

LAND AND SOIL CAPABILITY ASSESSMENT

Proposed Battery Energy Storage System

57 Burgess Lane, Calala, NSW, 2340 Also known as 474 Calala Lane, Calala, NSW, 2340 ENV218049

For:

Equis Energy (Australia) Projects (NGUMI4) Pty Ltd as trustee for the Equis Energy (Australia) Ngumi 4 Asset Trust

By:

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Date:

28/09/2023

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SCOPE OF ENGAGEMENT AND LIMITATIONS

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- Appendix A Site Figures
- Appendix B Laboratory Results
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LIST OF ACRONYMS

Below is a list of commonly used acronyms in this report:

- AHD Australian Heigh Datum
- **ENV ENV Solutions**
- LSC Land and Soil Capability
- LSCA Land and Soil Capability Assessment
- NSW EPA New South Wales Environment Protection Authority
- ppm_v Parts Per Million (by volume)
- BSAL Biophysical Strategic Agricultural Land



1 INTRODUCTION

ENV Services Pty Ltd (ENV) has undertaken a Land and Soil Capability Assessment (LSCA) for Lot 17 on DP629969, 57 Burgess Lane, Calala, NSW 2430 (also known as 474 Calala Lane, Calala NSW 2340) (hereafter referred to as the 'site'). ENV understands that the LSCA has been requested to support a Development Application for a proposed Battery Energy Storage System (BESS), in accordance with the requirements under the Planning Secretary Environmental Assessment Requirements (SEAR's). This Land and Soil Capability includes a soil survey and discusses the potential for water and wind erosion.

Table 1 provides an overview of relevant identification details for the site. The site location is depicted in Figure 1 and Figure 2, Appendix A.

Site Address	57 Burgess Lane, Calala, NSW 2430 (also known as 474 Calala Lane, Calala, NSW 2340)
Real Property Description	Lot 17 on DP629969
Site Area	Approximately 36.3ha
Local Government Area	Tamworth Regional Council
Existing Land Use	Agriculture (Grazing/Cropping)
Proposed Land Use	Battery Energy Storage System (Commercial)

Table 1: Site Details.

1.1 Study Area

The assessment area for the LSCA comprises the lot area of approximately 36.3 ha, with the project infrastructure footprint itself comprising of approximately 8.87 ha.

The proposed transmission line to the substation of approximately 1.6km is not considered relevant to the assessment as fragmentation of land use is not anticipated post-completion.

1.2 **Objective**

The objective of the LSCA was to assess the soil characteristics including erosion potential and Biophysical Strategic Agricultural Land (BSAL) identification.

1.3 **Technical and Regulatory Framework**

The following technical and regulatory framework has been considered in preparing this LSCA.

- Australian Soil Classification (ASC) system (Isbell, 2002).
- Guidelines for Surveying Soil and Land Resources (McKenzie et al., 2008).
- Australian Soil and Land Survey Field Handbook (NCST, 2009).
- Office of Environment and Heritage (2012) The land and soil capability assessment scheme.
- Primary Industries Office of Agricultural Sustainability and Food Security (DPI-OASFS) (2013) Interim protocol for site verification and mapping of biophysical strategic agricultural land (NSW Government, (2013).



1.4 **Zoning and Land Use**

The site is zoned RU4 – Primary Production Small Lots, under the Tamworth Regional Council Local Environmental Plan (LEP) (2010). The following land uses are permitted without consent within an RU4 zone: Agricultural produce industries; Aquaculture; Cellar door premises; Dual occupancies (attached); Dwelling houses; Farm buildings; Intensive plant agriculture; Kiosks; Landscaping material supplies; Light industries; Markets; Plant nurseries; Roadside stalls; Rural workers' dwellings. The site is currently used for Rural activities improved grazing/cropping. See the Tamworth LEP Zoning Map in Figure 3, Appendix A.

1.5 Edge Land Planning (2023) Calala Battery Energy Storage System Agricultural Land Capability Report.

An Agricultural Land Capability Report was previously prepared by Edge Land Planning (Edge). This report considers a range of environmental and economic factors including local agricultural practices and their limitations relating to the land parcel size.

