risk items that were considered as part of the LUCRA process. Ten significant potential conflicts and six moderate potential conflicts were identified. Following assessment of the proposed mitigation measures, this was revised to five moderate potential conflicts. These potential land use conflicts may require further management and are discussed in the following sections; biodiversity and biosecurity have been addressed together due to similarity of impact. The full LUCRA assessment is included as **Appendix A.**

4.3.1 VISUAL AMENITY

The visual amenity of the Project Area will be impacted by the installation of the solar farm, BESS and associated infrastructure. Conflict relating to visual impacts is common for renewable energy projects. The Landscape and Visual Impact Assessment (LVIA) identified that the Project may impact public viewpoints and non-associated dwellings. Mitigation measures and design considerations outlined in the LVIA (appended to the EIS) will be incorporated to reduce visual impacts, and the Applicant will engage in ongoing consultation with the community to identify and address concerns.

The mitigation measures are detailed in the EIS and LVIA (appended to the EIS)

4.3.2 INCREASED BUSHFIRE RISK

Potential bushfire risks were assessed within the Bushfire Assessment Report and within the Preliminary Hazard Analysis (PHA). Mitigation measures such as Asset Protection Zones (APZ), installation of water tanks, and vegetation management will reduce the potential impact of bushfires to the Project Area and the neighbouring properties.

The mitigation measures are further detailed in the EIS and Bushfire Risk Assessment (appended to the EIS).

4.3.3 DECREASED BIODIVERSITY VALUE AND BIOSECURITY

The biodiversity value of the Project Area may be impacted by the introduction of foreign weeds and pest species. These species might be introduced through the increased vehicles movements throughout project construction or from the importation of foreign materials. Mitigation measures to decrease the impact of weeds and pests on the Project Area have been assessed within the Biodiversity Development Assessment Report (BDAR) (appended to the EIS) and include an assessment of measures to employ that will reduce the risk of impacts spreading to neighbouring properties.

The management of pests and weeds will be addressed through the development of a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP), which will be guided by the Biodiversity Management Plan (BMP) and Vegetation Management Plan (VMP).

Further detail is provided in **Section 5.1.4** of this report, and in the biodiversity section of the EIS and the BDAR (appended to the EIS).

4.3.4 PROPERTY DEVALUATION AND INCREASED LIVING COSTS

Many factors influence land value, and as such the development of the Project could impact the value of surrounding properties. However, construction impacts will be temporary, and the Project has been refined to avoid, minimise or mitigate potential impacts that may cause devaluation. Any impact of the Project on land value and subsequent increased council rates is not anticipated to impact neighbouring agricultural properties, however consultation between the Applicant and surrounding landowners will remain ongoing to address any concerns as they arise.

5. IMPACT ASSESSMENT

5.1 LAND USE FOR AGRICULTURE

Infrastructure areas such as the BESS, switchyard, substation and associated facilities (laydown area, control building) will not be suitable for agricultural use during Project operation. The Project will result in the temporary loss of agricultural land. However, the Applicant is committed to using as much of the Project Area as possible for agricultural purposes for the duration of the operational phase of the Project, limiting the loss of agricultural land and ensuring continuation of agricultural practices. Land being used simultaneously for agriculture and the solar farm is known as agrisolar.

During Project operations, measures will be implemented to maintain the land during the Projects life. These will be detailed within the OEMP, which will be developed during the construction phase of the Project. Following decommissioning and rehabilitation, the land will be returned to its current capability of agricultural productivity.

The agricultural activity that immediately surrounds the Project Area is unlikely to be impacted by the proposed change of land use.

5.1.1 SOILS

The construction of a solar farm typically requires land clearing for the following activities:

- Access tracks;
- Clearing of land for O&M buildings and other ancillary infrastructure;
- Cabling and reticulation trenching; and
- Piling for the solar panel support posts.

The removal of topsoil and soil displacement from the Project is therefore anticipated to be minimal. However, it is noted that there may be some minor landscaping and levelling required as part of the Project detailed design and construction phases. To the extent possible, the Applicant will maintain the existing vegetation and soil structure. Displaced soil will be replaced back in the order that it was displaced (i.e. the subsoil will be replaced prior to topsoil).

Where land clearing is required, the soil will be stripped and stored in small stockpiles for reuse in rehabilitation strategies. By doing so, the long-term impacts will be minimised. The Proponent will progressively rehabilitate the Project Area throughout the construction phase to also reduce the time between soil stripping and rehabilitation of bare earth to manage erosion and dust risks, which will allow the soil stripping process to remain localised.

Localised, progressive rehabilitation, and maintenance of the native vegetation, will allow for the maintenance of the current nutrient availability across the Project Area. If the soil is not rehabilitated or is left unmanaged for a significant period of time, then additional efforts may be required to restore the soil to its current state.

Overall, the impacts to the soils from the construction and operation of the solar farm are estimated to be minimal and temporary to the construction phase. Following operations, it is also anticipated that the soils can be returned to their current state.

5.1.2 WATER RESOURCES

The surface water resources within the Project Area include one named watercourse (Tamarang Creek), farm dams and multiple ephemeral streams. Apart from one culverted bridge crossing in the northern section of the Project Area, Tamarang Creek and its riparian zone has been excluded from the Development Footprint. Four major farm dams have also been excluded to minimise impact during construction and operation. Erosion and sediment control measures will be designed and implemented to prevent run-off during the construction phase (refer **Section 5.1.3**), and a Soil and Water Management Plan (SWMP) will also be developed to minimise impacts on water resources during operation.

The Project is not located in an area identified to be groundwater vulnerable, and no aquatic, terrestrial or subterranean Groundwater Dependent Ecosystems (GDEs) have been identified. The Project is not anticipated to have a significant impact on groundwater resources.

Water is anticipated to be sourced from existing on-site dams, surface water pumps or groundwater bores (subject to seasonal availability and water license permissions) or alternatively from an offsite local source from an approved facility. Water supply agreements would be secured in consultation with Tamworth Regional Council or local water suppliers to ensure adequate water supply is secured for construction and operation.

Further detail is provided in the Surface Water Attachment, which is appended to the EIS.

5.1.3 EROSION AND SEDIMENTATION

The assessment determined that the dispersion risk across the Project Area was low. However, the removal of ground cover may lead to higher levels of erosion hazard. Erosion and sediment control measures were considered within the EIS, with impacts to be addressed through the development of an Erosion and Sediment Control Plan (ESCP). The ESCP will be included within the CEMP.

Further detail regarding erosion and sediment control measures is provided in the Surface Water Attachment, which is appended to the EIS.

5.1.4 BIOSECURITY, PESTS AND WEEDS

Construction activities, intensified vehicle movements and imported materials within the Project Area will increase the risk of pest species (fauna and weeds) being introduced to the region. If introduced, these species could reduce the efficacy of site rehabilitation and future agricultural practices following decommissioning.

The Applicant will prepare a BMP for the duration of the Project, in accordance with the *NSW Biosecurity Act 2015* and NSW Biosecurity and Food Safety Strategy 2022-2030. Once established, it is not considered that there is a significant biosecurity risk to the Project Area or region.

Mitigative measures may include the spraying of weeds. If weed spraying was to be undertaken, measures will be put in place to ensure that the spray does not impact neighbouring agricultural industries. These measures will be detailed within the OEMP, BMP and VMP, as required.

5.1.5 AIR QUALITY AND DUST

Air emissions from the Project are likely to comprise vehicle emissions or dust emissions from bare earth and access tracks during the construction period. However, dust impacts are considered unlikely to be significant. Dust suppression methods such as water spraying will be included within the CEMP and Traffic Management Plan (TMP).

5.2 AGRICULTURAL PRODUCTIVITY

Agriculture is a primary industry within the Tamworth Regional LGA, accounting for 88% of total land use and a total gross value of approximately $305.46 million (2020-2021). The Project Area is 369 ha, which is comprised of 268.81 ha of grazing modified pasture and 100.19 ha of land used for dryland cropping (NSW DCCEEW, 2019). This equates to 0.12% and 0.09% of the land used for livestock production and cropping within the Tamworth Regional LGA respectively.

The NSW Department of Primary Industries Gross Margin Budgets for Livestock (DPIPR, 2024) and Winter Crop (Dryland north-east) (NSW DPI, 2012) can be used to provide a broad estimation of productivity of grazed and cropped land within the Project Area. For beef enterprises, the estimated productivity of grazed land in the Project Area ranges from $42,940.26 - $88,941.16 per annum, whilst the estimated productivity of cropping land ranges from $10,859.59 - $49,845.53 per annum (depending on specific agricultural commodity). The estimated productivity for the main agricultural commodities is summarised in **Table 5-1**, which also provides estimated productivity of grazing land within the Project Area (268.81 ha).

