Preliminary Agricultural Land Assessment

Miriam Vale Solar Farm

Prepared for: Private Energy Partners Pty Ltd

Date: 24 May 2024

Document Information

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Suitably Qualified Persons
The author of this document is a suitably qualified and experienced consultant in land and resource management, soils science and agricultural land assessments.
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1. Introduction

1.1 Project Overview

Private Energy Partners is proposing to develop a photovoltaic (PV) solar farm of up to 1 gigawatt (GW) generation capacity and associated infrastructure, including a substation, approximately 6 kilometres (km) southwest of Miriam Vale and 60 km southwest of Gladstone.

1.2 Purpose and Scope

Attexo Group Pty Ltd (Attexo) was engaged by Private Energy Partners to undertake as assessment to determine potential impacts of the Project on the agricultural land values of the Project area, identified within the *Our Place Our Plan* Gladstone Regional Council Planning Scheme's (Version 2) (GRC Planning Scheme) Agricultural Land Classification Overlay Map. This Preliminary Agricultural Land Assessment (P-ALA) has been prepared to support a development application for the Miriam Vale Solar Farm Project (the Project) under the GRC Planning Scheme, being:

- Development permit for Material Change of Use for a Renewable Energy Facility (Solar Farm); and
- Development permit for Material Change of Use for a Substation.

The report uses the best available land resource survey information and the latest Queensland guidelines related to agricultural land evaluation to identify potential agricultural land uses and their potential distribution. Specifically, the objectives of this report are to:

- Present a qualitative agricultural land assessment through a review of the GRC agricultural land class mapping of Class B for the subject site.
- Identify the potential agricultural impacts of the proposed Project and impact mitigation measures recommended for the construction and operation of the Project at the site.
- Assess potential agricultural land impacts against the GRC Planning Scheme.

2. Project Description

2.1 Site Overview

The Project is located 6 km west of Miriam Vale and 43 km west-southwest of Agnes Water, spanning 14 pastoral properties. The Project is described using the terms defined in **Table 2.1**.

Table 2.1: Project Area and Footprint Descriptions

Area	Definition	Size (hectares, ha)
Project area	Encompasses the entirety of the 14 land parcels associated with the Project	1,082.25 ha
Miriam Vale Solar Farm footprint	Comprises the maximum area to be disturbed by the Miriam Vale Solar Farm Project, equating to 85.2% of the Project area. 603.77 ha of the area traverses Class B Agricultural Land.	921.74 ha

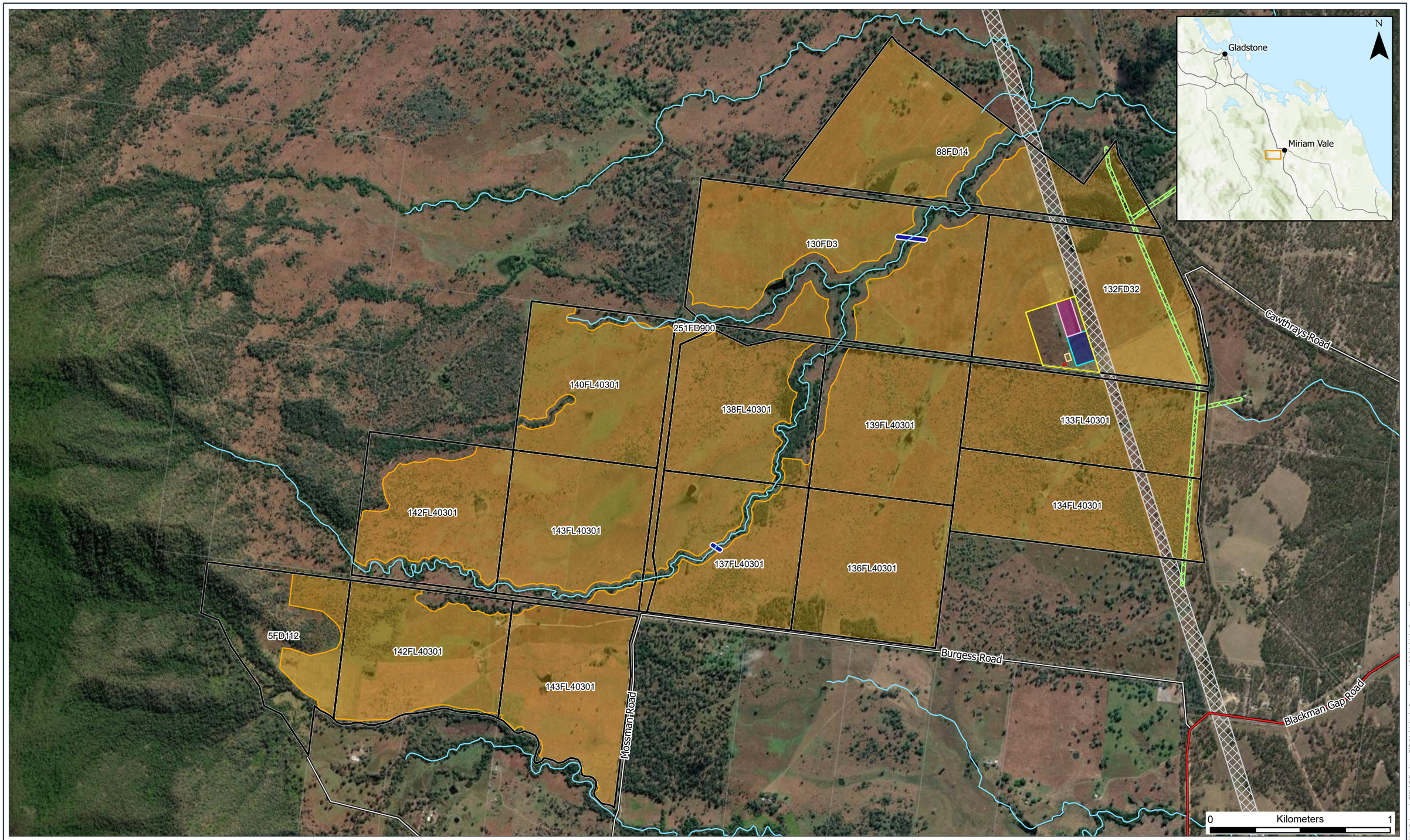
A layout map showing the Project area and footprints as described in **Table 2.1** is provided in **Figure 2.1.**

2.2 Project Components

The Miriam Vale Solar Farm comprises an up to 527 MWp photovoltaic (PV) solar farm and includes:

- Solar PV modules (panels)
- Access tracks and cabling runs
- An internal substation on the 275 kilovolt amperes (kVA) Calliope River-Gin Gin transmission line;
- Internal collector lines;
- Internal fire trail and bushfire asset protection zones (APZ);
- Security fencing around the solar farm;
- Control building including site office, operation and maintenance facilities, spare parts supervisory control and data acquisition (SCADA) systems and staff amenities serviced by septic systems and rainwater tanks;
- Car park adjacent to control building; and
- Meteorological station(s).

An overview of the Project configuration and disturbance footprint is shown in **Figure 2.1**.



Project Overview

MIRIAM VALE SOLAR FARM

- Highway
- Local Road
- Watercourses
- Miriam Vale Solar Farm Development Footprint
- Proposed Substation and Switchyard Area
- Proposed Substation Development Area
- Proposed Switchyard Development Area
- Proposed Laydown Area
- Proposed Maintenance and Storage Shed Area
- Waterway Crossings
- OHTL Exclusion Zone
- Powerlink Corridor Easement
- Property Boundary
- Lot Type Parcel

Attexo

REVIEWED: MW | **DRAWN:** FM | **SCALE (A3):** 1:20,000 | **DATE:** 21/05/2024 | **DWG No:** PRI-001_026[A]

FIGURE 2-1

GDA2020 MGA Zone 56

2.3 Construction Works

Construction of the Miriam Vale Solar Farm Project is expected to commence in 2025 and extend for a period of 18-24 months. A detailed construction methodology will be developed by the Project construction contractor upon award. A high-level summary of construction activities is as follows:

General

- Mobilisation: of machinery and equipment to site (staggered throughout the construction phase as needed).
- Site establishment: install temporary construction compounds, workshops, warehouses, amenities, laydown and stockpiling areas. Establish site entrance points sufficient for construction vehicles and plant.
- Vegetation clearing: any clearing of non-remnant vegetation within the Project footprint will be via mechanical means. No remnant vegetation will be cleared for the Project.
- Machinery and equipment maintenance: includes general servicing and minor repairs such as oil and filter changes, hose replacements, refuelling and other top ups (i.e. hydraulic fluids, lubricants, coolant, etc.).
- Hot works: includes cutting, grinding, welding, soldering and other.
- Concreting: where pre-cast foundations are not used, wet mix will be transported to site in agitators, no on-site concrete batching is proposed.
- Site rehabilitation: groundcover re-establishment to be completed progressively as individual sites or Project sections are completed.

Solar Farm

- Earthworks: cut and fill to establish required site profile and track gradients, trenching for subsurface cable installation, excavation for the installation of foundations and subsurface equipment. Establish compacted, unsealed tracks, laying and compaction of fill for temporary and permanent hardstand areas.
- Instream work: vehicle creek crossings will be established which will comprise either bed level or culvert types.
- Solar array: Install galvanised steel pole support structures – pile driving or screw in methods are proposed to minimise loss of pre-existing groundcover where practicable. Where soil depth is insufficient poles will be mounted onto concrete foundations. Install buried cable – excavate trench, install cable / conduit and backfill. If conduit is used, cable will be pulled through conduit post trench backfill as per the construction sequence. Install PV panels – lift panels into place via crane and attach to pole support structures.
- Substation: Pour concrete foundations for transformers and other equipment, erect buildings and enclosures (e.g. hut / control room, equipment housing etc.), install subsurface cabling and other buried infrastructure, install switchgear, earthing and protection systems, communications equipment and other as per design, install fencing and signage.
- OH powerlines: install of tower / pole footings, erect lattice towers or poles, stringing and tensioning of powerline cable.
- Electrical works (OH and underground) general: cable joining, facility interconnection and grid connection.
- Site finishing: install site fencing, signage, bollards, gravel surfaces, etc.