The site is identified as having a number of constraints. The site's limitations in terms of soil fertility, water supply, and proximity to an urban area restrict its use primarily to cattle grazing. However, additional off-farm income is likely necessary to support a family's livelihood. Exploring alternative agricultural activities would require careful consideration of expertise, capital, and economic sustainability.

The Edge Report concluded that "The land is not suitable for full time agriculture and its use for a Battery Energy Storage System will not have a detrimental impact on the agricultural capability of the land."

Further details of the Edge report are summarised throughout this report. ENV understands a copy of the Edge report shall be made available to the planning authority and as such, has not been appended to this document.



2 SITE DESCRIPTION AND CHARACTERISTICS

2.1 **Topography**

The site has an approximate elevation between 392 and 412m Australia Height Datum (AHD) and gently slopes towards the northern boundary. The northern paddock is developed with contour banks and the investigation area generally drains to the north.

2.2 Soil Landscape

The NSW Department of Planning, Industry and Environment's eSPADE v2.2 webapp maps the site as being situated within the Duri soil landscape. The soil landscape is summarised as follows.

Extremely complex due to rapid changes in underlying lithology. Generally dominated by duplex soils such as moderately deep, moderately well-drained Red and Brown Chromosols (Noncalcic Brown Soils; Red-brown Earths) with minor occurrences of shallow, very well-drained Rudosols (Lithosols) around rock outcrops. Deep, imperfectly drained Red Vertosols (Red Clays) and deep to very deep, imperfectly drained Red and Brown Chromosols (Non-calcic Brown Soils) and possibly some Sodosols (Solodic Soils) occur along drainage lines and on sodic bedrock.

The site investigation undertaken on 4 July 2023 revealed the surface soils generally comprised of brown to red clays being homogenous, medium stiffness, medium plasticity and moist (due to recent rainfall). The site observations are consistent with the eSpade soil landscape profile.

2.3 Soil Profiles & Previous Reports

Regional soil surveys undertaken by the NSW Office of Environment and Heritage (SOIL SURVEY OF TAMWORTH ARC Survey (1000976), Profile 204) describe the site soils as follows.

- Physiography: other lithology and used for cropping, elevation 408.0 m AHD, aspect southeast. Surface condition is recently cultivated, profile is well drained, erosion hazard is high.
- Vegetation/Land Use: irrigated cultivation at the site, used for cropping, with cropping, improved pasture in the general area.
- Surface Condition: recently cultivated when described, expected to be cracked when dry.
- Erosion/Land Degradation: high.
- Soil Hydrology: profile is well drained.

A copy of the full Soil Survey Technical Report is provided as Appendix C.

Edge Land Planning (2023) Calala Battery Energy Storage System Agricultural Land Capability Report describes the site fertility as the following.

"The soils in this landscape generally have only moderate fertility and are subject to severe structure decline. The dominant land use for this landscape is livestock grazing. Its rural capability is for grazing with moderate limitations for cropping."

Further details on the site fertility, erodibility and other land and soil hazards are discussed in Section 4 of this report.



3 HYDROLOGIC CONDITIONS

3.1 Surface Water Bodies and Flooding

The site is bisected by Calala Creek to the north and an unnamed drainage line that falls to the north to the north to Calala Creek. The property is improved with one earthen dam. The BESS project area has no surface water bodies. The Tamworth Flood Mapping indicates the site is free from flooding, however, during high rainfall events overland flow is likely to traverse the northern portion of the site. The Tamworth Flood mapping has been included within Figure 4, Appendix A.

A Water Management Report has been compiled by Northrop Consulting Engineers (2023) which summarises the Tamworth City Wide Flood Investigation commissioned by the Tamworth Regional Council. The northern portion of the site where Calala Creek bisects the site is prone to flooding based upon the 1% Annual Exceedance Probability and Probable Maximum Flood Levels. The BESS project area is above known flood heights however, the access road from Calala Lane will need to be improved with a culvert crossing as per Sky Civil Engineering's design. The Tamworth Regional Council City Wide Flood Investigation figures are presented in Figure 6, Appendix A.

3.2 Groundwater Resources

A search of the WaterNSW Realtime groundwater database was completed on 26 June 2023. The search identified two (2) bores within 500m that are summarised in Table 2.

GW Licence Number	Authorised Purpose	Depth of Well	Depth to Water
GW064001	Domestic	18.20m	8.20m
GW901433	Stock & Domestic	25.90m	4.00m

Table 2 - Groundwater Licence Details.