It is noted that the estimated productivity for crops is based on data from 2012, and as such may not be an accurate valuation of current productivity. RaboBank analysed winter crop performance nationally from 2017 – 2024, and forecast the gross margins per hectare for wheat, barley and canola in 2024/25 season (Vitor Pistoia, 2024). Productivity of cropping land within the Project Area (100.19 ha) has been calculated using these metrics and is presented in **Table 5-1.**

Broad productivity estimates can also be calculated based on land use and gross value of agricultural commodities within the Tamworth Regional LGA (refer **Table 5-2**). The overall productivity was estimated at $349/ha for livestock (meat and products combined) and at $363/ha for cropping. Using these assumptions, the annual productivity of the Project Area is estimated to be $93,814.69 for livestock, and $36,368.97 for crops. This calculation does however assume that each commodity within a broad enterprise category is equally proportional to the area used. For example, it assumes that of all livestock commodities (i.e. cattle, poultry, sheep) returns the same productivity per hectare. Additionally, it does not consider the application of agrisolar (refer **Section 6.1**), which would reduce productivity loss.

Whilst these estimates may not be acutely accurate values of productivity, they do provide insight into the economic impact of the land being removed from agricultural use. However, the loss of productivity is considered to be negligible compared to the overall agricultural activity of the New England and North West region. Additionally, the Applicant is committed to using as much of the Project Area as possible for agricultural purposes for the duration of the operational phase of the Project, with only a minimal area (BESS, switchyard, substation) lost during operation. Therefore, the land will still be able to provide agricultural productivity.

There may also be secondary impacts that are associated with the loss of land to agriculture. Within the Tamworth Regional LGA, 5% of the workforce is employed within the agricultural industry (NSW DPIRD, 2024). Other employment opportunities relating to agriculture include:

- Meat and dairy manufacturing;
- Machinery providers;
- Livestock transport;
- Fencing contractors; and
- Chemical and fertilizer providers.

Due to the scale of operation currently occurring on the Project Area, it is considered unlikely that the loss of agricultural productivity would have a material impact to local providers.

TABLE 5-1 ESTIMATED PRODUCTIVITY OF AGRICULTURAL LAND ASSOCIATED WITH THE PROJECT

Enterprise	Estimated Gross Margin ($/ha/yr)	Gross Margin ($/yr) of the Project Area
Beef		
Inland Weaners	159.15	42,940.26
Feeder steers	208.30	55,993.12
Grow-out steers	330.87	88,941.16
Heavy grassfed MSA	216.86	58,294.14
Winter Crop – 2012		
Wheat - short fallow	254.56	25,504.37
Wheat - long fallow	497.51	49,845.53
Wheat - grazing and grain	201.90	20,228.36
Wheat - durum	395.05	39,580.06
Oats	110.11	11,031.92
Barley – feed grade	108.39	10,859.59
Barley – malting grade	165.04	16,535.36
Canola	229.76	23,019.65
Winter Crop – 2024/25 forecast		
Wheat	281	28,153.39
Barley	282	28,253.58
canola	251	25,147.69

Source: NSW DPIDR Gross margins for NSW beef enterprises October 2024
Source: NSW DPI NSW Winter crop Gross Margins budgets, Dryland north-east, Winter 2012
Source: RaboResearch Food & Agribusiness, Australian Winter crop gross margins forecast 2024/25

TABLE 5-2 AGRICULTURAL PRODUCTIVITY ASSUMPTIONS, TAMWORTH REGIONAL LGA

Category	Tamworth Regional LGA Statistic
Livestock	
Total Gross Value – livestock products and meat	$263,474,784
Gross Value – livestock slaughter	*$230,394,999*
Gross Value – livestock products	*$33,079,785*
Total area - Livestock Production (ha)	755,100
Grazing modified pasture (ha)	*221,600*
Grazing native vegetation (ha)	*532,400*
Cropping	
Total Gross Value - Cropping	$41,987,458
Total Area used for Cropping (ha)	115,700

Source: AgTrack – Agricultural and Land Use Dashboard; ABS, Value of Agricultural Commodities Produced, Australia 2020-2021

5.3 LAND TO BE RETURNED TO AGRICULTURE

Following decommissioning, it is anticipated that the Project Area will be rehabilitated to return the primary land use to agricultural activities. All land will be rehabilitated to the same standard as prior to the construction of the solar farm.

Decommissioning and rehabilitation are considered further within the EIS.

5.4 TRAFFIC

Agricultural enterprises may be affected by increased traffic, leading to higher noise and dust levels. Additionally, the cumulative use of road transport for solar farm operations could reduce transport availability for agriculture.

During peak construction, traffic volumes near the Project Area are expected to rise. However, the Traffic Impact Assessment (TIA) (Amber, 2025) concluded that the existing road network has sufficient capacity to accommodate construction traffic, once mitigation measures have been applied. Therefore, the Project's traffic impacts are unlikely to significantly affect agricultural enterprises in the area.

Traffic impacts and mitigation measures are detailed further in the EIS and TIA (appended to the EIS) (Amber, 2025).

5.5 NOISE

Agriculture is only affected by noise when persistently high levels or sudden loud sounds cause increased stress in livestock, leading to reduced production. For example, cattle can generally tolerate moderate noise and adapt to levels between 60-90 dB, but continuous exposure to noise exceeding 90 dB has been shown to have severe effects (Dairy Global, 2017).

A Noise Impact Assessment (NIA) was conducted to assess potential construction and operational noise impacts associated with the Project (ERM, 2025).This determined impacts from noise are anticipated to be relatively low and limited to the construction phase of the Project, and outlines appropriate mitigation measures to avoid or minimise impacts. The CEMP will consider environmental noise limits and implement noise reduction measures.

The EIS and NIA (appended to the EIS) provide further detail on potential noise impacts and mitigation measures.

5.6 CUMULATIVE IMPACTS

The Project has the potential to generate cumulative impacts with other existing, approved or proposed developments in the region. There are several developed, approved or proposed energy-related SSDs within proximity to the Project, as further detailed in the EIS.

Cumulative impacts related to these developments include land use change and loss of agricultural productivity. The relative loss of agricultural productivity against the total regional agricultural productivity, as well as land used for agricultural purpose, is negligible. Impacts of the remaining renewable developments are also considered likely to be low, given the small footprint of the proposed developments within the context of the wider regional area. The applicability of agrisolar also reduces cumulative impacts.

Therefore, given the nature and scale of the agricultural industries within the region, there are not considered to be any significant cumulative impacts arising from the Project.

6. MITIGATION MEASURES

6.1 AGRISOLAR

Agrisolar refers to the co-development of land for use as both a solar facility and agriculture. This approach limits the loss of agricultural land and ensures the continuation of agricultural practices, minimising the impacts to agricultural productivity and enterprises.

This co-development can often be beneficial to both operations. For example, solar panels may provide livestock with shading or shelter from weather condition, whilst livestock grazing is an cost-effective and safe way to maintain vegetation levels (removing the requirement for mowing, spraying etc).

The Applicant is committed to implementing agrisolar, integrating solar panel installation with the existing agricultural use where possible. Project design will consider livestock movements and accommodate agricultural practices during construction and operation.

6.2 SOIL DISTURBANCE

The key impacts associated with the removal of soil were determined to be associated with erosion and soil fertility. Soil disturbance can be managed through:

- The development of a CEMP and OEMP that identifies the location and management of the stripped soil;
- Project design that targets areas of the Project Area that reduce the requirement for large volumes of cut and fill (to the extent practicable);
- Progressive rehabilitation of the Project Area to manage erosion and sedimentation;
- Seeding of bare earth as required (where native vegetation planting is required to reduce the total area of bare earth);
- Routine inspections of the existing vegetation and maintenance of vegetation throughout the Project Area; and
- Weed management strategies to increased native vegetation cover and reduce the spread of invasive species.

If required, soil rehabilitation measures will also be implemented to manage the nutrient availability and soil biological balance. These measures could include applying mulch the area being rehabilitated, application of fertilisers and regenerative farming practices.

6.3 BIOSECURITY

Biosecurity will be managed through the development of a VMP and BMP. These plans will be developed prior to construction and adhered to prior to both the construction and operational phases of the Project and incorporated into both the CEMP and OEMP.

Biosecurity measures that may be considered as part of the Biosecurity Management Plan include:

- Inspection and washdown of all vehicles and plant entering the Project Area;
- The establishment of dedicated biosecurity wash down bays (as required);
- Weed management practices, such as spraying;
- Limited vehicle access to the established internal road network; and

- Pest management practices, as required.

6.4 REHABILITION

During construction, progressive rehabilitation of the Project Area will occur to manage erosion and sedimentation.

At the end of the Project operations, the ground condition will be returned to the condition that existed prior to the Project construction, in accordance with the Decommissioning and Rehabilitation Strategy that will be developed for the Project. A Decommissioning and Rehabilitation Plan will be prepared within 5 years of the completion of Project operations.

6.5 MANAGEMENT PLANS

The following management plans should be developed to ensure that the impacts to land and agriculture are adequately mitigated:

- CEMP; and
- OEMP.

These management plans should include, but be limited to, the following sub-plans:

- Noise and Vibration Management Plan;
- Soil and Water Management Plan;
- Erosion and Sediment Control Plan;
- Traffic Management Plan;
- Waste Management Plan;
- Vegetation Management Plan; and
- Biodiversity Management Plan.