Commissioning

- Testing and commissioning of plant / equipment.

Demobilisation

- Progressive disassembly and removal of all construction machinery, equipment and materials from site.
- Final site stabilisation and rehabilitation works.

2.4 Guidelines and Standards

The guidelines and standards relevant to the P-ALA for the Project to confirm the suitability of the Project area for the establishment of the Project include the following key documents:

- Guidelines for agricultural land evaluation in Queensland (2nd edn) (DSITA & DNRM, 2015)
- Regional Land Suitability Frameworks for Queensland (DNRM & DSITA, 2013)
- Soil and Land Field Survey Handbook (National Committee on Soil and Terrain (NCST), 2009)
- Guidelines for Surveying Soil and Land Resources (Mckenzie, et al., 2008)
- The Australian Soil Classification, Revised Edition (Isbell, 2002)
- Salinity Management Handbook (DERM, 2012).

3. Gladstone Regional Council Planning Scheme

The GRC Planning Scheme is a local planning instrument prepared in accordance with the *Planning Act 2016* and is a framework for managing development in a way that advances the purposes of the Planning Act.

The Project area is located within the GRC local government area and is zoned as Rural. The proposed Project is defined by the Planning Scheme as a *Renewable Energy Facility* and a *Substation*. A Material Change of Use for the *Renewable Energy Facility* and a *Substation* is Code Assessment in the applicable Rural Zone. There are several overlays affecting the Project area, namely:

- Agricultural Land Classification;
- Biodiversity;
- Bushfire Hazard;
- Scenic Amenity; and
- Steep Land.

This report addresses the requirements of the Rural Zone Code as relevant to Class B Agricultural land identified on the Agricultural Land Classification Overlay Map which are applicable to the Project. Specifically, Performance Outcome (PO) 10 states that:

Development -

- *is consistent with the rural character of the locality*
- *supports the primary rural function of the zone, and*
- *protects rural, natural and scenic values of the locality.*

3.1 Rural Zone Code

An extract of the Rural Zone Code is included below with the purpose and overall outcomes from the GRC Planning Scheme underlined where they are relevant to Agricultural Land Classification Class A and B agricultural land.

3.1.1 Purpose and Overall Outcomes (Section 6.2.22.2 of the GRC Planning Scheme)

1. The purpose of the Rural Zone Code is to:
    a. Ensure appropriately sized lots, being predominantly very large lots, display rural and landscape character and provide for a wide range of rural uses including cropping, intensive horticulture, intensive animal industries, animal husbandry, grazing, animal keeping and other primary production activities.
    b. Provide opportunities for non–rural uses that are compatible with agricultural and rural activities, and the landscape character of the rural area where they do not compromise the long–term use of the land for rural purposes.
    c. Protect or manage significant natural features, resources, and processes, including the capacity for primary production and extractive industry in designated areas.
    d. Ensure rural uses are not adversely impacted by inappropriate land uses and development.
    e. Ensure areas of Agricultural Land Classification Class A and B agricultural land are protected for agricultural uses and from fragmentation, alienation or diminished agricultural productivity.
    f. The potential for conflict between agricultural and other uses on Agricultural Land Classification Class A and B are minimised.
2. The purpose of the zone will be achieved through the following overall outcomes:
    a. Areas for use for primary production are conserved and fragmentation is avoided through maintaining appropriate lot sizes, being predominantly large lots to support sustainable rural agricultural activities.

b. The viability of both existing and future rural uses and activities are protected from the intrusion of incompatible uses.

c. The establishment of a wide range of rural pursuits is facilitated, including cropping, intensive horticulture, grazing, intensive animal industries, animal husbandry and animal keeping and other compatible primary production uses.

d. Cropping activities are encouraged on Agricultural Land Classification Class A and B agricultural land.

e. Development does not result in the fragmentation of Agricultural Land Classification Class A and B agricultural land. This applies to reconfiguring a lot except where it has been assessed that there is an overriding need in the public interest for a related material change of use and the reconfiguring of a lot is consistent with the material change of use.

f. Continued….

4. Project Site

4.1 Development Details

Details of the proposed development are provided in **Table 4.1**.

Table 4.1: Development details

Aspect	Description
Local Government Zoning	Rural Zone
Current use	Grazing of improved pastures and small isolated areas of plantation forestry
Proposed development	Solar farm and substation
Area and number of lots	1,082.25 ha across 14 land parcels
Ownership	The Project has an option to purchase the land
Project duration	The solar array is expected to have up to a 40-year life span

4.2 Current and Past Land Uses

The land the subject of the Development Application and surrounding areas are of a rural nature and currently used primarily for grazing.

Most of the Project area had been substantially cleared of remnant vegetation by 1955, with all parts of the Project area either cleared or significantly thinned by 1981. Current regulated vegetation mapping reflects this clearing history, with no regulated vegetation located within the current Project footprint.

A substantial proportion of the Project area was previously developed as a private hardwood plantation under a Managed Investment Scheme. The plantation areas have been harvested and are now generally maintained as pastoral land, with scatted patches of Tasmanian Blue Gum (Eucalyptus globulus) remaining. Narrow corridors of woodland vegetation have been retained along drainage lines. The topography consists of drainage lines, alluvial plains and low rolling hills.

The northern, southern, and eastern edges of the Project area border farmland utilised for cattle grazing. These adjacent areas share a comparable landscape with the Project area, characterised by grassland and sporadic patches of woodland vegetation.

Bulburin National Park adjoins the southwest corner of the Project area. Mount Colosseum National Park is located approximately 7 km to the southeast of the Project area.

4.3 Potential Cropping Land Uses

4.3.1 Regional Land Suitability Frameworks

The Regional Land Suitability Frameworks for Queensland (DSITI & DNRM 2013) includes land suitability frameworks prepared for various regional areas of Queensland, drawing on information contained in projects within each region. A land suitability framework for each regional cropping area in Queensland is included in regional framework document.

The Project site is in the South East Queensland region and the Coastal Burnett sub region.

4.3.1.1 Suitability framework for the Coastal Burnett area

The Coastal Burnett suitability framework uses 17 limitations and includes 42 different land uses (**Table 4.2**) ranging from dryland and irrigated vegetable, grain and sugarcane crops through to dryland and irrigated horticultural crops and hardwood plantations.

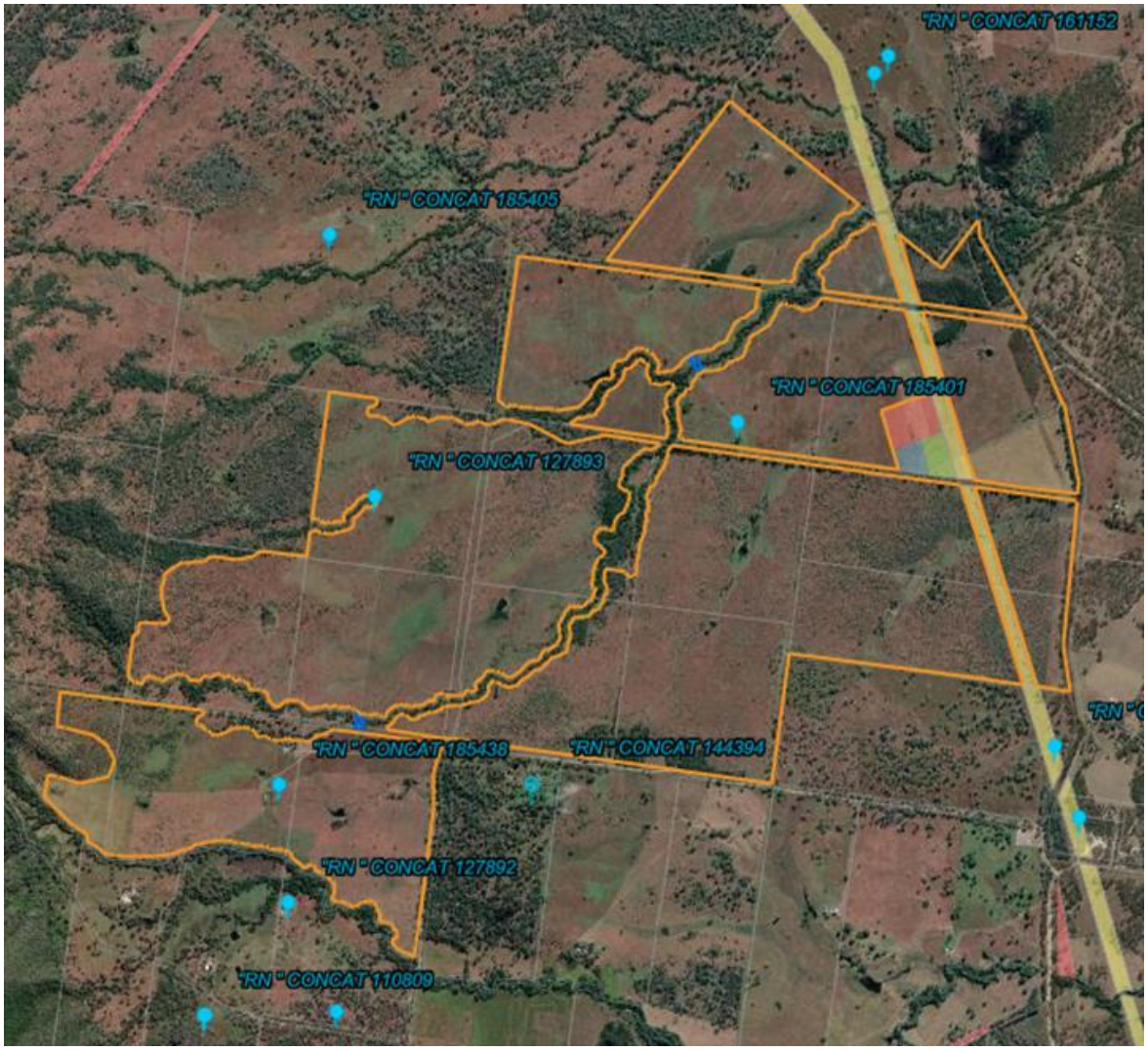
The *Guidelines for agricultural land evaluation in Queensland* (2nd Edition) (DSITI & DNRM 2015) acknowledge that particular land uses may not be relevant to the study area. It has been determined that due to the lack of availability of, or unlikely availability of, a suitable water supply, several cropping land uses that require irrigation have been determined not relevant for consideration for the Project area. This is further discussed below.