Both bores are located outside the investigation area.



4 LAND AND SOIL CAPABILTY ASSESSMENT

This Land and Soil Capability Assessment (LSCA) is undertaken in accordance with the NSW Land and Soil Capability assessment scheme to determine the physical capacity of the land to sustain a range of land uses without degradation to soil, land, air and water. The LSCA assesses the biophysical features of the land and soil including the slope gradient, drainage, climate, landform position, soil types and soil characteristics against a range of land and soil hazards. These land and soil hazards include wind erosion, soil erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement. Each hazard is given Land and Soil Capability (LSC) class rating between 1 (highest capability land) and 8 (lowest capability land) with the overall class of the land based on the most limiting hazard.

4.1 Laboratory and Field Analysis

The site investigation and soil sampling program was undertaken on 5 July 2023. The soil sampling program included the collection of soil samples from the upper soil stratum (0 – 0.15 m Below Ground Level (BGL)) at thirty (30) discrete locations within the investigation area. Sampling locations are depicted in Figure 7 Appendix A. Four (4) (S-1, S-8, S-16 & S-24) samples were submitted to Eurofins and East West laboratories for the following analysis.

- Electrical Conductivity.
- pH (1:5 Water and CaCl2).
- Cation Exchange Capacity (CE).
- Particle Size Analysis.
- Munsell Colour.

Laboratory reports are provided in Appendix B.

4.2 Water Erosion Hazard

Water erosion hazard is the potential of soil detachment and movement from the effects of raindrop impact, runoff and flowing water. Table 3 illustrates the water erosion LSC class.

NSW	Slope class (%) for each LSC class									
division	Class 1	Class 2	Class 3	Class 4 ¹	Class 5 ²	Class 6	Class 7	Class 8		
Eastern and Central divisions	<1	1 to <3	3 to <10 or 1 to <3 with slopes >500 m length	10 to <20	10 to <20	20 to <33	33 – <50	>50		
Western Division ³	<1	1 to <3 or <1 for hardsetting red soils	1–3	3–5	3–5	5–33	33–50	>50		

Table 3 - Water Erosion Hazard Class.

Sand bodies are classified as Class 1 for water erosion hazard.

¹ No gully erosion or sodic/dispersible soils are present.

² Gully erosion and/or sodic/dispersible subsoils are present.

³ Western CMA provided advice on the slope classes.



The site has an approximate slope of 2.6% and is located within the Eastern and Central Divisions indicating a water erosion hazard of Class 2. Due to the nature and structure of soils, the surface soils are considered sodic and there is potential for soil dispersion and erosion during construction. The production of an Erosion and Sediment Control Plan incorporating the findings from the Northrop Consulting Engineers Water Management Plan – inclusive of site-specific sediment controls and sediment basins – will be required to manage the potential water erosion hazards in relation to the proposed land use.

4.3 Wind Erosion Hazard

wind erosion hazard is the potential for the detachment of soil and movement from the effects of wind blowing across the soil surface. Soil texture, rainfall, wind erosive power and site exposure all influence the wind erosion hazard for the site. Table 4 outlines the wind erodibility class of the soil.

	Factor						
Class	Surface soil texture	Site exposure to prevailing winds	Wind erosive power*				
Low	Loams, clay loams or clays (all with >13% clay)	Sheltered locations in valleys or in the lee of hills	Low				
Moderate	Fine sandy loams or sandy loams (all with 6–13% clay); also includes organic peats	Intermediate situations – not low or high exposure locations	Moderate				
High	Loamy sands or loose sands (all with <6% clay).	Hilltops, cols or saddles, open plains or exposed coastal locations	High				

Table 4 - Wind Erodibility

The site comprises of clayey soils with their clay content between 44.7% - 61.5%, indicating a low wind erosion category. Tamworth has an annual rainfall of 673mm (Bureau of Meteorology, 2023) and the site is considered to be located within an intermediate situation to prevailing winds. Figure 1 illustrates the wind erosive power zone designations within NSW, with Tamworth being located within a high wind erosive power zone.



153*

154°

-29"

-30"

-31"

-32°

-33°

142° 149° 150" 151* 152" 141" 143" 147* 148 144" 145 146 -29 Wanaaring -30" -31° -32" -33" -34°

Figure 1 - Wind Erosive Power





Table 5 outlines the LSC class for wind erosion hazard.