6.6 PROJECT MONITORING

The efficacy of the management measures detailed in the preceding sections will be monitored throughout the life of the project, with the relevant controls to be regularly updated throughout the Project phases. All construction and operational activities will be undertaken in accordance with the approved plans and conditions of consent to reduce identified environmental impacts.

7. CONCLUSION

This assessment has been conducted in accordance with the Large-Scale Solar Energy Guidelines 2022, and considers the impact of the project on land, soil and agricultural resources within the Project and broader Tamworth Regional LGA and New England and North West Region. The assessment was based off a review of desktop sources to establish various mapped soil properties and a field verification survey. The key findings that were Land, Soil and Agriculture Assessment include:

- Soil across 16 sampled sites within the Project Area were classified in accordance with the *Australian Soil Classification* guide and concluded that soils within the Project Area are chromosols, vertosols and dermosols;
- Land and soil capability across the Project Area ranged from Class 4 to Class 6, land ranging from a High to Low capability, with the majority classified as Class 4;
- A LUCRA was conducted that determined that, following assessment of the proposed mitigation measures for the various aspects, there were five aspects remaining that presented a potential moderate impact;
- The loss of annual productivity of the Project Area is estimated to range from $42,940.26 - $88,941.16 per annum for livestock, and 10,859.59 - $49,845.53 per annum for cropping. The calculation for livestock does not consider application of agrisolar, which reduce productivity loss; and
- The Project is anticipated to have a negligible impact on agricultural productivity within the Tamworth Regional LGA and New England and North West Region.

The Project will also result in the maximum temporary loss of 305.43 ha of agricultural land, which equates to approximately 0.04% of land used for agricultural production in Tamworth Regional LGA. This area would be reduced further with the successful implementation of agrisolar.

The Project will have a net positive impact through increased investment in the area and increased employment opportunities. Additionally, the Project will utilise existing electricity infrastructure, reducing the requirement for further agricultural displacement due to increase electricity transmission infrastructure.

The proposed mitigation measures included in **Section 6** will ensure that temporary impacts during the construction phase of the Project can be managed appropriately and will reduce the risk of permanent impacts to the Project Area during the Project operation, decommissioning and rehabilitation phase.

Based on the findings in this report, as well as the proposed mitigation measures for soil management, the long-term impacts of the Project can be appropriately managed and the land can be returned to its current agricultural capability following the life of the Project. Therefore, there are not anticipated to be any permanent impacts to land, soil or agriculture as a result of the Project.

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APPENDIX A LAND USE CONFLICT RISK ASSESSMENT (LUCRA)

Garoo Solar Farm and BESS

Land Use Conflict Risk Assessment

PREPARED FOR
GreenPulse Solar Farm and BESS Unit Trust

DATE
15 May 2025

REFERENCE
0751705

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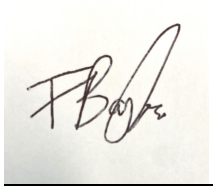
Garoo Solar Farm and BESS

Land Use Conflict Risk Assessment

0751705



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CONTENTS

LIST OF TABLES

TERMINOLGIES, ACRONYMS AND ABBREVIATIONS

Name	Description
Terminologies	
Applicant	GreenPulse Solar Farm and BESS Unit Trust
Project	Garoo Solar Farm and BESS
Project Area	The area to which the development application applies, including temporary and permanent Project infrastructure and areas excluded from development during both construction and operation.
Development Footprint	Represents the land that is directly impacted by the Project, including all temporary and permanent disturbance areas.
Acts, Regulations and Guidelines	
LUCRA Guide	Land Use Conflict Risk Assessment Guide
Solar Guideline	Large-Scale Solar Energy Guideline
Management Plans	
BMP	Biodiversity Management Plan
CEMP	Construction Environmental Management Plan
DRMP	Decommissioning and Rehabilitation Management Plan
ESCP	Erosion and Sediment Control Plan
OEMP	Operations Environmental Management Plan

Name	Description
SWMP	Soil and Water Management Plan
VMP	Vegetation Management Plan
WMP	Waste Management Plan
Acronyms and Abbreviations	
AC	Alternating current
BDAR	Biodiversity Development Assessment Report
BESS	Battery Energy Storage System
CoA	Conditions of Approval
DPI	NSW Department of Primary Industries
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Assessment
EMF	Electro-magnetic field
ERM	Environmental Resources Management Pty Ltd
LAIA	Land and Agricultural Impact Assessment Report
LUCRA	Land Use Conflict Risk Assessment
LVIA	Landscape and Visual Impact Assessment
MW	Megawatt
MWh	Megawatt hour
NIA	Noise Impact Assessment
NSW	New South Wales
ORR	Original Risk Rating
OSOM	Oversize and/or Overmass
PHA	Preliminary Hazard Analysis
RRR	Revised Risk Rating

1. OVERVIEW

A Land Use Conflict Risk Assessment (LUCRA) is required as part of a Level 2- Reduced Agricultural Impact Assessment as per the Large-Scale Solar Energy Guideline (Solar Guideline) (DPE, 2022). LUCRA is a system to identify and assess the potential for land use conflict to occur between neighbouring land uses. This process helps land managers and consent authorities assess the possibility for and potential level of future land use conflict, and to identify conflict avoidance or mitigation measures.

The purpose of this LUCRA is to:

- Accurately identify and address potential land use conflict issues and risk of occurrence before a new land use proceeds or a dispute arises;
- Objectively assess the effect of a proposed land use on neighbouring land uses;
- Increase the understanding of potential land use conflict to inform and complement development control and buffer requirements; and
- Highlight or recommend strategies to help minimise the potential for land use conflicts to occur and contribute to the negotiation, proposal, implementation and evaluation of separation strategies.

This LUCRA has been prepared by Environmental Resources Management Pty Ltd (ERM) on behalf of GreenPulse Solar Farm and BESS Unit Trust (the 'Applicant'), who propose to construct, operate, maintain and decommission the Garoo Solar Farm and Battery Energy Storage System (BESS) (the 'Project') in Garoo, New South Wales (NSW).

Refer to the Environmental Impact Statement (EIS) or Land and Agricultural Impact Assessment (LAIA) (to which this LUCRA is attached) for further detail on the Project.

2. LUCRA METHODOLOGY

The LUCRA follows the revised approach stated in the NSW DPI Land Use Conflict Risk Assessment Guide (DPI, 2011) The approach essentially includes four key steps:

1. Gather information about proposed land use change and associated activities;
2. Evaluate the risk level of each activity;
3. Identify risk reduction management strategies; and
4. Record LUCRA results.

Step 1 – Gather information

Background information regarding the Project has been collected to ensure site specific factors relevant to this LUCRA have been identified and considered. This has been summarised in **Section 3**, with further detail provided in the Land and Agricultural Impact Assessment report (to which this LUCRA is appended).

Step 2 – Evaluate Risk Level

Step two of the LUCRA process uses a 'risk ranking matrix' to identify the risk level of potential land use conflicts, assessing the environmental, public health, amenity and legal impacts according to the 'probability of occurrence' and 'consequence of the impact'.

Each potential land use conflict is assigned a probability score and consequence score, which are both defined by five levels. Probability of occurrence ranges from A-E ('Almost Certain' to 'Rare'), whilst consequence of impact range from 1-5 ('Severe' to 'Negligible'). The probability and consequence levels are defined in **Table 2-1** and **Table 2-2**, respectively.

The risk ranking matrix is then applied to yield an 'Original Risk Ranking', which ranges from 1 to 25. A rank of 25 is the highest magnitude of risk (i.e. an almost certain and severe risk), while a rank of one (1) represents the lowest magnitude of risk (i.e. a rare and negligible risk). The risk ranking matrix is presented in **Table 2-3**. Shaded scores indicate those identified activities which should be at a higher priority for implementing reduction strategies.

TABLE 2-1 LUCRA PROBABILITY LEVELS

Level	Descriptor	Description
A	Almost Certain	Occurs often – will generally occur at least once a year and potentially much more often
B	Likely	Likely to occur – more than 50% chance of occurrence in any 12-month period
C	Possible	Could occur, unlikely to occur in any 12-month period but >50% chance within 5 years
D	Unlikely	Will only occur in unusual circumstances but >50% chance within 20 years
E	Rare	Only occurs in highly exceptional circumstances. <50% chance in any 20-year period

TABLE 2-2 LUCRA CONSEQUENCES LEVELS

Level	Descriptor	Description
1	Severe	• Severe and/or permanent damage to the environment; • Irreversible; • Severe impacts on the community; • Neighbours are in prolonged dispute and legal action involved.
2	Major	• Serious and/or long-term impact to the environment; • Long-term management implications; • Serious impact on the community; • Neighbours are in serious dispute.
3	Moderate	• Moderate and/or medium-term impact to the environment and community; • Some ongoing management implications; • Neighbour disputes occur.
4	Minor	• Minor and/or short-term impact to the environment and community; • Can be effectively managed as part of normal operations; • Infrequent disputes between neighbours.
5	Negligible	• Very minor impact to the environment and community; • Can be effectively managed as part of normal operations; • Neighbour disputes unlikely.