Assessment of irrigation water supply

There are no irrigation schemes in vicinity of the Project area and previously proposed dams have not been progressed due to various constraints that are unlikely to ever be resolved. In terms of groundwater, there are a number of bores within the vicinity of the Project area (**Figure 4.1**). The two bores (RN185438 and RN185401) within the Project area are both identified as no longer used in the Queensland Government groundwater database and have salinity levels of 3940 µS/cm and 1406 µS/cm respectively. These salinity levels would only be suitable for moderately tolerant and tolerant crops (DERM 2011).

Some of the other bores in the Project area and surroundings have better water quality, particularly in some of the aquifers in volcanic geologies (e.g. granites and basalts), although the yields are low at around one litre per second or less (RN144394, RN185668, RN127892 and RN127893).

Figure 4.1: Groundwater bores in the vicinity of the Project area



Potential cropping land uses for the Project area

Due to the unlikely availability of an irrigation water supply, only seven dryland cropping land uses from the Queensland regional suitability framework have been considered relevant to the Project area, as shown in **Table 4.2.**

Table 4.2: Land uses in the Coastal Burnett area regional sustainability framework

Dryland	Irrigate
• Pineapple-Dryland • Radiata Pine-Dryland • Soybean-Dryland • Gympie messmate-Dryland • Spotted gum-dryland • Sugarcane-Dryland • Macadamia-Dryland • Improved Pasture-Dryland	• Asparagus-Spray Irrigated • Navy Bean-Furrow/row Irrigated • Strawberry-Trickle Irrigated • Potato-Spray Irrigated • Peanut-Furrow/row Irrigated • Avocado-Microsprinkler Irrigated • Navy Bean-Spray Irrigated • Sweet Potato-Spray Irrigated • Peanut-Spray Irrigated • Banana-Trickle Irrigated • Beans-Spray Irrigated • Pineapple-Spray Irrigated • Capsicum-Trickle Irrigated • Citrus-Microsprinkler Irrigated • Sorghum (forage)-Furrow/row Irrigated • Cruciferae-Trickle Irrigated • Sorghum (forage)-Spray Irrigated • Cucurbit-Furrow/row Irrigated • Cucurbit-Spray Irrigated • Soybean-Furrow/row Irrigated • Grapes-Trickle Irrigated • Soybean-Spray Irrigated • Stone Fruit-Microsprinkler Irrigated • Improved Pastures-Spray Irrigated • Lucerne-Spray Irrigated • Sugarcane-Furrow Irrigated • Lychee-Microsprinkler Irrigated • Sugarcane-Spray Irrigated • Sweet corn-Furrow/row Irrigated • Macadamia-Microsprinkler Irrigated • Sweet corn-Spray Irrigated • Maize-Furrow/row Irrigated • Tomato-Trickle Irrigated • Maize-Spray Irrigated • Turf-Spray Irrigated • Mango-Microsprinkler Irrigated • Zucchini-Trickle Irrigated

5. Land Evaluation

Land evaluation involves determining the potential of land for alternative land uses and identifying management requirements for sustainable use. In Queensland the best reference document is *The Guidelines for agricultural land evaluation in Queensland* (2nd Edition) (DSITI & DNRM 2015) which:

- Summarises existing land evaluation systems,
- Describes a system of land classification appropriate to Queensland conditions, and
- Recommends best practice methods for conducting land evaluation.

Two land classifications systems that have been widely used in Australia as part of land resource survey projects are the land capability classification that evaluates the potential of land for broad land uses (e.g. cropping, grazing, non-agricultural) and the land suitability classification that assesses the potential of land for a specific land use (e.g. dryland wheat).

5.1 Agricultural Land Classes (ALC)

Agricultural land classification (ALC) in Queensland allows the presentation of interpreted land evaluation data to indicate the location and extent of agricultural land that can be used sustainably for a wide range of land uses with minimal land degradation. ALC is land classification system for planning purposes that use the base land resource survey information and assessments of land suitability or land capability where they occur for the delineation of agricultural land.

Provision is also made to highlight areas that may be suitable for one specific crop considered important in a particular area (DSITI & DNRM 2015).

Three broad classes of agricultural land and one non-agricultural land class are identified:

- Class A – Crop land
  - has two subclasses:
    - A1 – land suitable for a wide range of broadacre crops, and
    - A2 – land suitable a wide range of horticultural crops only. This allows better discrimination of crop land at both local and state-wide levels.
- Class B – Limited crop land;
  - is land that is not suitable for a wide range of crops (broadacre and/or horticultural) but is suitable for a narrow range of crops or crops with specialised requirements e.g. tea, pineapples, plantation forestry. Class B land may be suitable for a wider range of crops with changes to knowledge, economics or technology. It is also suitable for sown pastures and pasture phases may be an integral part of a cropping system on this type of land.
- Class C – Pasture land
- Class D – Non-agricultural land.

6. Miriam Vale Solar Farm Project

6.1 Project Soils and Class B Agricultural Land

The soils in the Project area have been mapped in the 1:250,000 Land systems of the Miriam Vale and Kolan Shires by Donnollan et al (2004). The associated report is titled *Resources of the Miriam Vale and Kolan Shires (Donnollan, Wetherall & Griffiths, 2004)*. This survey mapped approximately 6,153 km^2 at 1:250,000 scale. Due to the survey scale, individual soils are not explicitly mapped. Instead, the mapping units are land systems, or areas throughout which there is a recurring pattern of geology, topography, soils and vegetation. Within each land system, component land units were described in terms of soils, landform attributes and vegetation.

Four land systems are mapped across the Project area; these are described in **Table 6.1** and are shown in **Figure 6.1**.

The Project area is predominantly located on the Boondilla land system, host to a range of soil orders including sodic duplex soils (Sodosols and Kurosols) and heavy clay Vertosols. The site compound and substation are all mapped as the Miriam Vale 1 land system that may consist of a wide range of soil types from shallow Dermosols to texture contrast soils such as Chromosols and Sodosols through to deep Vertosols. A soil site ~130 m away from the site compound is a Brown Sodosol. Sodosols are present in the area and will have a sodic clay subsoil that is highly likely to disperse.

Table 6.1: Land System Intersecting the Miriam Vale Solar Farm Project area

Map code	Land system	Landform and geology	Dominant vegetation	Major soils	Area intersected by the Project [1] (ha)
Alluvial Plains of Rivers and Creeks					
Bd	Boondilla	Alluvial plains and pediments and minor gently undulating rises on acid and intermediate intrusive rocks.	Open forest to woodland. Queensland blue gum, swamp mahogany, gum-topped box, cockatoo apple, bloodwoods and narrow-leaved iron bark.	Moderately deep to very deep, grey and brown sodic duplex soils (Sodosols and Kurosols), deep to very deep, black, cracking clays (Vertosols), black and grey, non-cracking clays and gradational soils (Dermosols) and coarse textured, uniform and gradational soils (Tenosols and Kandosols).	622.6
Acid to Intermediate Intrusive Rocks					
Mv1	Miriam Vale 1	Gently undulating rises to undulating rises on intermediate intrusive rocks.	Open forest to woodland. Narrow-leaved iron bark, bloodwoods, Moreton Bay ash, Queensland blue gum and silver-leaved iron bark.	Shallow to deep, brown and red, gradational soils (Dermosols) and non-sodic duplex soils (Chromosols), moderately deep to deep, brown, yellow and grey sodic and non-sodic duplex soils (Sodosols and Chromosols) and deep, black and grey, cracking clays (Vertosols).	300.8
Mv2	Miriam Vale 2	Gently undulating rises to undulating rises on acid intrusive rocks.	Open forest to woodland. Bloodwoods, Moreton Bay ash, yellow stringybark, narrow-leaved iron bark, Queensland blue gum, smooth barked apple and swamp mahogany often with an understorey of wattles, Melaleuca and Banksia species.	Moderately deep to deep, uniform, coarse textured soils (Tenosols) and deep, grey and yellow, non-sodic and sodic duplex soils (Chromosols, Sodosols and Kurosols).	2.5

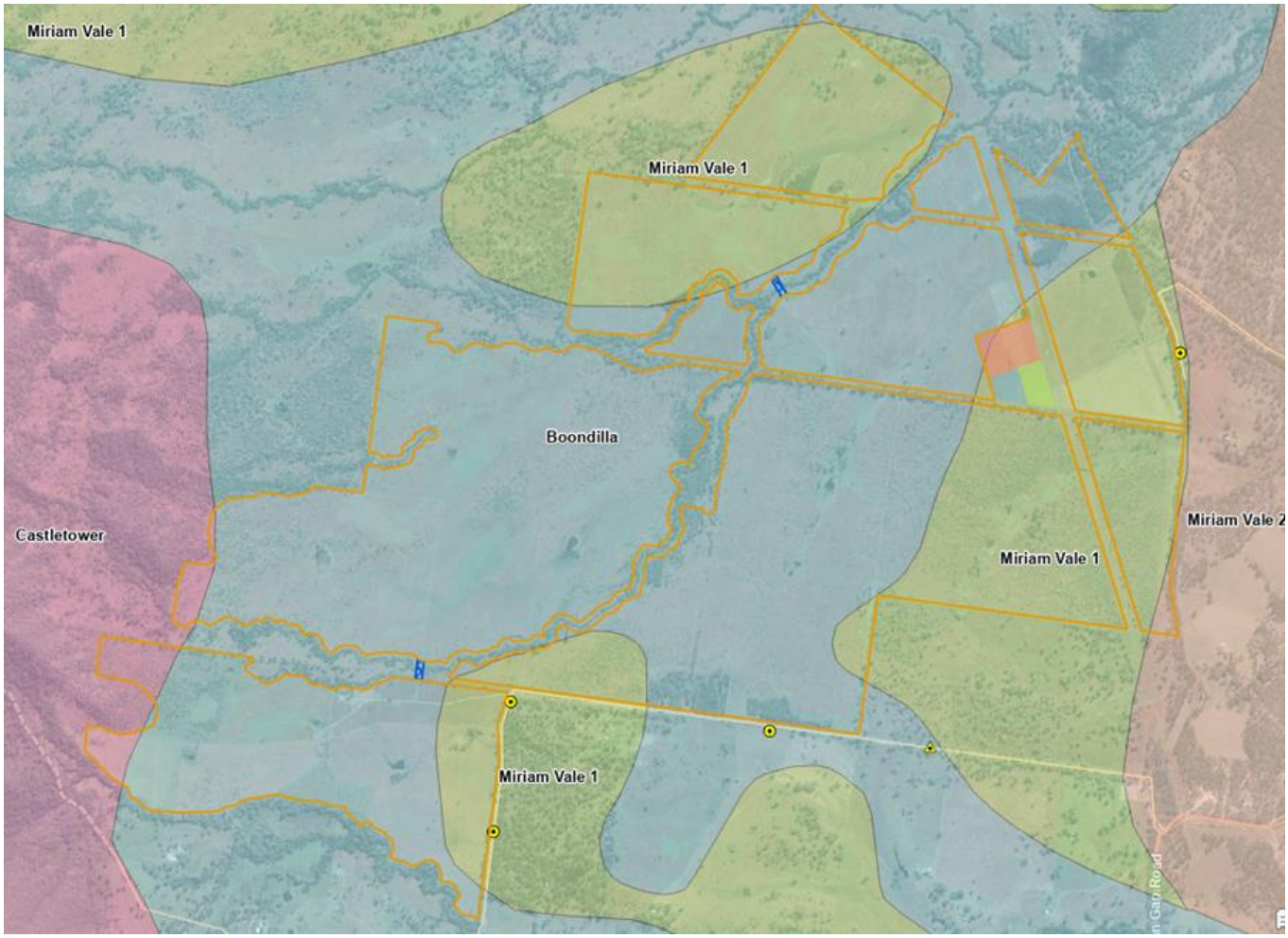
[1] Refers to Miriam Vale Solar Farm Project area