Wind		_	Ave	erage annua	l rainfall (mm)
erodibility class of surface soil	Wind erosive power	Exposure to wind	>500	300–500	200 to <300	<200
Low	Low	Low	1	2	3	6
		Moderate	1	2	3	6
		High	2	3	4	7
	Moderate	Low	1	2	3	6
		Moderate	2	3	4	6
		High	3	4	5	7
	High	Low	2	3	4	6
		Moderate	3	4	5	7
		High	4	5	6	7
Moderate	Low	Low	2	3	4	7
		Moderate	3	4	5	7
		High	4	5	6	8
	Moderate	Low	2	3	4	6
		Moderate	3	4	5	7
		High	4	5	6	8
	High	Low	3	4	5	7
		Moderate	4	5	6	8
		High	5	6	7	8
High	Low	Low	3	4	5	7
		Moderate	4	5	6	8
		High	5	6	7	8
	Moderate	Low	4	5	6	8
		Moderate	5	6	7	8
		High	6	7	8	8
	High	Low	5	6	7	8
		Moderate	6	7	8	8
		High	7 (8*)	8	8	8

Table 5 Wind Erosion Hazard

* Mobile sand bodies such as coastal beaches, foredunes and blowouts are Class 8.

Based upon the low wind erodibility class of surface soils, a high wind erosive power, a moderate exposure to wind and an average annual rainfall >500mm, the site has a wind erosion hazard of 3.



4.4 Soil Structure Decline Hazard

Soil structure decline is the physical breakdown of the soil particles and pore spaces in soil generally associated with compaction and tillage. Table 6 illustrates the LSC classes for soil structure decline hazard.

Field texture (surface soils)	Modifier	Outcome – surface soil type	LSC class
Loose sand	Nil	Loose sand	1
Sandy loam	Nil	Fragile light textured surface soil	3
Fine sandy	Normal	Fragile light textured soil	3
loam	High levels of silt and very fine sand (>60%)	Fragile light textured soil – very hardsetting	4
Loam	Normal	Fragile medium textured soil	3
	Friable/ferric ¹	Friable medium textured soils – includes dark, friable loam soils	1
	High levels of silt and very fine sand	Fragile medium textured soil – very hardsetting	4
	Mildly sodic	Mildly sodic loam surface soil	4
	Moderately sodic	Moderately sodic loam surface soil	6
Clay loam	Normal	Fragile medium textured soil	3
	Friable/ferric ¹	Friable clay loam surface soil – includes dark, friable clay loam soils	1
	High levels of silt and very fine sand (>60%)	Fragile medium textured soil – very hardsetting	4
	Mildly sodic	Mildly sodic clay loam surface soil	4
	Moderately sodic	Moderately sodic clay loam surface soil	6
Clay	Friable/ferric ¹	Friable clay surface soil	2
	Strongly self-mulching	Strongly self-mulching surface soil	1
	Weakly self-mulching	Weakly self-mulching surface soil	3
	Mildly sodic	Mildly sodic/coarsely structured clay surface soil	4
	Moderately sodic	Moderately sodic/coarsely structured clay surface soil	6
	Strongly sodic	Strongly sodic surface soil	7
Highly organic soils	Mineral soils with high organic matter ²	Mineral soils with high organic matter	_2
	Organosol/peat soils ³	Organic/peat soils	7

Table 6		Class	Soil	Structure	Decline
	LJC	Class	3011	Julucture	Decime

¹ The occurrence of friable or ferric surface soils is associated with (a) basaltic or basic parent materials and soils of the Ferrosols groups in the Australian Soil Classification or the Krasnozems and Euchrozem Great Soil Groups, and (b) the dark loam surface soils of the Chernozems and Prairie Soils on alluvial flats.

² Loosely defined here as soils with over 8% organic carbon. These soils revert to the LSC class determined by the mineral component of the soils.

³ Organosols have organic material layers over 0.4 m thick with minimum organic carbon of 12% if sands or 18% if clays (Isbell 2002).

Based upon field inspection and laboratory testing, the soil is best described as clay being mildly sodic with a soil structure decline hazard LSC class of 4.