TABLE 2-3 LUCRA RISK RANKING MATRIX

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

Step 3 – Risk Reduction Management Strategies

Activities that score a risk ranking of 10 or lower are considered to low risk for land use conflict and subsequently do not need further management to reduce their potential impact. However, activities assigned a risk ranking greater than 10 require defined controls/measures to reduce the risk of conflict.

To lower the risks values of activities associated with the Project, relevant risk reduction management strategies are established. These consider relevant risk reduction controls/mitigation measures that lower the probability and/or consequence of the activity. The risk ranking is then revised based on the implementation of this strategy. The objective is to identify and define controls that lower the 'Revised Risk Ranking' score to 10 or below.

The risk reduction management strategies are therefore developed to minimise or avoid potential for land conflict to arise. Performance targets are also identified for each management strategy

3. STRATEGIC, REGIONAL AND SITE-SPECIFIC CONTEXT

Background information regarding the Project has been collected to ensure site specific factors relevant to this LUCRA have been identified and considered. These have been detail within the EIS and the LAIA. **Table 3-1** summarises these findings.

TABLE 3-1 SUMMARY OF STRATEGIC, REGIONAL AND SITE-SPECIFIC FACTORS

Site Specific Factors	Summary
Project Description	Construction, operation, and decommissioning of a 155 MW alternating current (AC) Solar Farm and 360 Megawatt (MW) BESS (up to 1,440 Megawatt hours (MWh)) in the rural locality of Garoo. Project Area extends across 369 ha, with a Development Footprint of 305.8 ha
Landform & Climate	The Project Area is characterised by flat open plains with gentle undulations. There is one named watercourse, and multiple farm dams and ephemeral streams. The climate within the region is mostly warm and dry, with frequent high intensity rainfall that follows a summer dominant pattern.
Existing & Historic Land Use	The land within the project Area has historically used for agricultural purposes, and is currently utilised for grazing of livestock and cereal cropping
Regional Context	Agriculture is a major industry within the region. This is primarily comprised of livestock grazing, with cropping and poultry farming also present. .
Strategic Context	The Project aligns with Commonwealth and State strategies, plans and policies regarding renewable energy transition, to the transition to renewable energy greenhouse gas reduction targets and electricity strategies. The Project is located in RU1 zoned land, and aligns with goals, objectives and priority themes of land use planning documents, including the New England North West Regional Plan 2041, Tamworth Blueprint 100, and Tamworth Regional Local Environmental Plan 2010.
Stakeholder Engagement	A Community and Stakeholder Engagement Strategy has been produced in support of the development, which identifies stakeholders and details a robust engagement strategy. Stakeholder engagement and feedback relating to the Project has been utilised to inform this assessment.

4. LAND USE CONFLICT RISK ASSESSMENT

This LUCRA process has identified and assessed the potential for activities associated with the Project to potentially cause land use conflict. The management strategies listed in **Table 4** provide plans to reduce identified potential conflict that originally received a Risk Rating above 10. To ensure these management strategies are successfully implemented, performance monitoring is an important ongoing tool throughout the construction and operation stages of the Project. Performance targets are also outlined in **Table 4.**

4.1 LIMITATIONS AND ASSUMPTIONS

The LUCRA was prepared with the following limitations and assumptions:

- The Project design will not be significantly altered, whereby the findings of the LUCRA are no longer accurate;
- Future developments in the surrounding area and region continue to align with current development plans;
- Agrisolar practice will be implemented successfully;
- The Project will not be exposed to any additional or unanticipated risks/changes, other than those caused by the project. This includes:
  - Variation in biosecurity risks (e.g. large-scale outbreaks of livestock diseases).
  - Large-scale changes to transport infrastructure (e.g new rail system, highway etc).
  - Significant fluctuations/changes in property value in the area.
  - Unpredicted variation in intensity of climate related risks.
- The status of rural land use in the surrounding area is not considered likely to change significantly during the life of the Project.

TABLE 4-1 LAND USE CONFLICT RISK ASSESSMENT AND MANAGEMENT STRATEGY

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
Agricultural Land Use	Loss of agricultural land and degradation of capacity for surrounding land to support agricultural practices	Probability: A Consequence: 3 **ORR: 20**	• The impact the regional agricultural industry has been assessed as part of the agricultural impact assessment. This determined that impact to regional scale agriculture industry is negligible; • Agrisolar practices will be implemented, limiting loss of agricultural land and ensuring continuation of agricultural practices; • The Operations Environmental Management Plan (OEMP) will include provisions to maintain the land during the Projects life; and • A Decommissioning and Rehabilitation Management Plan (DRMP) will be developed to maintain soil and restore the land to its current capability. This will enable the Project Area to be returned to agricultural use at Project cessation.	Probability: D Consequence: 4 **RRR: 5**	• Comply with Conditions of Approval (CoA); • Implement management measures outlined in the EIS and OEMP; and • Return of the land to its current capability at the cessation of the Project operations.
	Loss of future agricultural expansion opportunities	Probability: D Consequence: 3 **ORR: 9**	• Intent for surrounding agricultural industries to expand operations has not been identified; • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise; and • A DRMP will be developed to maintain soil and restore the land to its current capability. This will enable the Project Area to be returned to agricultural use at Project cessation.	Probability: E Consequence: 3 **RRR: 6**	• Comply with CoA; • Receive no complaints from agriculture enterprises regarding expansion opportunities; and • Develop and implement DRMP

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
Disturbance or damage to livestock	Construction and/or operational noise disturbing livestock	Probability: C Consequence: 4 **ORR: 8**	• A Noise Impact Assessment (NIA) has been conducted to assess potential risk of noise generated during construction and operation. Impacts from noise are anticipated to be relatively low and limited to the construction phase of the Project. Appropriate mitigation measures have been detailed in the EIS and NIA; • A Construction Environmental Management Plan (CEMP) will consider environmental noise limits and implement noise reductions measures during construction; • Consultation with potentially sensitive receptors prior to construction start as to potential noise impacts and required mitigations; and • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise.	Probability: D Consequence: 5 **RRR: 2**	• Comply with CoA; • Comply with relevant noise criteria; • Implement all mitigation measures outlined in the EIS and supporting documents, notably the NIA and CEMP; and • Receive no complaints from agriculture enterprises regarding noise impacts on livestock.
	Damage/disturbance resulting from livestock interacting with Project infrastructure	Probability: C Consequence: 3 **ORR: 13**	• The OEMP will include provision to maintain fencing to prevent livestock interaction with the development infrastructure, machinery or vehicles; and • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise.	Probability: D Consequence: 4 **RRR: 5**	• No recorded incidents of livestock interacting with Project infrastructure; and • No complaints regarding damage/disturbance of livestock.

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
Biosecurity	Introduction and/or spread of weeds, pests and disease.	Probability: B Consequence: 2 **ORR: 21**	• The impact of weeds and pests has been assessed as part of this report and within the BDAR, which is appended to this EIS. Appropriate mitigation measures are specified to minimise risk of spread throughout the Project Area and to neighbouring properties. A Biodiversity Management Plan (BMP) and Vegetation Management Plan (VMP) will manage the implementation of these mitigative actions. It is anticipated that compliance with these mitigation measures will adequately mitigate biosecurity risks that are associated with the Project; and • Ongoing consultation with neighbours and DPI industry to identify and manage future biosecurity risks.	Probability: C Consequence: 4 **RRR: 8**	• Comply with CoA; • Implement all biosecurity management measures outlined in the EIS and associated documents (notably BMP and VMP); • Receive no complaints regarding biosecurity..
	Waste generated attracting pests/vermin, impacting agricultural productivity	Probability: D Consequence: 4 **ORR: 5**	• Waste related impacts are assessed in the EIS, which outlines mitigation measures. A Waste Management Plan (WMP) will also be developed to appropriately manage waste generated by the Project. Compliance with WMP and relevant mitigation measures is anticipated to reduce risk of attracting pests; and • Ongoing consultation with neighbours to identify and manage biosecurity risks resulting from waste.	Probability: E Consequence: 4 **RRR: 3**	• Comply with CoA; • Implement mitigation measures in the EIS and WMP; and • Receive no complaints regarding waste/vermin.
Air Quality	Dust generated during construction activities, including movement of heavy vehicles	Probability: D Consequence: 3 **ORR: 9**	• Dust suppression mitigation measures will be included within the CEMP. The CEMP will be developed to implement controls during the construction of the Project such as: ◦ Dust suppression (water application) on exposed areas, in particular unsealed road networks, or excavated areas;	Probability: D Consequence: 5 **RRR: 2**	• Implement mitigation measures outlined in the EIS and CEMP. • No complaints regarding air quality.