Map code	Land system	Landform and geology	Dominant vegetation	Major soils	Area intersected by the Project [1] (ha)
Cw	Castletower	Rolling hills to steep mountains on acid intrusive rocks.	Open forest to woodland. Spotted gum, narrow-leaved iron bark, bloodwoods, Moreton Bay ash, Queensland blue gum and swamp mahogany and minor areas of semi-evergreen vine forest.	Very shallow to shallow, uniform, coarse textured soils (Tenosols) and shallow to moderately deep, red, brown and yellow gradational soils (Dermosols and Kandosols) and non sodic duplex soils (Chromosols).	15.4

There are three soil sites data in SALI[2] that are relevant to the Class B agricultural land in the Project area, one of which also has laboratory analysis data. The soil site reports are attached in **Appendix B**.

The soil sites include a Grey Sodosol (MVK site 89) on an alluvial plain, a Black Vertosol (MVK site 88) on a valley flat and a Brown Dermosol (MVK site 87, with limited chemistry) on a mid-slope in rises.

Figure 6.1: Soils associated with the Miriam Vale Solar Farm Project area



6.2 Land Capability

In the Donnollan et al. (2004) study the land capability classification of Rosser et al. (1974) was used to assess the land units of each land system for agricultural, pastoral and non-agricultural uses (**Table 6.2**). Agricultural use implies cultivation and rainfed cereal cropping while pastoral use implies grazing of stock on improved or native pasture.

Table 6.2: Land Capability classes used in classifying land in the Miriam Vale Kolan shires

Land Class	Description
Class I	Land suitable for all agricultural and pastoral uses. Land is suited to a wide range of crops and is highly productive. Land presents no limitations to use of machinery or choice of implements. Wind and water erosion hazard are low even under intensive cultivation.
Class II	Land suitable for all agricultural uses but with slight restrictions to use for cultivation in one or more of the following categories:

[2] SALI is the State Soil and Land Information system that stores land resource data

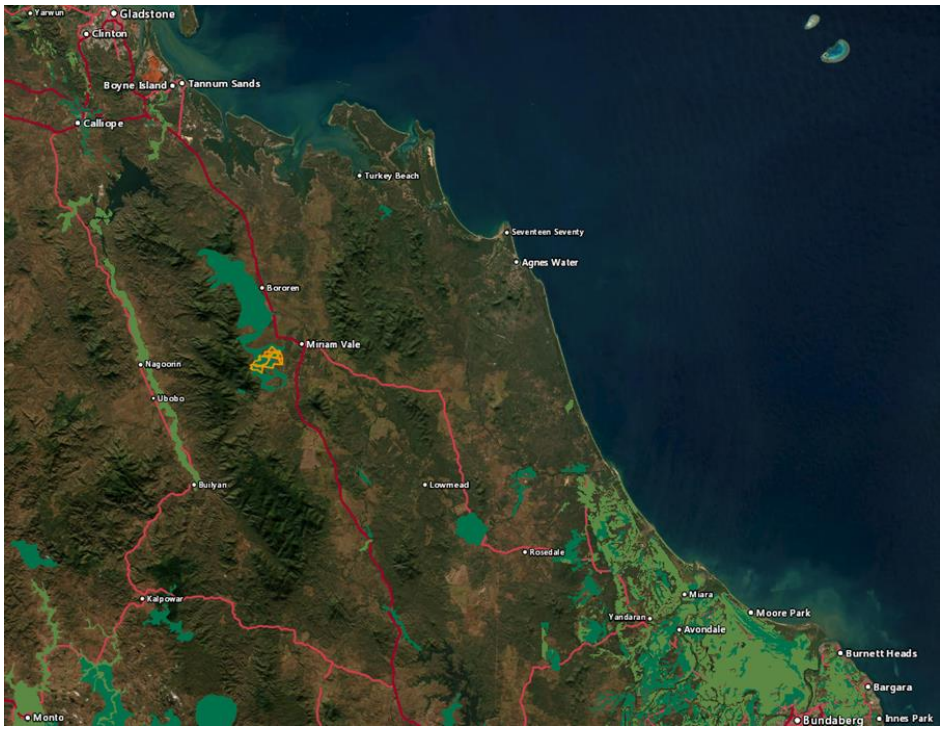
Land Class	Description
	Land with some limitation to the choice of crops and/or slight restrictions to productivity. Land with some impediment to the use of cultivation machinery which limits the choice of implements or restricts the conditions for successful operation. Land which under cultivation requires simple conservation practices to reduce soil loss to an acceptable level. These include agronomic practices such as contour working, strip cropping, stubble mulching.
Class III	Land suitable for all agricultural uses but with moderate restrictions to use for cultivation in one or more of the following categories: Land with moderate limitations to the choice of crops and/or moderate restrictions to productivity. Land with moderate impediment to the use of cultivation machinery which limits the choice of implements or restricts the conditions for successful operation. Land which under cultivation requires intensive conservation practices to reduce soil loss to an acceptable level. These include contour banking systems and intensive residue management involving specialised machinery.
Class IV	Land primarily suited to pastoral use but which may be safely used for occasional cultivation with careful management. Land on which the choice of crops is severely restricted and/or condition is such that productivity under cropping is severely limited. Land with severe impediment to the use of cultivation machinery which limits the choice of implements or severely restricts the conditions for successful operation. Land which cannot be used safely for permanent cultivation. If cropped, a pasture phase must be the major component in the cropping program to limit soil loss to acceptable levels.
Class V	Land which in all other characteristics would be arable but has limitations which, unless removed, make cultivation impractical and/or uneconomical.
Class VI	Land which is not suitable for cultivation but is well suited to pastoral use and on which pasture improvement involving the use of machinery is practicable.
Class VII	Land which is not suitable for cultivation but on which pastoral use is possible only with careful management. Pasture improvement involving the use of machinery is not practicable.
Class VIII	Land which has such severe limitations that it is unsuited for either cultivation or grazing.

6.3 Agricultural Land (Class A and Class B)

6.3.1 Regional Distribution or Agricultural Land

The Project area is located on an area of Class B Agricultural Land is relatively isolated from a regional perspective (refer to **Figure 6.2**). There are large areas of Class A and B land to the southeast around Bundaberg with a variety of high value crops including irrigated horticultural and irrigated sugar cane. There are also areas of Class A and B land to the northwest around Calliope and Benaraby.

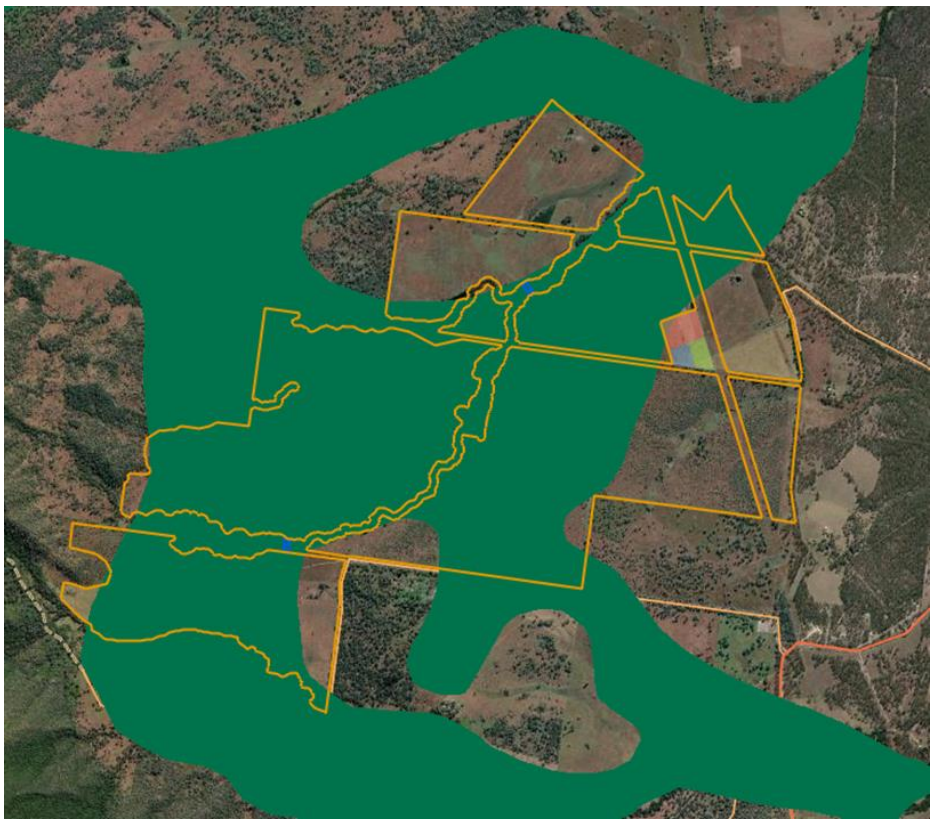
Figure 6.2: Regional distrbution or Agricultural land (QLD Globe) (Class A light green; Class B dark green)