4.5 Soil Acidification Hazard

Soil acidification can be a significant limitation of agricultural production with soils having variable acidity and buffering capacity to resist pH changes. Table 7 illustrates the estimated buffering capacity of soils based upon the Great Soil Group.



Table 7 – Estimated Buffering Capacity

Great Soil Group	Buffering capacity of surface soil	Great Soil Group	Buffering capacity of surface soil
Acid Peats	VL	Non-calcic Brown soils	М
Alluvial Soils – Light sandy textured (Sands to Sandy Loams)	L	Peaty Podzols	L
Alluvial Soils – Medium textured (Loams clay loams)	М	Podzols	VL
Alpine Humus soils	М	Prairie Soils	н
Black Earths	VH	Red and Brown Hardpan Soils	н
Brown Earths	М	Red-brown Earths	Μ
Brown Podzolic Soils	М	Red Earths – less fertile (granites and metasediments)	L
Calcareous Red Earths	Н	Red Earths – more fertile (volcanics, granodiorites) or highly structured	М
Calcareous Sands	М	Red Podzolic Soils – less fertile (granites and metasediments)	L
Chernozems	н	Red Podzolic Soils – more fertile (volcanics, granodiorites) or highly structured	М
Chocolate soils	М	Rendzinas	н
Desert Loams	М	Siliceous Sands	VL
Earthy Sands	VL	Solodic soils	L
Euchrozems	н	Solonchaks	н
Gleyed Podzolic Soils	L	Solonetz	Μ
Grey-brown and Red Calcareous Soils	н	Solonized Brown Soils	М
Grey-brown Podzolic soils	L	Solonized Solonetz	L
Grey, Brown and Red Clays	VH	Soloths	L
Humic Gleys	L	Terra Rossa Soils	М
Humus Podzols	L	Wiesenboden	н
Krasnozems	М	Xanthozems	М
Lateritic Podzolic Soils	L	Yellow Earths	L
Lithosols	VL	Yellow Podzolic Soils – less fertile (granites and metasediments)	L
Neutral to Alkaline Peats	М	Yellow Podzolic Soils – more fertile (volcanics, granodiorites) or highly structured	М

Field investigations indicate the soils comprise brown to red clays indicating a Very High (VH) buffering capacity. Table 8 provides the LSC class for soil acidification hazard.



Table 8 - LSC Class Soil Acidification Hazard

	pH of the natural surface soil						
Texture/ buffering capacity	<4.0 (CaCl ₂) <4.7 (water)	4.0–4.7 (CaCl ₂) 4.7–5.5 (water)	4.7–6.0 (CaCl₂) 5.5–6.7 (water)	6.0–7.5 (CaCl ₂) 6.7–8.0 (water)	>7.5 (CaCl ₂) >8.0 (water)		
Mean annual rainfall <550	mm						
Very low	6*	5	4	3	n/a		
Low	5	5	3	3	n/a		
Moderate	5	4	3	2	1		
High	4	3	2	1	1		
Very high	n/a	n/a	1	1	1		
Mean annual rainfall 550-7	700 mm						
Very low	6*	5	5	4	n/a		
Low	5	5	4	3	n/a		
Moderate	5	4	3	3	1		
High	n/a	n/a	2	2	1		
Very high	n/a	n/a	1	1	1		
Mean annual rainfall 700-9	900 mm						
Very low	6*	5	5	4	n/a		
Low	6*	5	4	4	n/a		
Moderate	5	4	3	3	2		
High	n/a	n/a	2	2	1		
Very high	n/a	n/a	2	1	1		
Mean annual rainfall >900	mm or irrigation						
Very low	6*	5	5*	4	n/a		
Low	6*	4	4	3*	n/a		
Moderate	5	4	3	3	2		
High	5	3	2	2	1		
Very high	5	3	2	1	1		

Based on natural pH status, buffering capacity and climate

* These lands usually have very low fertility.

The site is located within a rainfall area between 550mm-700mm and pH testing (water) ranges between 5.2 - 7.4 and calcium carbonate (CaCl₂) pH testing ranges between 5.0 - 7.5. Based upon the pH results against Table 6, the property has a Soil Acidification Hazard of 1.

4.6 Salinity Hazard

Salinity hazard is the potential for mobilised salts to migrate to the substrate surface and waterways due to the changes in land management and land uses. Different farming practises, land clearing and irrigation and can impact salinity. Figure 2 illustrates the salt stores of NSW with the general Tamworth region being within a low salt store zone.