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
			◦ Covering of stockpiles during periods of high wind, dry weather and if stockpiles are to be left for long (i.e. >2 days) period of time); and ◦ Progressive rehabilitation of groundcover throughout the construction process. Topsoil to be removed will be stripped in a way that enables it to be maintained and used to the cover bare areas. • Consultation with potentially sensitive receptors prior to construction start as to potential air quality impacts and required mitigations		
	Dust generation from increased traffic movement and general operation.	Probability: D Consequence: 3 **ORR: 9**	• The impact to air quality during operation has been assessed as part of the EIS, and includes mitigation measures to address potential air quality issues; • An OEMP will include provisions to remain compliant with relevant air quality criteria, and outline general maintenance requirements to reduce risk of dust disturbance; and • Ongoing consultation with potentially sensitive receptors to identify any potential air quality issues, enabling mitigative actions to be implemented quickly.	Probability: D Consequence: 5 **RRR: 2**	• Comply with CoA; • Implement mitigation measures outlined in the CEMP. • No complaints regarding air quality.
	Dust from neighbouring land uses impacting efficiency of solar panels.	Probability: E Consequence: 3 **ORR: 6**	• The OEMP will be prepared that will detail the regular cleaning requirements of the solar panels; and • Ongoing consultation with to identify and manage dust emissions.	Probability: E Consequence: 4 **RRR: 3**	• Comply with CoA; • Compliance with relevant air quality criteria; • Implement mitigation measures outlined in the OEMP and EIS; and

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
					• No air quality complaints.
Water Quality	Surface disturbances and associated run-off causing changes to local water quality, quantity and surface water flows.	Probability: C Consequence: 3 **ORR: 13**	• Consideration of water impacts are detailed within the hydrology section of the EIS. This specifies appropriate mitigation measures to avoid, minimise and mitigate impacts to hydrological systems. A Soil and Water Management Plan (SWMP) and/or Erosion and Sediment Control Plan (ESCP) will manage the implementation of these mitigative actions; • Preparation and implementation of a CEMP to ensure that groundcover is maintained, with groundcover to be progressively reinstated; and • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise.	Probability: D Consequence: 4 **RRR: 5**	• Comply with CoA; • Implement mitigation measures as detailed in the EIS, SWMP/ESCP and CEMP; • Compliance with relevant water quality criteria; and • No water quality complaints.
Traffic	Increased traffic movements along local roads, resulting in machinery, infrastructure or livestock damages	Probability: C Consequence: 4 **ORR: 8**	• The Traffic Impact Assessment (TIA) recommended mitigation measures to minimise risk of Project traffic impacting/disrupting other road users. These measures include: ° Development of a Construction Traffic Management Plan (TMP) in consultation with Tamworth Regional Council and TfNSW; ° Neighbours notified regarding timing of major deliveries that may require additional traffic control; ° Timing of heavy vehicle movements to consider local bus schedule; ° Schedule of Oversize and or Overmass (OSOM) vehicle trips to consider other OSOM movements in the area;	Probability: D Consequence: 4 **RRR: 5**	• Comply with CoA; • Implement mitigation measures outlined in the EIS and TMP; • No damage or degradation to local transport infrastructure; • No complaints related to traffic incidents; and • Zero traffic incidents occurring as a result of Project construction and operation.
	Increased traffic movements causing congestion or delay to local road users and agricultural transport vehicles	Probability: D Consequence: 3 **ORR: 9**		Probability: E Consequence: 5 **RRR: 1**	

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
			◦ Implement intersection treatments to accommodate prevent adverse impacts of Project associated traffic; • The TMP to outline a range of traffic management measures in order to ensure the construction traffic would have a minimal impact to the capacity and safety of the surrounding road network. This may include measures such as: ◦ Carpooling program to limit number of vehicles; ◦ Development of a drivers code of conduct; ◦ Relevant signage to be incorporated within the site and around site access points; and • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise management.		
Visual Amenity	Solar infrastructure causing a change in visual amenity for surrounding residents and locals.	Probability: B Consequence: 3 **ORR: 17**	• A Landscape and Visual Impact Assessment (LVIA) has been undertaken as part of the EIS. This determined that there is likely to be impact to public viewpoints along Bulls Road and Garoo Road, and seven non-associated dwellings; • Mitigation measures and design considerations outlined in the LVIA may be incorporated to lower visual impacts. This includes: ◦ Vegetation screening; ◦ Adjusted tracking schedule of the solar modules; and ◦ Height and colour of ancillary structures.	Probability: C Consequence: 4 **RRR: 8**	• Comply with CoA; • Implement mitigation measures and design considerations detailed in the LVIA; and • No complaints regarding visual impacts.

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
			• Consultation with potentially sensitive receptors prior to construction start as to potential visual impacts and required mitigations; and • Ongoing consultation between the Applicant and the community to identify and address concerns as they arise.		
Bushfire	Increased fire hazard, resulting in amplified bushfire risk, damage / loss of assets and potential threat to life / wellbeing.	Probability: C Consequence: 2 **ORR: 18**	• A Preliminary Hazard Analysis (PHA) and Bushfire Impact Assessment have been undertaken as part of the EIS. These are appended to the EIS and specify appropriate mitigation measures to reduce risks of fire, protecting surrounding land from potential incidents; and • Ongoing consultation between the Applicant and the stakeholders to identify and address concerns as they arise.	Probability: D Consequence: 3 **RRR: 9**	• Comply with CoA; • Implement relevant mitigation measures outlined in the EIS and relevant associated documents; • No complaints received regarding fire risk; and • Zero bushfires attributed to the Project.
Biodiversity	Decreased biodiversity value on the project area and associated local areas.	Probability: B Consequence: 3 **ORR: 17**	• Biodiversity was assessed within the Biodiversity Development Assessment Report (BDAR), which is appended to the EIS. This specifies appropriate mitigation measures to avoid, minimise and mitigate impacts to biodiversity where identified. A BMP will manage the implementation of these mitigative actions. It is anticipated that compliance with these mitigation measures will adequately mitigate biodiversity risks that are associated with the Project.	Probability: D Consequence: 3 **RRR: 9**	• Comply with CoA; and • Implement mitigation measures detailed in the EIS, BDAR and BMP.
Waste	Generation of waste during construction and operation.	Probability: C Consequence: 4	• The generation of waste during the construction and operational phase of the	Probability: E	• Comply with CoA; • Implement the WMP; and

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
		ORR: 5	Project has been addressed within the EIS; and • Waste will be disposed at licensed facilities, and a WMP will be developed to manage waste generation for the Project	Consequence: 5 **RRR: 1**	• No complaints from the community relating to waste.
Local infrastructure / services (excluding transport)	Adverse impacts associated with increased demand.		• Consideration of potential impacts to surrounding local services and infrastructure has been undertaken as part of the EIS; • Mitigation measures outlined in the CEMP will minimise the risk of construction activities damaging existing infrastructure; and • Ongoing consultation between the Applicant and the stakeholders to identify and address concerns as they arise.		• Implement all relevant mitigation measures outlined in the EIS and CEMP; • No damage or degradation to local infrastructure; and • No complaints associated with local services.
Socio-economic	Employment	Probability: D Consequence: 5 **ORR: 2**	• A Social Impact Assessment (SIA) has been undertaken to assess the impact of the Project on the local workforce, including availability of seasonal and agricultural workers. This is appended to the EIS and outlines measures to enhance local employment opportunities associated with the Project.	Probability: E Consequence: 5 **RRR: 1**	• Project successfully utilises local workers for construction and operation, where available; and • No complaints regarding employment or local property values.
	Property value and council rates	Probability: B Consequence: 3 **ORR: 17**	• The Project has been refined to avoid, minimise and mitigate adverse impacts on surrounding properties and therefore reduce potential for property devaluation. • Any impact of the Project on land value and subsequent increased council rates is not anticipated to impact neighbouring agricultural properties • Ongoing consultation between the Applicant and the stakeholders to identify and address concerns as they arise	Probability: D Consequence: 3 **RRR: 9**	

Potential Conflict	Associated Activity	Original Risk Ranking (ORR)	Management Strategy (Risk Reduction Measures)	Revised Risk Ranking (RRR)	Performance Target
Health	Impacts of electro-magnetic field (EMF) associated with the Project	Probability: E Consequence: 3 **ORR: 6**	• The PHA undertaken as part the EIS considers EMF impacts, which determined that the potential for EMF to exceed acceptable levels was negligible; and • The Project proposes to use the existing transmission line. Additional transmission infrastructure will be minimal and mainly underground, with key risk associated with localised impacts from the ancillary infrastructure	Probability: E Consequence: 4 **RRR: 3**	• No health issues within the local community or livestock arising from the Project.
Rehabilitation and Decommissioning	Land degradation during decommissioning reducing future agricultural capability	Probability: C Consequence: 2 **ORR: 18**	• Rehabilitation of the Project Area was assessed as part of this report. Proposed mitigation measures are anticipated adequate to enable the land to return to its former land use.	Probability: D Consequence: 4 **RRR: 5**	• Comply with CoA; and • Successful rehabilitation of the Project to current condition following cessation of operations.
Cumulative Impacts	Construction and operational cumulative impacts	Probability: B Consequence: 3 **ORR: 17**	• Cumulative impacts for the Project were considered during the EIS. Appropriate mitigation measures (where required) are specified in the EIS to minimise the potential for cumulative impacts to occur at or near the Project Area.	Probability: D Consequence: 4 **RRR: 5**	• Comply with CoA; and • Implement relevant mitigation measures outlined in the EIS.