6.3.2 Project Area Agricultural Land

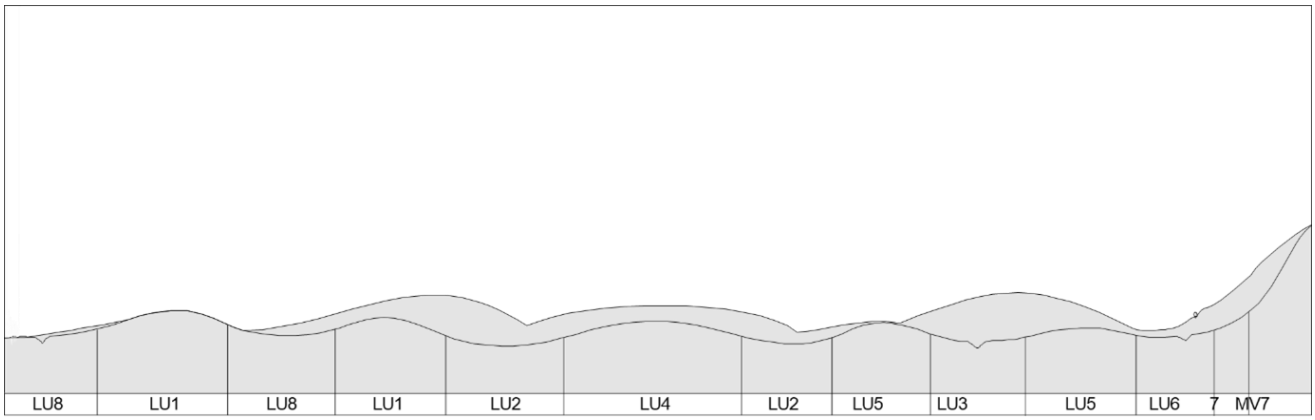
The Boondilla land system is mapped as Class B agricultural land on Council's Agricultural Land Classification Overlay as shown in **Figure 6.3**.

Figure 6.3: Agricultural Land Classification Overlay - Agricultural Land (Class B) within the Project area



The Boondilla land system has eight different land units (LU) as presented in **Figure 6.4** and in **Appendix A**.

Figure 6.4: Bondilla Land Units



The land units and dominant soils in the Boondilla land system have been classified into a land capability class by assessment against agricultural, pastoral and non-agricultural uses (refer to **Section 6.2**).

The land units LU2 and LU8 are assessed to have a land capability Class of IV- VI (as listed in **Table 6.2**) and are the most suitable for cultivation and cropping. Typically, these land units would occupy ~30% of the land system. The rest of the land units have a land capability class of VI which is land primarily suited to pastoral use. The land units have one or more of the limitation subclasses below that limit their use for cropping purposes:

- m6 <75 mm plant available water capacity (PAWC)
  - Not suitable for dryland sugarcane, macadamia, and Gympie messmate.
  - If <50mm PAWC not suitable for most dryland crops (excl improved pasture and radiata pine)
- pd4 0.25–0.5 m effective soil depth
- ps3 Moderate limitation – surface conditions with provide limitations to germination, seedling emergence and crop establishment
- nd3 Low nutrient status, especially phosphorous
- x6 Areas normally suitable for cultivation but due to inaccessibility, small areas or other restrictions cause the area to be downgraded
- f2 Flooding occurs but only minimal to moderate damage to crops
- tm2 Vertical interval of gilgai between 0.1 and 0.3 m
- e3-e6
  - e3 Suitable for cultivation with intensive erosion control methods, i.e. slopes 2–5% for Sodosols, 5–10% other soils
  - e4 Marginal soils for cultivation even with intensive control methods, i.e. slopes 10–12% on soils other than Sodosols
  - e6 Continuous pasture required to reduce erosion losses but cultivation acceptable to establish pasture, i.e. slopes 5–10% for Sodosols, 12–20% for other soils.

6.4 Qualitative Assessment of Mapped Class B Agricultural Land

The Project area appears to contain the landforms consistent with those in the Boondilla land system (i.e. alluvial plains, pediments and minor gently undulating rises) and therefore all the land units are likely to occur.

The land capability assessment was only undertaken for broad agricultural uses as outlined in **Section 6.2**. The land capability classes for the Boondilla land system range from IV to VI which has been interpreted to be Class B Agricultural Land Classification (ALC). This appears to be appropriate given the scale of the mapping with the latest

definition of ALC in the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI & DNRM 2015) and the range of land uses included in the Regional Land Suitability Framework (DSITI & DNRM 2013).

Based on the limitation subclasses in the land capability assessment for the land units in the Boondilla land system that will limit cropping land uses for the Project area and using the current Regional Land Suitability Framework:

- m6- not suitable for Gympie messmate, Macadamia, sugarcane and if PAWC <50mm (range not used in Donnollan et al 2004) also not suitable for soybean and spotted gum.
- f2/f3 –if flooding occurs 1 in 2 to 1 in 10 years not suitable for pineapple and macadamia and if annual flooding (about 1 in 1 to 1 in 2 years) also not suitable for any dryland crops.
- pd4 – not suitable for Gympie messmate, spotted gum and radiata pine (it should be noted that effective soil depth may have used different criteria compared to regional suitability framework)
- w4 – (Other areas which are wet seasonally have been given a subclass of w4 due to fewer restrictions on the use of that land) not suitable for Gympie messmate and spotted gum assuming imperfectly drained to very poorly drained soils
- e3-e6 – Suitable for cultivation with intensive erosion control methods, ie. slopes 2–5% for Sodosols, 5–10% other soils; - Continuous pasture required to reduce erosion losses but cultivation acceptable to establish pasture, ie. slopes 5–10% for Sodosols, 12–20% for other soils. Based on hardsetting duplex soils with sodic subsoils land >1% not suitable for soyabeans and not suitable for pineapple >3%.

The most significant limitation subclasses limiting agricultural cropping land use within the mapped Class B agricultural land on the Project area are soil water availability, effective soil depth and soil erosion.

Suitable cropping land uses within the mapped Class B agricultural land on the Project area are presented in **Appendix B** based on the assessment outlined above translating the original land capability assessment to a land suitability assessment for the cropping land uses in the regional land suitability framework.

Approximately half of the Class B land is only suitable for Radiata pine and potentially spotted gum hardwood plantations. The remainder of the area is often suitable for a couple of additional other potential crops that maybe suitable such as Gympie messmate, macadamia, soyabean and pineapple, although the areas are likely to be too small for some of these land units / land uses and additional soils information is needed to confirm the land use suitability's against the current suitability framework.

The definition of Class B - Limited crop land, is land that is not suitable for a wide range of crops (broadacre and/or horticultural) but is suitable for a narrow range of crops or crops with specialised requirements.

Due to the range of limitation subclasses impacting land use choice across the land units / soils in the Boondilla land system, it considered that no single land use is likely to be suitable across the whole Project area mapped as Class B ALC.

6.4.1 Viability of Agricultural Land

The ALC relates to the inherent characteristics of the land to support agricultural use but does not consider other aspects regarding the viability of agricultural use of that land. Viability of an agricultural use may depend on the makeup and configuration of the land that facilitates its efficient use such as:

- Contiguous areas of same slope and soil types (e.g. is it dissected by drainage lines),
- No significant land degradation (e.g. gully erosion), and
- Extent of land suitable for a single land use, rather than a changing make up of different cropping land uses.

The viability of agricultural use will also depend on the size and makeup of enterprises being undertaken by the landholder or company. Mapped areas of Class B ALC may not contribute significantly to the profitability and viability of the agricultural enterprise.

A qualitative assessment of the mapped Class B land indicates:

- The mapping of the Class B agricultural land appears to be consistent with the latest guidelines for the mapping scale and resolution of the base soil survey,

- The range of limitation subclasses identified for the land units means that no single crop is going to be suitable across the whole area of mapped Class B land,
- The scale of the mapping at 1:250,00 is likely to overstate the extent of agricultural land, and
- There are likely to be isolated areas that are not suitable for any cropping and larger extents that would struggle to meet the definition of Class B agricultural land, although these areas are not able to be spatially identified based on the current data.

6.5 Soil Conservation Plans

No soil conservation plans exist in the State mapping on the proposed lots.

6.6 Stock Routes

No State mapped stock routes intersect the proposed lots.

7. Potential Agricultural Impacts and Mitigation Measures

Whilst the Project is not able to avoid the reduction of available Class B agricultural land due to its abundant distribution across the Project area properties, the land is not considered to be suitable for cropping in part due to the broadscale of the underlying land resource mapping. To make full use of Class B land, a number of different crops would need to be planted due to the varying limitations across the site, which is not practicable or economically realistic. Any potential impacts associated with the Project are unlikely to be significant as the risks to agricultural values can be managed throughout the life of the Project by the implementation of appropriate mitigation and management measures.

Despite there being limitations to the types of cropping suitable within the Project area, the loss of potential agricultural production throughout the life of the Project (~40 years) is unavoidable. However, the Project will result in significant benefits to land holders and to the wider region representing an alternative productive land use.

The Project may result in several potential impacts on Class B agricultural land including:

- The construction, operation and rehabilitation phases of the Project, in particular the solar arrays which constitute majority of the Project footprint, have the potential to impact soil and pasture resources due to; soil erosion, soil compaction, inversion/mixing of soil profiles in cable trenches and changes to pasture composition from exclusion of grazing.
- The construction and operation phases of the Project have the potential to cause the proliferation of existing invasive weeds and the introduction of additional species. Further infestation of agricultural weeds could potentially impede agricultural production.
- The reduction in available cropping land throughout the life of the Project, as cropping will be excluded from the Project area during the construction and operational phase of the Project. However, the Project will not have a significant impact on cropping land availability in Queensland with approximately 84% of land in Queensland used for agriculture (DAF, 2022) and only 604.96 ha being excluded by the Project.