Figure 2 - Salt Store Map of NSW.



Due to the dissenting creek and watercourse with high clay content soils (less permeable soils), the property is considered to have a moderate recharge potential and moderate discharge potential. Table 9 provides the LSC class for salinity hazard.



	Tabl	e 9	- LSC	Salinity	y Hazard
--	------	-----	-------	----------	----------

Recharge potential	Discharge potential	Salt store	LSC class
		Low	1
	Low	Moderate	3
		High	4
		Low	1
Low	Moderate	Moderate	4
		High	4
		Low	1
	High	Moderate	4
		High	5
		Low	1
	Low	Moderate	3
		High	4
		Low	2
Moderate	Moderate	Moderate	5
		High	6
		Low	1 (3) *
	High	Moderate	6
		High	6
		Low	1
	Low	Moderate	4
		High	5
		Low	3 (2) *
High	Moderate	Moderate	4
		High	7
		Low	2 (3) *
	High	Moderate	6
		High	7

* The values in brackets are more accurate and should be used in preference to the original rating.

Based upon a moderation recharge potential, a moderate discharge potential and a low salt store, the site has a LSC salinity hazard of 2.

4.7 Waterlogging Hazard

Waterlogging may be a significant limitation for agricultural holdings and is determined by soils, climate, position in the landscape and drainage. Table 10 outlines the LSC class for waterlogging hazard.

Typical waterlogging duration (months)	Return period	Typical soil drainage	LSC class**
0	every year	rapidly drained and well drained	1
0-0.25	every year	moderately well drained	2
0.25-2	every year	imperfectly drained	3
2–3	every 2 to 3 years	imperfectly drained	4
2–3	every year	imperfectly drained	5
>3	every year	poorly drained	6
Almost permanently	every year	very poorly drained	8

Table 10 - Waterlogging Hazard LSC

* NCST (2009, p.202-4)

** Based on slope position, climate and length of time soils are wet.



Based on the gently sloping soils, high rainfall area, and imperfectly draining soils, the property is considered to be in a waterlogging LSC class of 4.

4.8 Shallow soils and rockiness hazard

Shallow soils and the presence of rock in surface soils impact the agricultural capability of the land. Table 11 illustrates the LSC class for shallow soils and rockiness.

Table 11 - Shallow Soils and Rockiness Hazard

Rocky outcrop (% coverage)*	Soil depth (cm)	LSC class**
Nil	>100	1
	>100	2
	75-<100	3
<30 (localised*)	50- <75	4
	25- <50	6
	0-<25	7
	>100	4
20 EQ (wideepreed*)	75–100	5
50-50 (widespread)	25-75	6
	<25	7
	>100	6
50 70 (widespread*)	50-100	6
50-70 (widespiead)	25- <50	7
	<25	7
>70	n/a	8

* Rock outcrop limitation from soil landscape report.

** Based on rocky outcrop and soil depth

Based on the Duri soils landscape overlaying sedimentary rocks with shallow soils along with the Soil Landscape Technical Report (Appendix C) the site has a soils and rockiness hazard of 4.

4.9 Mass Movement Hazard

Mass movement is the large-scale movement of the earth under gravity (also known as landslides). Factors impacting mass movement include, slope, soil structure, climate, geology and land formations. Table 12 outlines the LSC class or mass movement.

Mean annual rainfall (mm)	Mass movement present	Slope class (%)	LSC class
<500	No	n/a	1
	Yes	n/a	8
>500	No	n/a	1
	Yes	<20	6
		>20-50	7
		>50 or any scree or talus slope	8

Table 12 - Mass Movement LSC

Note that scree or talus slopes go automatically into Class 8.



The property is located within a >500mm annual rainfall area and no mass movement was present in the field inspection. Therefore, the property has a mass movement LSC class of 1.

4.10 LSC Class Assessment

4.10.1 Site Specific LSC Class Assessment

Table 13 summarises the site specific LSC class for each hazard calculated above.