5. REFERENCES

DPE. (2022). *Large-Scale Solar Energy Guideline.* NSW Department of Planning and Environment.

DPI. (2011). *Land Use Conflict Risk Assessment (LUCRA) Guide.* Department of Primary Industries .

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APPENDIX B SOIL SAMPLES – PHOTOS AND DESCRIPTIONS

Site ID: SB01

Details	
Coordinates:	Lat: -31.434054°
	Long: 150.899009°
Land Use:	Grazing
Surface Condition:	Hard
Landform:	Hillslope (low)
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic Brown
ASC Classification:	Brown vertosol
LSC Classification	Class 5

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.2	Sand, brown, loose to medium density, subangular
A2	0.2-0.7	Sandy clay, medium stiffness to stiff, non-plastic, brown with light yellow mottle

Site ID: SB02

Details	
Coordinates:	Lat: -31.434108°
	Long: 150.903749°
Land Use:	Grazing
Surface Condition:	Hard
Landform:	Gentle slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.2	Sandy loam, brown, medium dense, medium grained
B1	0.2-0.5	Sandy clay, brown, medium stiffness, friable, non-plastic, medium grained sand
B2	0.5-0.8	Sandy clay, light brown bleached, medium to stiff, non-plastic

Site ID: SB03

Details	
Coordinates:	Lat: -31.434189°
	Long: 150.909155°
Land Use:	Grazing
Surface Condition:	Hard to medium
Landform:	Gentle slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
-	0-0.05	No horizon, clay like sand, brown, loose, medium density,
A1	0.03-0.2	Sandy clay, brown, medium stiffness, non-plastic
A2	0.2-0.4	Sandy clay, red-brown, stiff, friable, non-plastic
B1	0.4-0.8	Sandy clay, light yellow-brown, stiff, friable, slightly bleached

Site ID: SB04

Details	
Coordinates:	Lat: -31.431244°
	Long: 150.906531°
Land Use:	Grazing
Surface Condition:	Hard
Landform:	Midslope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
-	0.0-0.02	Grass
A1	0.02-0.5	Clay, brown, stiff to very stiff, non-plastic, homogenous

Site ID: SB05

Details	
Coordinates:	Lat: -31.430987°
	Long: 150.911569°
Land Use:	Cropping
Surface Condition:	Hard
Landform:	Midslope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.3	Sandy clay, shrink swell, brown, moderate plasticity, soft to medium stiffness, homogenous
A2	0.3-1.0	Sandy clay, brown, medium stiffness, low plasticity, homogenous, minor bleaching

Site ID: SB06

Details	
Coordinates:	Lat: -31.426606°
	Long: 150.907522°
Land Use:	Grazing
Surface Condition:	Hard to medium
Landform:	Upper slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.3	Sandy clay, brown, friable, medium stiffness, non-plastic, homogenous
A2	0.3-0.8	Brown, slight bleaching, medium stiffness to stiff, non-plastic, homogenous

Site ID: SB07

Details	
Coordinates:	Lat: -31.427700°
	Long: 150.914685°
Land Use:	Cropping
Surface Condition:	Hard
Landform:	Flat
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.2	Clay, dark brown, slight bleaching, low plasticity, medium stiffness
A2	0.2-0.6	Clay, brown, stiff to very stiff, non-plastic

Site ID: SB08

Details	
Coordinates:	Lat: -31.436091°
	Long: 150.914074°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Lower slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m) (m)	Description
A1	0.05-0.15	Sandy loam, black / brown, organic matter leachate, fine to medium grained sand, organic matter inclusions.
A2	0.15-0.3	Sandy loam, brown, fine to medium grained sands, medium density,
B1	0.3-0.65	Sandy clay, light yellow / brown, medium stiffness, non-plastic

Site ID: SB09

Details	
Coordinates:	Lat: -31.433331°
	Long: 150.915635°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Midslope
Hydrological group	C
Fertility:	Moderate
Great soil group	Red-brown earths
ASC Classification:	Brown Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.2	Sandy loam, brown, medium density, fine to medium grained sand, subangular.
B1	0.2-0.5	Sandy clay, stiff, non-plastic, brown bleached to light yellow / grey, inclusions of shade.

Site ID: SB10

Details	
Coordinates:	Lat: -31.436418°
	Long: 150.918443°
Land Use:	Grazing
Surface Condition:	Medium
Landform:	Flat
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Red Dermosol
LSC Classification	Class 6

Lithology

Soil Horizon	Depth (m)	Description
A1	0-0.15	Silty sand, red brown, loose, medium grained, non-plastic.
A2	0.15-0.3	Silty sand, red-brown, medium density, fine to medium grained sand, low plasticity.

Site ID: SB11

Details	
Coordinates:	Lat: -31.432052°
	Long: 150.919694°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Upper slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Red brown earths
ASC Classification:	Brown Vertosol
LSC Classification	Class 6

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.1	Sandy clay, brown, medium stiffness, non-plastic, homogenous, fine grained sand
A2	0.1-0.35	Sandy clay, brown, stiff, non-plastic, fine grained sand

Site ID: SB12

Details	
Coordinates:	Lat: -31.427056°
	Long: 150.920350°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Midslope
Hydrological group	C
Fertility:	Moderate
Great soil group	Red-brown earths
ASC Classification:	Yellow Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
-	0.00-0.01	No horizon, sandy loam, medium density, medium grained, organic matter inclusions.
A1	0.01-0.05	Yellow sand, loose, fine to medium grained, subrounded, bleached.
A2	0.05-0.2	Light yellow, bleached, medium density, fine to medium grained sand, subrounded, trace of clay.
B1	0.2-0.6	Yellow / grey, bleached, some mottle, friable, non-plastic, trace of sand.

Site ID: SB13

Details	
Coordinates:	Lat: -31.437272°
	Long: 150.923828°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Flat
Hydrological group	C
Fertility:	Moderate
Great soil group	Red-brown earths
ASC Classification:	Brown Chromosol
LSC Classification	Class 6

Lithology

Soil Horizon	Depth (m)	Description
-	0.00-0.05	No horizon, sandy loam, brown, loose, medium grained. Organic matter inclusions
A1	0.05-0.15	Sandy loam, brown, loose, medium grained, homogenous
-	0.15-0.25	Weather basalt, fractured, angular

Site ID: SB14

Details	
Coordinates:	Lat: -31.432855°
	Long: 150.924067°
Land Use:	Grazing
Surface Condition:	Medium to hard
Landform:	Flat, lower slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Red-brown earths
ASC Classification:	Grey Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
A1	0.0-0.2	Sandy loam, brown, medium density, medium grained
A2	0.2-0.5	Sandy loam, light brown, medium density, fine to medium grained, minor bleaching
B1	0.5-0.7	Sandy clay, light grey, bleached, medium stiffness, non-plastic, homogenous

Site ID: SB15

Details	
Coordinates:	Lat: -31.428376°
	Long: 150.927552°
Land Use:	Grazing
Surface Condition:	Hard
Landform:	Upper slope
Hydrological group	C
Fertility:	Moderate
Great soil group	Red brown earths
ASC Classification:	Grey Chromosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
-	0.01-0.05	No horizon, sandy loam, brown, organic matter inclusions
A1	0.05-0.2	Sandy loam, minor clay, fine to medium grained, subangular, non-plastic
A2	0.2-0.5	Sandy clay, brown, medium stiffness, friable, homogenous
B1	0.5-0.6	Clay, yellow-grey, bleached, friable, non-plastic

Site ID: SB16

Details	
Coordinates:	Lat: -31.433863°
	Long: 150.928595°
Land Use:	Grazing
Surface Condition:	Hard
Landform:	Midslope
Hydrological group	C
Fertility:	Moderate
Great soil group	Non-calcic brown
ASC Classification:	Brown Vertosol
LSC Classification	Class 4

Lithology

Soil Horizon	Depth (m)	Description
-	0.00-0.1	No horizon, dark brown, sandy clay, firable, non-plastic, fine grained, organic matter inclusions
A1	0.1-0.3	Sandy clay, brown, friable, non-plastic, homogenous
A2	0.3-0.5	Dark brown, organic matter leachate and inclusions, friable, non-plastic

APPENDIX C LABORATORY RESULTS

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ABN 48 648 447 198

ANALYSIS REPORT SOIL

PROJECT NO: EW242099		**Date of Issue:**	**19/12/2024**
Customer:	ERM Australia Pty Ltd	Report No:	1
Address:	Level 14, 207 Kent Street SYDNEY NSW 2000	Date Received:	9/12/2024
		Matrix:	Soil
Attention:	Meg Coles	Location:	Greenpulse SF
Phone:	0448 355 220	Sampler ID:	Client
Fax:		Date of Sampling:	3/12/2024
Email:	meg.coles@erm.com	Sample Condition:	Acceptable

Comments:
3a = severe dispersion of the remould. 3b = moderate to slight dispersion of the remould.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed:

Stephanie Cameron
Laboratory Operations Manager

PROFICIENT LAB
Visit www.aspac-australasia.com to view our certification details.