No significant impacts in relation to soil or pasture are anticipated with the implementation of relevant management measures during the various phases of the Project as presented below.

- Specific measures for the minimisation and management of potential impacts on the agricultural land will be developed and implemented as part of the following management plans:
- Erosion and Sediment Control Plan (ESCP) in accordance with the Best Practice Erosion and Sediment Control (Aust IECA, 2008) guideline for the construction and decommissioning phases of the Project to minimise soil erosion.
- Soil management measures for the Project to preserve topsoil resources at the site and minimise impacts to soil resources to be incorporated into a Construction Environmental Management Plan (CEMP) or similar.
- Weed and pest management measures during all phases of the development to be incorporated into a CEMP or similar.
- A Rehabilitation Plan to address any identified impacts to soil and to ensure that re-established pasture is at least comparable to active grazing land outside the lease areas at the site at the time of decommissioning.

8. Assessment of Agricultural Land Impacts against the Gladstone Regional Council's Planning Scheme

8.1 Assessment of Agricultural Land on the Project Site

As concluded within this report, the Project area has a range of limitation subclasses impacting land use choice across the land units / soils in the Boondilla land system and no single land use will be suitable across the whole area mapped as Class B land.

The majority of the Class B land has a very narrow range of crop options with approximately half the area only suitable for Radiata pine and potentially spotted gum hardwood plantations. The remainder of the area is often suitable for a couple of additional other potential crops that maybe suitable such as Gympie messmate, macadamia, soyabean and pineapple, although the areas are likely to be too small for some of these land units / land uses and additional soils information is needed to confirm the land use suitability's against the current suitability framework.

8.2 Assessment Against the Rural Zone for Impacts to Agricultural Land

The Project is to be assessed against the GRC Planning Scheme's Rural Zone code, specifically the POs relevant due to the presence of Class B agricultural land within the broader Project area. A comprehensive response to the Rural Zone code is provided in the Planning Report which accompanies the development application for the Project. The proposed development has been designed to meet the objectives of the Rural Zone code.

Table 8.1 and **Table 8.2** provide a high-level response to the purpose and overall outcomes of the Rural Zone Code relevant to the Project's location within the Agricultural Land Classification overlay.

Table 8.1: Rural Zone Code Response

Purpose	Response
b. Provide opportunities for non–rural uses that are compatible with agricultural and rural activities, and the landscape character of the rural area where they do not compromise the long–term use of the land for rural purposes.	The Project is compatible with rural activities and does not require any separation or buffer zones to be established that would limit agricultural or rural activities occurring on surrounding land. The Project has a life of approximately 40 years and does not cause impacts that would limit the use of the land for rural purposes following decommissioning of the Project.
e. Ensure areas of Agricultural Land Classification Class A and B agricultural land are protected for agricultural uses and from fragmentation, alienation or diminished agricultural productivity.	The Class B land on the Project area is not suited to traditional broadscale cultivation and cropping and the highest value for a future agricultural use over any significant area is most likely to be plantation forestry. The Project will not fragment or alienate the potential future use of the land for agricultural use. This is due to the nature of the topography of the Project area and property sizes in the area that breakup the landscape so that agricultural production systems are not continuous like on a broad alluvial plain. The current use of the properties is for livestock grazing with very small patches of plantation forestry. The potential impacts from the Project are unlikely to reduce the overall agricultural productivity of the land. Minor impacts to productive potential may occur on the substation site; however, this area only covers less than 1.2% of the total Project footprint.

Purpose	Response
f. The potential for conflict between agricultural and other uses on Agricultural Land Classification Class A and B are minimised.	The Project will take the land out of potential agricultural production for the life of the Project. However, the Project will result in significant benefits to landholders and to the region as an alternative productive land use.

Table 8.2: Rural Zone – Overall Outcomes Response

b. The viability of both existing and future rural uses and activities are protected from the intrusion of incompatible uses.	The existing landholders are using the properties for livestock grazing and have no immediate plans to undertake cropping activities that are potentially suitable on the Class B land. This is largely because the crops that are suitable and the investment in equipment / infrastructure and potential timeframes for financial returns are not attractive to the existing landholders. Cropping of pineapples, soybeans or sugarcane would all require significant capital investment, and the extent of suitable land makes it unattractive. There are also no similar land uses on Class B land in proximity to the Project site. The alternative crop type would be plantation forestry and the initial capital outlay and timeframes for financial returns make this use unviable. As an alternative option to an agricultural cropping land use, the Project will result in significant benefits to land holders and to the region as an alternative productive land use.
c. The establishment of a wide range of rural pursuits is facilitated, including cropping, intensive horticulture, grazing, intensive animal industries, animal husbandry and animal keeping and other compatible primary production uses.	The Project is a viable and productive land use that will have significant benefits to the region and is not incompatible with surrounding primary production uses.
d. Cropping activities are encouraged on Agricultural Land Classification Class A and B agricultural land.	Cropping on these parcels is financially unattractive to the current landholders due to the initial investment and/or timeframes before revenue would be produced. Hence why the current landholders are interested in their land to be used for the proposed Project.
e. Development does not result in the fragmentation of Agricultural Land Classification Class A and B agricultural land. This applies to reconfiguring a lot except where it has been assessed that there is an overriding need in the public interest for a related material change of use and the reconfiguring of a lot is consistent with the material change of use.	The proposed Project will not involve the reconfiguration of a lot and will not result in fragmentation of Agricultural Land Classification Class A and B agricultural land in this manner.

9. Conclusion

Whilst the Project has the potential to reduce the available cropping land, the potential agricultural impacts can be adequately managed and do not present a risk of significant or permanent impact to the agricultural values of the Project area.

This agricultural assessment concludes that:

- The Project will be developed on mapped Class B land; however, the area has a range of limitation subclasses impacting land use choice across the land units / soils in the Boondilla land system and no single land use will be suitable across the whole area mapped as Class B land.
- The Project will not have a significant impact on cropping land availability across Queensland, as the temporary loss of 604.96 ha of land is negligible where 84% of land in Queensland is used for agricultural purposes.
- A number of invasive weed species are present throughout the Project area in abundance, and it is recommended that weed and pest management measures are implemented during all phases of the Project which will adequately manage biosecurity risks associated with the Project.
- The implementation of soil management measures and specific ESCPs will be adequate for managing potential impacts to land resources.
- The Project may continue to support agricultural land uses, such a sheep grazing, throughout the life of the Project and allow for the recommencement of other agricultural land uses based on inherent soil constraints at the end of the Project life following decommissioning and rehabilitation works.

10. References

DAF (2022). DAF Annual Report (Department of Agriculture and Fisheries), Brisbane, Queensland.

DSITI & DNRM (2013). Regional Land Suitability Frameworks for Queensland. Queensland Government (Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines), Brisbane, Queensland.

DSITI & DNRM (2015). Guidelines for agricultural land evaluation in Queensland (2nd edn). Queensland Government (Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines), Brisbane, Queensland.

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Appendix A

Land Units of Boondilla Land System

Land Unit	Area %	Landform Attributes	Soils	Remnant Vegetation	Land Class	Suitable cropping land uses
LU1	5	Levees and alluvial fans, 2–4%.	Deep, yellow, coarse textured gradational soils with hardsetting surfaces; coarse sand to sandy loam, very thick A horizons; coarse sandy loam to coarse sandy clay loam B horizons, with fine gravel common throughout; neutral soil reaction trend. Yellow Kandosols.	Open forest. Queensland blue gum, bloodwoods and swamp mahogany with cockatoo apple dominating the lower stratum.	VI m6, ps3, nd3	Pineapple, radiata pine, soybean? Spotted gum?
LU2	25	Plains and drainage depressions, 0–2%. Gilgai may be present.	Deep to very deep, occasionally mottled, black, cracking clays with self-mulching to hardsetting surfaces; light medium clay A horizons; light medium to medium clay B horizons; few to common fine pebbles at depth; few to many carbonate nodules in B horizon; neutral to alkaline soil reaction trend. Black Vertosols.	Woodland. Queensland blue gum. Small areas dominated by *Melaleuca* species may be present.	IV or VI m2, ps2, pm3, (sa 4 or 6), w4, f2–3, tm2	Soybean, Radiata Pine, Spotted gum, Sugarcane?
LU3	5	Plains and drainage lines, 1–4%.	Deep to very deep, coarse textured uniform soils with hardsetting surfaces; loamy sand to sandy clay loam, medium to thick A horizons often with bleached A2 horizons; (when present) coarse sand to sand B horizons; sand to coarse sand D horizons or buried soils may be present; neutral soil reaction trend. Bleached Leptic and Bleached Orthic Tenosols and Leptic Rudosols.	Woodland, extensively cleared. Queensland blue gum and swamp mahogany, bloodwoods and narrow-leaved ironbark.	VI m6, ps3, nd3, f2	radiata pine, soybean? Spotted gum?
LU4	30	Plains, 0.5–2%.	Deep to very deep, black and grey, sodic duplex soils with hardsetting surfaces; sandy loam to sandy clay loam, medium A horizons usually with bleached A2 horizons; sandy light medium to medium clay B horizons; coarse sandy light to medium clay D horizons may be present;	Open forest to woodland. Queensland blue gum, narrow-leaved ironbark, gum-topped box, swamp mahogany, bloodwoods	VI m6, pd4, ps3, nd3, e2, f2	radiata pine, Spotted gum?