Table 13 - LSC Class Summary

Hazard	LSC Class
Water Erosion Hazard	2
Wind Erosion Hazard	3
Soil Structure Decline Hazard	4
Soil Acidification Hazard	1
Salinity Hazard	2
Waterlogging Hazard	4
Shallow Soils and Rockiness	4
Mass Movement	1

As per the NSW Land and Soil Capability assessment scheme, the LSC is based upon the most limiting factor. The most limiting hazards are soil structure decline, shallow soils and rockiness and waterlogging therefore the site has a Land and Soil Capability rating of 4. LSC class of 4 defined by the Office of Environment and Heritage (2012) as;

" 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."

4.10.2 eSpade LSCA

The NSW eSpade LSC mapping indicates the property is predominately class 4 with the northern drainage line being class 5. This desktop mapping is generally consistent with the field LSC Assessment and the overall LSC Class of the site is considered to be 4. See appendix A, Figure 8 for the eSpade LSCA mapping.



5 BIOPHYSICAL STRATEGIC AGRICULTURAL LAND

Biophysical Strategic Agricultural Land (BSAL) mapping derived from The Central Resource for Sharing and Enabling Environmental Data in NSW (SEED) indicates the proposed site (inclusive of transmission lines) is not classified as BSAL. See appendix A, Figure 5 for the BSAL mapping. This non BSAL classification is consistent to this Land and Soil Capability Assessment, is not considered fertile land and has a moderate to high limitation for high impact agricultural uses. Furthermore, the Agricultural Land Capability Report conducted by Edge Land Planning (2023) concluded the following.

"The site has constraints for its use as an agricultural holding due to the poor soil fertility, lack of a permanent water supply and proximity to the urban area of Calala. These constraints limit its use to cattle grazing and the land size is not large enough to make a sufficient income to support a family full time and as a result, an off-farm source of income is needed. Other agriculture is possible but requires considerable expertise and capital investment and is therefore, not considered to be economically sustainable. The land is not suitable for full time agriculture and its use for a Battery Energy Storage System will not have a detrimental impact on the agricultural capability of the land."



6 **CONCLUSION**

ENV Services Pty Ltd (ENV) has undertaken a Land and Soil Capability Assessment (LSCA) for Lot 17 on DP629969, 57 Burgess Lane, Calala, NSW, 2430 (also known as 474 Calala Lane, Calala NSW 2340) to support a Development Application for a proposed battery energy storage system. This assessment incorporated data derived from the performed field assessment, soil surveys, laboratory analysis and desktop analysis of the site to derive the LSC of the site. This LSCA derived the overall LSC of the site is Class 4, being moderately capable land with moderate to high agricultural limitations with the most limiting hazards being soil structure decline, shallow soils and rockiness and waterlogging.

The site is not considered fertile land and is not mapped as BSAL by the NSW SEED Mapping. The site is mildly impacted by wind and water erosion with evidence of sodic soils with potential to disperse and erode. An approved site-specific Erosion and Sediment Control Plan for construction of the battery storage facility will be required, incorporating the findings from the Northrop Consulting Engineers Water Management Plan before construction commences.



7 **REFERENCES**

Isbell, R. F. (2002). The Australian soil classification. Csiro.

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Strategic regional land use policy (SRLUP) - Strategic agricultural land - Biophysical - SEED.

(2023). Dataset | SEED. https://datasets.seed.nsw.gov.au/dataset/srlup-salbiophysical

ical strategic agricultural land

APPENDIX A

Figures





BESS Site Boundary (Approximate)

Ο

0

0.4km 0.8km



Figure 1 – Site Location 474 Calala Lane, Calala, NSW, 2340





BESS Site Boundary (Approximate)

Project Area (Approximate)







Figure 2 – Site Plan 474 Calala Lane, Calala, NSW, 2340



BESS Site Boundary (Approximate)



Figure 3 – Zoning Map 474 Calala Lane, Calala, NSW, 2340



Bess Site Boundary (Approximate)

ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 4 – Flood Map 474 Calala Lane, Calala, NSW, 2340



Bess Site Boundary (Approximate)



Strategic Agricultural Land Classification



Figure 5 – Biophysical Strategic Agricultural Land Map 474 Calala Lane, Calala, NSW, 2340

1% Annual Exceedance Probability

Probable Maximum Flood



LEGEND



Bess Site Boundary (Approximate)

Project Site Area



Figure 6 – Flood Mapping 474 Calala Lane, Calala, NSW, 2340

Project: Land and Soil Capability Assessment Image source: Northrop Consulting Engineers ENV Project Number: 218049