GSG Laboratories is certified by the Australasian Soil & Plant Analysis Council to perform various soil and plant tissue analysis. The tests reported herein have been performed in accordance with our terms of accreditation.

This report must not be reproduced except in full and GSG takes no responsibility of the end use of the results within this report.

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB01_A1	SB01_A2	SB02_A1	SB02_B1
				DEPTH	0 - 0.2	0.2 - 0.7	0 - 0.2	0.2 - 0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-1**	**242099-2**	**242099-3**	**242099-4**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na	5.36	7.33	5.78	6.50
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na	4.95	6.97	5.35	5.62
Chloride Soluble	DA	DAP-06	mg/kg	5	14.0	13.8	9.88	8.49
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.08	0.04	0.04	0.15
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5	41.4	21.0	61.7	49.3
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	301	186	251	201
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	1803	4370	2078	3879
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	384	1735	328	611
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	48.8	371	45.4	187
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2	2.40	<2.00	2.00	2.80
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.77	0.48	0.64	0.52
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	9.02	21.9	10.4	19.4
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	3.20	14.5	2.73	5.09
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.21	1.61	0.20	0.81
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.03	0.02	0.02	0.03
ECEC	Calculation	PMS-15A1	cmol/kg	na	13.2	38.4	14.0	25.8
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.82	1.51	3.80	3.81
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.24	0.03	0.24	0.10
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	5.84	1.24	4.60	1.99
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	68.2	56.9	74.3	75.0
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	24.2	37.6	19.5	19.7
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	1.60	4.20	1.41	3.15
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.20	0.06	0.16	0.12
Emerson Aggregate Test	Class	PMS-21	Number	na	5	5	5	3b
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	20.9	5.2	0.3	<0.1
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	10.0	5.7	16.1	3.8
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	25.2	15.1	23.1	18.0

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB01_A1	SB01_A2	SB02_A1	SB02_B1
				DEPTH	0 - 0.2	0.2 - 0.7	0 - 0.2	0.2 - 0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-1**	**242099-2**	**242099-3**	**242099-4**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	18.3	13.9	23.3	14.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	25.6	60.2	37.2	63.5

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB02_B2	SB03_A1	SB03_A2	SB03_B1
					DEPTH	0.5 - 0.8	0.03 - 0.2	0.2 - 0.4	0.4 - 0.8
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-5**	**242099-6**	**242099-7**	**242099-8**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na		7.51	5.42	7.02	7.79
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na		7.18	4.90	6.45	7.55
Chloride Soluble	DA	DAP-06	mg/kg	5		6.63	15.7	13.0	52.9
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01		0.06	0.08	0.30	0.06
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5		11.2	37.2	10.3	6.34
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10		163	111	161	115
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20		5218	1782	5349	7217
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10		682	380	1337	1425
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10		290	52.2	217	333
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2		2.40	5.10	<2.00	<2.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na		0.42	0.28	0.41	0.29
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na		26.1	8.91	26.7	36.1
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na		5.68	3.17	11.1	11.9
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na		1.26	0.23	0.94	1.45
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na		0.03	0.06	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na		33.5	12.6	39.3	49.7
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		4.59	2.81	2.40	3.04
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		0.07	0.09	0.04	0.02
Exchangeable Potassium %	Calculation	PMS-15A1	%	na		1.25	2.25	1.05	0.59
Exchangeable Calcium %	Calculation	PMS-15A1	%	na		77.9	70.5	68.1	72.6
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na		17.0	25.0	28.4	23.9
Exchangeable Sodium %	Calculation	PMS-15A1	%	na		3.77	1.79	2.40	2.91
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na		0.08	0.45	0.06	0.04
Emerson Aggregate Test	Class	PMS-21	Number	na		5	7	5	4
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na		<0.1	3.4	<0.1	<0.1
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na		4.7	11.5	2.9	4.2
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na		20.6	33.2	24.1	26.6

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB02_B2	SB03_A1	SB03_A2	SB03_B1
					DEPTH	0.5 - 0.8	0.03 - 0.2	0.2 - 0.4	0.4 - 0.8
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-5**	**242099-6**	**242099-7**	**242099-8**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na		17.5	19.5	17.0	27.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na		57.2	32.4	55.9	41.5

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB04_A1	SB05_A1	SB05_A2	SB06_A1
					DEPTH	0.02 - 0.5	0 - 0.3	0.3 - 1.0	0 - 0.3
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-9**	**242099-10**	**242099-11**	**242099-12**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na		6.37	7.62	8.21	5.55
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na		5.91	7.44	7.49	5.25
Chloride Soluble	DA	DAP-06	mg/kg	5		9.55	12.8	10.8	36.0
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01		0.20	0.18	0.18	0.08
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5		23.5	17.2	<5.00	32.6
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10		350	241	219	187
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20		4403	6186	5629	2592
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10		972	1164	2035	507
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10		113	158	340	48.0
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2		4.50	2.60	<2.00	2.40
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na		0.90	0.62	0.56	0.48
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na		22.0	30.9	28.1	13.0
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na		8.10	9.70	17.0	4.23
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na		0.49	0.69	1.48	0.21
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na		0.05	0.03	0.02	0.03
ECEC	Calculation	PMS-15A1	cmol/kg	na		31.6	42.0	47.2	17.9
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		2.72	3.19	1.66	3.07
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		0.11	0.06	0.03	0.11
Exchangeable Potassium %	Calculation	PMS-15A1	%	na		2.84	1.47	1.19	2.68
Exchangeable Calcium %	Calculation	PMS-15A1	%	na		69.8	73.7	59.7	72.4
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na		25.7	23.1	36.0	23.6
Exchangeable Sodium %	Calculation	PMS-15A1	%	na		1.56	1.64	3.13	1.17
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na		0.16	0.07	0.05	0.15
Emerson Aggregate Test	Class	PMS-21	Number	na		5	5	5	5
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na		<0.1	<0.1	<0.1	<0.1
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na		7.4	1.5	1.0	5.7
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na		16.4	19.2	18.4	25.9

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB04_A1	SB05_A1	SB05_A2	SB06_A1
					DEPTH	0.02 - 0.5	0 - 0.3	0.3 - 1.0	0 - 0.3
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-9**	**242099-10**	**242099-11**	**242099-12**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na		22.9	21.2	13.9	25.4
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na		53.3	58.1	66.6	43.0

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB06_A2	SB07_A1	SB07_A2	SB08_A1
					DEPTH	0.3 - 0.8	0.0 - 0.2	0.2 - 0.6	0.05 - 0.15
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-13**	**242099-14**	**242099-15**	**242099-16**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na		6.68	7.27	7.18	7.37
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na		6.06	6.87	6.90	7.09
Chloride Soluble	DA	DAP-06	mg/kg	5		8.46	10.3	9.77	10.1
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01		0.06	0.10	0.06	0.26
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5		11.5	12.0	7.24	220
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10		153	268	260	799
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20		3448	6596	5773	6400
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10		1315	1032	1282	447
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10		318	82.5	87.2	36.6
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2		<2.00	3.00	<2.00	2.40
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na		0.39	0.69	0.67	2.05
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na		17.2	33.0	28.9	32.0
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na		11.0	8.60	10.7	3.73
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na		1.38	0.36	0.38	0.16
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na		0.02	0.03	0.02	0.03
ECEC	Calculation	PMS-15A1	cmol/kg	na		30.0	42.7	40.6	38.0
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		1.57	3.83	2.70	8.59
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		0.04	0.08	0.06	0.55
Exchangeable Potassium %	Calculation	PMS-15A1	%	na		1.31	1.61	1.64	5.40
Exchangeable Calcium %	Calculation	PMS-15A1	%	na		57.5	77.3	71.1	84.3
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na		36.5	20.2	26.3	9.81
Exchangeable Sodium %	Calculation	PMS-15A1	%	na		4.61	0.84	0.93	0.42
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na		0.07	0.08	0.05	0.07
Emerson Aggregate Test	Class	PMS-21	Number	na		3b	5	5	7
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na		<0.1	<0.1	<0.1	12.5
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na		2.7	1.0	1.2	4.7
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na		14.8	14.8	15.1	22.6

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB06_A2	SB07_A1	SB07_A2	SB08_A1
				DEPTH	0.3 - 0.8	0.0 - 0.2	0.2 - 0.6	0.05 - 0.15
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-13**	**242099-14**	**242099-15**	**242099-16**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	15.0	18.1	14.0	23.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	67.5	66.1	69.7	36.5