Land Unit	Area %	Landform Attributes	Soils	Remnant Vegetation	Land Class	Suitable cropping land uses
			neutral to alkaline soil reaction trend. Black and Grey Sodosols.	and smooth-barked apple.		
LU5	15	Crests and mid slopes of ridges, 3–6%.	Moderately deep, brown, sodic duplex soils with hardsetting surfaces; fine sandy loam to clay loam, medium A horizons usually with bleached A2 horizons; light medium to medium clay B horizons; neutral to alkaline soil reaction trend. Brown Sodosols.	Open forest. Queensland blue gum, narrow-leaved ironbark and Moreton Bay ash.	VI m6, pd4, ps3, nd3, e3–4	Radiata pine, Spotted gum?
LU6	5	Footslopes and associated drainage lines, 2–6%.	Deep, mottled, grey, non cracking clays and gradational and sodic duplex soils with hardsetting surfaces; clay loam to light clay, medium A horizons with bleached A2 horizons; sandy light medium to medium heavy clay B horizons, with few to common fine gravel; alkaline soil reaction trend. Grey Dermosols and Sodosols.	Closed forest. Queensland blue gum and minor gum-topped box.	VI m4 or 6, pd3, ps3, e2–3, x6	Radiata Pine, Gympie messmate?, Spotted gum, Sugarcane?, Macadamia?
LU7	10	Footslopes and associated drainage lines, 3–10%. Surface pebbles and stone may be present.	Moderately deep to deep, often mottled, grey and brown, sodic duplex soils; sandy loam, thick to very thick A horizons with bleached A2 horizons; light medium to medium clay B horizons, with few to many fine gravel; acid to neutral soil reaction trend. Grey and Brown Kurosols and Chromosols..	Open woodland. Queensland blue gum, *Melaleuca* species and swamp mahogany. River she oak common in drainage lines.	VI m6, pd3, ps2, nd3, (r2–3), e3–6	Radiata pine, Spotted gum?
LU8	5	Plains, 0.5–1%.	Deep, black and grey, gradational soils with hardsetting surfaces; clay loam, medium A horizons; light to light medium clay B horizons; sandy D horizons may be present; neutral soil reaction trend. Black and Grey Dermosols.	Open forest. Queensland blue gum and swamp mahogany with *Melaleuca* species and cockatoo apple dominating the lower stratum.	IV–VI. m6, pd3, ps2, e2	Pineapple, radiata pine, soybean? Spotted gum?

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Appendix B

Soil Site Reports

Project MVK Site 584 Observation 1

SALI4320

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	5/04/2001	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class I (detailed soil profile description)

Slope (%):	6	Morphological type:	Crest
Slope type	Abney level or clinometer and tape	Landform element:	Hillcrest
Geology:	Miriam Vale Granodiorite: Biotite granodiorite, adamellite, quartz diorite, marginal pegmatite and gneiss, rare gabbro	Landform pattern:	Rises

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Moderately permeable (50-500 mm/day)	Erosion:	Not recorded
Drainage:	Moderately well drained	Microrelief type:	Not recorded
Disturbance:	Not recorded	Proportion gilgai:	N/A
Rock outcrop:	Not recorded	Vertical interval (m):	N/A
Surface condition:	Hard setting	Horizontal interval (m):	N/A
Surface coarse fragments:	Not recorded	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.36026	151.49655	56	347499	7305061	Not recorded	Averaging GPS
GDA 2020	-24.36025	151.49655	56	347500	7305063		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Bleached-Sodic, Eutrophic, Yellow Chromosol; thick, non-gravelly, clay loamy, clayey, moderate.	No analytical data are available but confidence is fair.	Isbell (2002) The Australian Soil Classification Revised Edition	N/A		Dy2.12

Vegetation

Community name	Tall open forest, Corymbia intermedia	
Stratum	Species	Common name
Tallest 12.01-20 m	*Corymbia intermedia*	pink bloodwood, red bloodwood
	Eucalyptus crebra	narrow-leaved ironbark
	Eucalyptus tereticornis	blue gum, forest red gum

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A	0	0.32	Very dark greyish brown (10YR 3/2) moist		Clay loam	Strong 2-5 mm Subangular blocky structure;				
2	B	0.32	0.7	Yellowish brown (10YR 5/8) moist		Light medium clay	Strong 2-5 mm Subangular blocky structure; Strong 2-5 mm Lenticular structure;				
3	C	0.7	0.77					abundant (50-90%) granodiorite;			

Field test

pH by Raupach and Tucker method

Depth (m)	Value
0.05	6.5
0.5	6.5

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	5/04/2001	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class I (detailed soil profile description)

Slope (%):	2	Morphological type:	Flat
Slope type	Abney level or clinometer and tape	Landform element:	Plain
Geology:	Miriam Vale Granodiorite: Biotite granodiorite, adamellite, quartz diorite, marginal pegmatite and gneiss, rare gabbro	Landform pattern:	Alluvial plain

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Moderately permeable (50-500 mm/day)	Erosion:	Not recorded
Drainage:	Imperfectly drained	Microrelief type:	Not recorded
Disturbance:	Not recorded	Proportion gilgai:	N/A
Rock outcrop:	Not recorded	Vertical interval (m):	N/A
Surface condition:	Hard setting	Horizontal interval (m):	N/A
Surface coarse fragments:	Not recorded	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.36574	151.49574	56	347424	7304453	Not recorded	Averaging GPS
GDA 2020	-24.36573	151.49575	56	347425	7304455		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Eutrophic, Subnatric, Grey Sodosol; medium, non-gravelly, clay loamy, clayey, very deep.	No analytical data are available but confidence is fair.	Isbell (2002) The Australian Soil Classification Revised Edition	N/A		Dy2.33

Vegetation

Community name	Tall open forest, Lophostemon suaveolens	
Stratum	Species	Common name
Tallest 12.01-20 m	*Lophostemon suaveolens*	swamp box, swamp mahogany
	Eucalyptus tereticornis	blue gum, forest red gum
	Eucalyptus crebra	narrow-leaved ironbark
	Corymbia species	
	Angophora floribunda	roughbark apple

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A1	0	0.1	Brown (7.5YR 4/2) moist		Sandy clay loam	Weak 2-5 mm Subangular blocky structure;				
2	A2j	0.1	0.25	Brown (7.5YR 4/3) moist		Sandy clay loam	Weak 2-5 mm Subangular blocky structure;				
3	B21	0.25	0.45	Brown (10YR 5/3) moist	few (2-10%) fine (<5 mm) faint orange mottles;	Light medium clay	Strong 5-10 mm Subangular blocky structure;				
4	B22	0.45	0.85	Yellowish brown (10YR 5/8) moist	common (10-20%) medium (5-15 mm) distinct grey mottles;	Light medium clay	Strong 5-10 mm Subangular blocky structure;		Few (2-10%) Fine (<2mm) Manganiferous Nodules;		
5	D1	0.85	1.1	Dark greyish brown (10YR 4/2) moist		Coarse sandy light clay	Strong 2-5 mm Subangular blocky structure;	few (2-10%) quartz large pebbles (20-60 mm); few (2-10%) granite small pebbles (2-6 mm);	Few (2-10%) Fine (<2mm) Manganiferous Veins;		

6	D2	1.1	1.35	Light olive brown (2.5Y 5/4) moist		Coarse sandy light clay	Strong 5-10 mm Subangular blocky structure;	common (10-20%) granite small pebbles (2-6 mm);	Common (10-20%) Fine (<2mm) Manganiferous Veins;		
7	D3	1.35	1.7	Dark greyish brown (2.5Y 4/2) moist	few (2-10%) fine (<5 mm) faint orange mottles;	Light clay	Strong 2-5 mm Subangular blocky structure; Strong 2-5 mm Lenticular structure;				

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.05	6
0.3	6
0.6	7.5
0.9	9
1.2	9
1.5	9

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	19/05/1999	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class IIIa (limited chemistry)

Slope (%):	5	Morphological type:	Mid-slope
Slope type	Abney level or clinometer and tape	Landform element:	Hillslope
Geology:	Miriam Vale Granodiorite: Biotite granodiorite, adamellite, quartz diorite, marginal pegmatite and gneiss, rare gabbro	Landform pattern:	Rises

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Imperfectly drained	Microrelief type:	Not recorded
Disturbance:	Extensive clearing	Proportion gilgai:	N/A
Rock outcrop:	Not recorded	Vertical interval (m):	N/A
Surface condition:	Hard setting	Horizontal interval (m):	N/A
Surface coarse fragments:	Not recorded	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.36213	151.51599	56	349474	7304875	Not recorded	Single GPS
GDA 2020	-24.36212	151.51600	56	349475	7304877		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Vertic, Calcic, Brown Dermosol; medium, non-gravelly, clay loamy, clayey, moderate.		Isbell (2002) The Australian Soil Classification Revised Edition	N/A	No suitable group	Gn3.92

Vegetation

Community name	Tall open forest, Eucalyptus crebra	
Stratum	Species	Common name
Tallest 12.01-20 m	*Eucalyptus crebra*	narrow-leaved ironbark
	Eucalyptus trachyphloia	
	Eucalyptus tereticornis	blue gum, forest red gum

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A11	0	0.1	Brownish black (7.5YR 3/2) moist		Clay loam	Moderate 2-5 mm Granular structure;			Dry, Weak strength;	
2	A12	0.1	0.15	Brownish black (7.5YR 3/2) moist		Light clay	Weak 2-5 mm Granular structure;	common (10-20%) angular chert medium pebbles (6-20 mm);		Dry, Weak strength;	
3	B21	0.15	0.3	Dull yellowish brown (10YR 5/4) moist		Medium clay	Strong 5-10 mm Subangular blocky structure;		Few (2-10%) Fine (<2mm) Manganiferous Nodules;	Moderately moist, Weak strength;	
4	B22	0.3	0.5	Yellowish brown (2.5Y 5/4) moist		Medium clay	Strong 5-10 mm Lenticular structure;			Moderately moist, Very firm strength;	
5	BC	0.5	0.85	Olive brown (2.5Y 4/3) moist		Light medium clay	Strong 5-10 mm Angular blocky structure;	common (10-20%) diorite small pebbles (2-6 mm);	Common (10-20%) Fine (<2mm) Calcareous Nodules;	Moderately moist, Very firm strength;	
6	C	0.85	0.88								

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.05	7
0.12	6
0.2	6
0.4	7
0.7	8.5
0.88	9

Notes			
Note level	Horizon name	Horizon no	Note
Observation			EC = 0.29 DS
Observation			Sampled 15-40 & 70-90 for CEC