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB08_A2	SB08_B1	SB09_A1	SB09_B1
					DEPTH	0.15 - 0.3	0.3 - 0.65	0-0.2	0.2-0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-17**	**242099-18**	**242099-19**	**242099-20**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na		7.81	8.07	5.16	6.95
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na		7.49	7.64	4.78	6.27
Chloride Soluble	DA	DAP-06	mg/kg	5		8.11	5.96	8.37	5.45
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01		0.15	0.17	0.04	0.04
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5		220	29.4	95.7	29.9
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10		404	194	340	241
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20		6117	7833	1967	5314
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10		490	1102	301	589
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10		40.0	123	25.3	65.9
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2		3.20	<2.00	5.10	<2.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na		1.04	0.50	0.87	0.62
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na		30.6	39.2	9.84	26.6
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na		4.08	9.18	2.51	4.91
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na		0.17	0.53	0.11	0.29
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na		0.04	0.02	0.06	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na		35.9	49.4	13.4	32.4
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		7.49	4.26	3.92	5.41
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		0.25	0.05	0.35	0.13
Exchangeable Potassium %	Calculation	PMS-15A1	%	na		2.88	1.01	6.51	1.91
Exchangeable Calcium %	Calculation	PMS-15A1	%	na		85.2	79.3	73.5	82.0
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na		11.4	18.6	18.7	15.1
Exchangeable Sodium %	Calculation	PMS-15A1	%	na		0.48	1.08	0.82	0.88
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na		0.10	0.04	0.42	0.07
Emerson Aggregate Test	Class	PMS-21	Number	na		4	4	5	5
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na		0.9	0.3	8.3	12.0
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na		5.9	2.0	21.7	5.5
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na		24.7	18.3	20.7	14.8

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB08_A2	SB08_B1	SB09_A1	SB09_B1
				DEPTH	0.15 - 0.3	0.3 - 0.65	0-0.2	0.2-0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-17**	**242099-18**	**242099-19**	**242099-20**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	22.9	19.3	16.5	17.0
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	45.6	60.2	32.9	50.8

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					SB10_A1	SB11_A1	SB11_A2	SB12_A1
			CLIENT SAMPLE ID					
			DEPTH		0-0.15	0-0.1	0.1-0.35	0.01-0.05
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-21**	**242099-23**	**242099-24**	**242099-25**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na	5.25	5.28	6.02	5.05
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na	5.00	5.01	5.45	4.61
Chloride Soluble	DA	DAP-06	mg/kg	5	6.51	9.04	5.16	12.5
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.07	0.04	0.04
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5	72.3	167	70.2	31.8
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	288	485	305	73.2
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	1294	2836	3117	993
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	265	483	528	191
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	29.8	47.8	48.2	35.3
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2	6.40	<2.00	<2.00	10.6
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.74	1.24	0.78	0.19
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	6.47	14.2	15.6	4.97
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	2.21	4.03	4.40	1.59
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.13	0.21	0.21	0.15
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.07	0.02	0.02	0.12
ECEC	Calculation	PMS-15A1	cmol/kg	na	9.62	19.7	21.0	7.02
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.93	3.52	3.54	3.12
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.33	0.31	0.18	0.12
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	7.68	6.32	3.72	2.68
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	67.3	72.1	74.2	70.8
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	23.0	20.5	21.0	22.7
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	1.35	1.06	1.00	2.19
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.74	0.11	0.11	1.68
Emerson Aggregate Test	Class	PMS-21	Number	na	3b	7	3b	7
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	1.0	<0.1	<0.1	1.9
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	20.5	6.6	3.0	26.5
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	26.5	20.1	22.4	31.2

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB10_A1	SB11_A1	SB11_A2	SB12_A1
					DEPTH	0-0.15	0-0.1	0.1-0.35	0.01-0.05
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-21**	**242099-23**	**242099-24**	**242099-25**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na		27.2	31.8	32.4	15.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na		24.8	41.5	42.2	24.6

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					CLIENT SAMPLE ID	SB12_A2	SB12_B1	SB13_A1	SB14-A1
					DEPTH	0.05-0.2	0.2-0.6	0.05-0.15	0-0.2
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**		**242099-26**	**242099-27**	**242099-28**	**242099-29**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na		6.91	5.78	5.77	5.54
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na		6.03	5.32	5.22	5.38
Chloride Soluble	DA	DAP-06	mg/kg	5		<5.00	5.89	9.39	19.5
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01		0.04	0.02	0.04	0.09
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5		41.2	14.2	47.1	124
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10		67.5	34.3	171	627
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20		1856	895	2922	1986
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10		1023	250	470	429
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10		225	50.7	77.3	43.2
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2		<2.00	2.00	2.60	2.20
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na		0.17	0.09	0.44	1.61
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na		9.28	4.48	14.6	9.93
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na		8.53	2.08	3.92	3.58
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na		0.98	0.22	0.34	0.19
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na		0.02	0.02	0.03	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na		19.0	6.89	19.3	15.3
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		1.09	2.15	3.73	2.78
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na		0.02	0.04	0.11	0.45
Exchangeable Potassium %	Calculation	PMS-15A1	%	na		0.91	1.28	2.27	10.5
Exchangeable Calcium %	Calculation	PMS-15A1	%	na		48.9	65.0	75.6	64.8
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na		44.9	30.2	20.3	23.3
Exchangeable Sodium %	Calculation	PMS-15A1	%	na		5.15	3.20	1.74	1.23
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na		0.12	0.32	0.15	0.16
Emerson Aggregate Test	Class	PMS-21	Number	na		3a	3b	7	5
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na		0.6	0.6	17.4	1.5
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na		15.5	28.5	17.6	27.5
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na		28.6	37.1	19.7	18.9

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB12_A2	SB12_B1	SB13_A1	SB14-A1
				DEPTH	0.05-0.2	0.2-0.6	0.05-0.15	0-0.2
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-26**	**242099-27**	**242099-28**	**242099-29**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	14.4	19.1	14.5	28.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	40.8	14.7	30.8	23.3

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

					SB14-A2	SB14-B1	SB15_A1	SB15_A2
			CLIENT SAMPLE ID					
			DEPTH		0.2-0.5	0.5-0.7	0.05-0.2	0.2-0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-30**	**242099-31**	**242099-32**	**242099-33**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na	5.69	6.50	5.59	6.95
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na	5.06	5.84	5.21	6.59
Chloride Soluble	DA	DAP-06	mg/kg	5	37.3	41.7	86.4	9.82
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.03	0.06	0.05
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5	59.3	305	28.7	9.81
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	384	100	290	213
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	2182	2573	2455	4253
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	429	415	508	879
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	35.4	37.1	36.2	94.1
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2	2.35	<2.00	2.80	<2.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.98	0.26	0.74	0.55
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	10.9	12.9	12.3	21.3
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	3.58	3.46	4.23	7.33
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.15	0.16	0.16	0.41
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.03	0.02	0.03	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	15.6	16.8	17.4	29.6
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	3.05	3.72	2.90	2.90
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.28	0.07	0.18	0.07
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.29	1.53	4.26	1.85
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	69.7	76.7	70.4	71.9
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	22.8	20.6	24.3	24.8
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	0.98	0.96	0.90	1.38
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.17	0.13	0.18	0.08
Emerson Aggregate Test	Class	PMS-21	Number	na	7	3b	5	5
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	7.1	2.2	3.6	1.7
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	20.5	26.3	19.2	9.9
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	20.2	21.8	21.4	11.4

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB14-A2	SB14-B1	SB15_A1	SB15_A2
				DEPTH	0.2-0.5	0.5-0.7	0.05-0.2	0.2-0.5
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-30**	**242099-31**	**242099-32**	**242099-33**
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	21.8	23.8	22.3	18.7
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	30.4	25.9	33.4	58.3

ANALYSIS REPORT

PROJECT NO: EW242099 Location: Greenpulse SF

				CLIENT SAMPLE ID	SB15_AB1	SB16_A1	SB16_A2	
				DEPTH	0.5-0.6	0.02-0.1	0.1-0.3	
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-34**	**242099-35**	**242099-36**	
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na	7.73	5.59	7.68	
pH (1:5 in CaCl2)	Electrode	R&L 4B2	pH units	na	7.09	5.18	7.36	
Chloride Soluble	DA	DAP-06	mg/kg	5	8.66	25.0	17.4	
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.09	0.11	0.21	
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	5	175	133	59.9	
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	79.0	689	225	
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	4144	3078	7509	
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	872	558	512	
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	117	33.7	48.9	
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2	<2.00	2.30	2.70	
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.20	1.77	0.58	
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	20.7	15.4	37.5	
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	7.27	4.65	4.27	
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.51	0.15	0.21	
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.03	0.03	
ECEC	Calculation	PMS-15A1	cmol/kg	na	28.7	22.0	42.6	
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.85	3.31	8.80	
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.03	0.38	0.14	
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	0.71	8.04	1.35	
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	72.1	70.0	88.1	
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	25.3	21.2	10.0	
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	1.77	0.67	0.50	
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.08	0.12	0.07	
Emerson Aggregate Test	Class	PMS-21	Number	na	5	3b	4	
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	11.4	3.2	1.4	
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	5.5	14.1	17.7	
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	18.4	18.0	21.4	

ANALYSIS REPORT

PROJECT NO: EW242099 **Location: Greenpulse SF**

				CLIENT SAMPLE ID	**SB15_AB1**	**SB16_A1**	**SB16_A2**	
				DEPTH	**0.5-0.6**	**0.02-0.1**	**0.1-0.3**	
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**242099-34**	**242099-35**	**242099-36**	
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	23.6	22.3	20.7	
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	41.2	42.3	38.9	

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Soils are air dried at 40^{0}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

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