Laboratory test results						
				Sample	1	2
				Upper depth (m)	0.15	0.7
				Lower depth (m)	0.4	0.9
Group	Method	Code	Units	Bulked Sample	N	N
Profile General	pH - 1:5 water	4A1			6.8	8.3
	EC - 1:5 water	3A1	dS/m		0.06	0.27
	Cl - 1:5 water - automated	5A2	mg/kg		57	155
	Water sol NO3 - automated	7B1	mg/kg		0.436	0.436
Alcoholic Cations	Exch Ca - Alch NH4Cl, pH8.5, prewash	15C1_Ca	cmol_c/kg		22.00	28.00
	Exch Mg - Alch NH4Cl, pH8.5, prewash	15C1_Mg	cmol_c/kg		13.00	14.00
	Exch Na - Alch NH4Cl, pH8.5, prewash	15C1_Na	cmol_c/kg		0.69	0.88
	Exch K - Alch NH4Cl, pH8.5, prewash	15C1_K	cmol_c/kg		0.07	0.01
	CEC - Alch NH4Cl pH8.5 pre wash	15C1_CEC	cmol_c/kg		31	27
Acid Cations	Exch Ca - NH4Cl, pH7, no prewash	15A1_Ca	cmol_c/kg		22.00	39.00
	Exch Mg - NH4Cl, pH7, no prewash	15A1_Mg	cmol_c/kg		14.00	14.00
	Exch Na - NH4Cl, pH7, no prewash	15A1_Na	cmol_c/kg		0.72	0.99
	Exch K - NH4Cl, pH7, no prewash	15A1_K	cmol_c/kg		0.20	0.15
	ECEC (Effective CEC)	15J1	cmol_c/kg		36.92	54.14

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	19/05/1999	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class I (detailed soil profile description)

Slope (%):	0.5	Morphological type:	Flat
Slope type	Abney level or clinometer and tape	Landform element:	Plain
Geology:	Miriam Vale Granodiorite: Granodiorite, tonalite, diorite	Landform pattern:	Alluvial plain

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Imperfectly drained	Microrelief type:	Not recorded
Disturbance:	Not recorded	Proportion gilgai:	N/A
Rock outcrop:	Not recorded	Vertical interval (m):	N/A
Surface condition:	Hard setting	Horizontal interval (m):	N/A
Surface coarse fragments:	Not recorded	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.37302	151.49437	56	347294	7303645	Not recorded	Single GPS
GDA 2020	-24.37301	151.49438	56	347295	7303647		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Hypercalcic, Subnatric, Grey Sodosol; medium, non-gravelly, clay loamy, clayey, very deep.		Isbell (2002) The Australian Soil Classification Revised Edition	N/A	Solodic soil	Dy2.43

Vegetation

Community name	Tall open forest, Eucalyptus trachyphloia	
Stratum	Species	Common name
Tallest 12.01-20 m	*Eucalyptus trachyphloia*	
	Eucalyptus crebra	narrow-leaved ironbark
	Eucalyptus tereticornis	blue gum, forest red gum

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A1	0	0.1	Greyish yellow-brown (10YR 4/2) moist		Fine sandy clay loam	Massive structure;			Dry, Very weak strength;	clear
2	A2e	0.1	0.2	Greyish yellow-brown (10YR 4/2) moist		Fine sandy clay loam	Massive structure;			Dry, Very weak strength;	abrupt
3	B21	0.2	0.55	Dark greyish yellow (2.5Y 4/2) moist		Light medium clay	Strong 10-20 mm Angular blocky structure;	few (2-10%) quartz small pebbles (2-6 mm);		Dry, Very firm strength;	gradual
4	B22	0.55	0.8	Brownish black (10YR 3/1) moist		Medium clay	Strong 10-20 mm Lenticular structure;			Moderately moist, Weak strength;	gradual
5	B23	0.8	1.2	Brownish black (2.5Y 3/1) moist		Light medium clay	Strong 10-20 mm Lenticular structure;		Few (2-10%) Fine (<2mm) Calcareous Nodules;	Moderately moist, Weak strength;	clear
6	B24	1.2	1.45	Dark greyish yellow (2.5Y 4/2) moist		Light medium clay	Strong 10-20 mm Lenticular structure;		Few (2-10%) Fine (<2mm) Calcareous Nodules;	Moderately moist, Weak strength;	
7	B25	1.45	1.55	Dark greyish yellow (2.5Y 4/2) moist	common (10-20%) fine (<5 mm) distinct brown mottles;	Light clay	Strong 5-10 mm Subangular blocky structure;	few (2-10%) quartz small pebbles (2-6 mm);	Common (10-20%) Fine (<2mm) Calcareous Nodules;	Moderately moist, Firm strength;	

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.05	5.5
0.3	7.5
0.6	8.5
0.9	8.5
1.2	8.5
1.5	10

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	19/05/1999	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class I (detailed soil profile description)

Slope (%):	3	Morphological type:	Crest
Slope type	Abney level or clinometer and tape	Landform element:	Hillcrest
Geology:	Miriam Vale Granodiorite: Biotite granodiorite, adamellite, quartz diorite, marginal pegmatite and gneiss, rare gabbro	Landform pattern:	Rises

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Imperfectly drained	Microrelief type:	Not recorded
Disturbance:	Extensive clearing	Proportion gilgai:	N/A
Rock outcrop:	Not recorded	Vertical interval (m):	N/A
Surface condition:	Hard setting	Horizontal interval (m):	N/A
Surface coarse fragments:	Not recorded	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.34553	151.52759	56	350631	7306726	Not recorded	Single GPS
GDA 2020	-24.34552	151.52760	56	350632	7306728		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Hypercalcic, Subnatric, Brown Sodosol; medium, non-gravelly, clay loamy, clayey, shallow.		Isbell (2002) The Australian Soil Classification Revised Edition	N/A	Brown podzolic soil	Db1.13

Vegetation

Community name	Tall open forest, Eucalyptus crebra	
Stratum	Species	Common name
Tallest 12.01-20 m	*Eucalyptus crebra*	narrow-leaved ironbark
	Corymbia citriodora	lemon-scented gum

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A1	0	0.25	Brownish black (10YR 3/2) moist		Clay loam	Weak 2-5 mm Granular structure;				clear
2	B2	0.25	0.45	Olive brown (2.5Y 4/3) moist		Medium clay	Strong 20-50 mm Subangular blocky structure;		Few (2-10%) Fine (<2mm) Manganiferous Nodules;	Dry, Very firm strength;	clear
3	BC1	0.45	0.6	Dark greyish yellow (2.5Y 4/2) moist		Light clay	Strong 20-50 mm Subangular blocky structure;		Few (2-10%) Fine (<2mm) Manganiferous Nodules;		
4	BC2	0.6	0.7					very abundant (>90%) diorite;			
5	BC3	0.7	1.12					very abundant (>90%) granite;	Common (10-20%) Medium (2-6 mm) Calcareous Soft segregations;		

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.05	6
0.3	6.5
0.6	7
0.9	8.5
1.12	9

Notes			
Note level	Horizon name	Horizon no	Note
Observation			Diagram drawn. Sodic in B

Project description

Project name:	Land systems and land resource survey of the Miriam Vale and Kolan Shires, South East Queensland
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	Kolan River and Baffle Creeks Catchments, Burnett-Mary, South East Queensland

Site characteristics

Date described:	19/05/1999	Observation type:	Relatively undisturbed soil core
Site Type:		Observation class:	Class I (detailed soil profile description)

Slope (%):	0.5	Morphological type:	Flat
Slope type	Abney level or clinometer and tape	Landform element:	Valley-flat
Geology:	Miriam Vale Granodiorite: Biotite granodiorite, adamellite, quartz diorite, marginal pegmatite and gneiss, rare gabbro	Landform pattern:	Rises

Soil Name:	Not recorded	Substrate lithology:	Not recorded
Runoff:	Not recorded	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Poorly drained	Microrelief type:	Normal gilgai
Disturbance:	Extensive clearing	Proportion gilgai:	Mound < depression; no shelf
Rock outcrop:	Not recorded	Vertical interval (m):	0.05
Surface condition:	Periodic cracking; Hard setting	Horizontal interval (m):	10
Surface coarse fragments:	Not recorded	Microrelief component sampled:	Not recorded

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-24.36150	151.50856	56	348719	7304937	Not recorded	Single GPS
GDA 2020	-24.36149	151.50856	56	348720	7304939		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Endocalcareous, Epipedal, Black Vertosol; —, non-gravelly, medium fine, medium fine, deep.		Isbell (2002) The Australian Soil Classification Revised Edition	N/A	Black earth	Ug5.16

Vegetation

Community name	Tall woodland, Eucalyptus tereticornis	
Stratum	Species	Common name
Tallest 12.01-20 m	*Eucalyptus tereticornis*	blue gum, forest red gum

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A1	0	0.1	Black (7.5YR 2/1) moist		Medium clay	Strong 5-10 mm Subangular blocky structure;			Moderately moist, Very firm strength;	
2	B21	0.1	0.3	Brownish black (7.5YR 3/1) moist		Medium clay	Strong 5-10 mm Subangular blocky structure;			Moderately moist, Very firm strength;	
3	B22	0.3	0.5	Dark greyish yellow (2.5Y 4/2) moist	few (2-10%) medium (5-15 mm) prominent yellow mottles;	Medium clay	Strong 5-10 mm Lenticular structure;		Few (2-10%) Fine (<2mm) Calcareous Soft segregations;	Moderately moist, Very firm strength;	
4	B23	0.5	0.95	Dark greyish yellow (2.5Y 5/2) moist	common (10-20%) medium (5-15 mm) prominent yellow mottles;	Medium clay	Strong 5-10 mm Lenticular structure;	few (2-10%) quartz small pebbles (2-6 mm);	Common (10-20%) Fine (<2mm) Calcareous Soft segregations;	Moderately moist, Firm strength;	
5	B24	0.95	1.4	Greyish olive (5Y 5/2) moist	common (10-20%) medium (5-15 mm) prominent yellow mottles;	Light medium clay	Strong 5-10 mm Subangular blocky structure;		Few (2-10%) Fine (<2mm) Calcareous Soft segregations;	Moderately moist, Weak strength;	

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.05	9
0.3	9.5
0.6	9.5
0.9	9.5
1.2	9
1.4	9