Project Site Area (approximate)



Sampling Location (approximate)

Image source: Intra Maps (2022)



Figure 7 – Sampling Plan 474 Calala Lane, Calala, NSW, 2340



- 1 Very slight to negligible limitations
- 2 Slight but significant limitations
- 3 Moderate limitations
- 4 Moderate to severe limitations
- 5 Severe limitations
- 6 Very severe limitations
- 7 Extremely severe limitations
- 8 Extreme limitations Not Assessed Water

BESS Site Area (approximate)

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Figure 8 – eSpade LSC Mapping 474 Calala Lane, Calala, NSW, 2340

APPENDIX B

Laboratory Results



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ANALYSIS REPORT SOIL

PROJECT	NO: EW231712	Date of Issue:	21/09/2023
Customer:	EUROFINS BRISBANE	Report No:	1
Address:	1/21 Smallwood Place MURARRIE	Date Received:	18/09/2023
	QLD 4172	Matrix:	Soil
Attention:	Alana Wadsworth	Location:	1026386
Phone:	0499 810 009	Sampler ID:	Client
Fax:		Date of Sampling:	7/07/2023
Email:	alanawadsworth@eurofins.com	Sample Condition:	Acceptable

Comments:

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:

Lisa Nies



PROFICIENT LAB Visit www.aspac-australasia.com to view our certification details. East West is certified by the Australian-Asian 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 EWEA 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.

Document ID:REP-01Issue No:3Issued By:S. CameronDate of Issue:16/12/2019

results you can rely on



PROJECT NO: EW231712

REP-01

16/12/2010

3 S. Cameron

Document ID: Issue No:

Issued By:

Date

Location: 1026386

	CLIENT SAMPLE ID				23-Se0034817	23-Se0034818	23-Se0034819	23-Se0034820
	DEPTH				S-01	S-02	S-03	S-04
Test Parameter	Method Description	Method Reference	Units	LOR	231712-1	231712-2	231712-3	231712-4
Soil Colour	Munsell	Munsell	Class	na	7.5YR 4/4	NA	NA	NA
Emerson Aggregate Test	Class	PMS-21	Number	na	5	5	7	5
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	2.4	NA	NA	NA
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	6.2	NA	NA	NA
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	9.0	NA	NA	NA
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	6.3	NA	NA	NA
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	3.3	NA	NA	NA
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	2.7	NA	NA	NA
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	7.0	NA	NA	NA
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	18.2	NA	NA	NA
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	44.7	NA	NA	NA



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PROJECT NO: EW231712

Document ID:

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Issued By: Date of Iss REP-01

3 S. Cameron 16/12/2019 Location: 1026386

	CLIENT SAMPLE ID				23-Se0034821	23-Se0034822	23-Se0034823	23-Se0034824
	DEPTH				S-05	S-06	S-07	S-08
Test Parameter	Method Description	Method Reference	Units	LOR	231712-5	231712-6	231712-7	231712-8
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	5YR 3/4
Emerson Aggregate Test	Class	PMS-21	Number	na	5	7	5	7
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	0.5
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	1.5
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	5.4
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	7.4
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	5.3
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	4.8
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	12.8
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	12.4
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	49.8

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3 S. Cameron 16/12/2019 Location: 1026386

	CLIENT SAMPLE ID				23-Se0034825	23-Se0034826	23-Se0034827	23-Se0034828
	DEPTH				S-09	S-10	S-11	S-12
Test Parameter	Method Description	Method Reference	Units	LOR	231712-9	231712-10	231712-11	231712-12
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	NA
Emerson Aggregate Test	Class	PMS-21	Number	na	3b	3b	3b	5
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA

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PROJECT NO: EW231712

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3 S. Cameron 16/12/2019 Location: 1026386

	CLIENT SAMPLE ID				23-Se0034829	23-Se0034830	23-Se0034831	23-Se0034832
	DEPTH				S-13	S-14	S-15	S-16
Test Parameter	Method Description	Method Reference	Units	LOR	231712-13	231712-14	231712-15	231712-16
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	5YR 3/4
Emerson Aggregate Test	Class	PMS-21	Number	na	5	3b	7	5
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	<0.1
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	1.2
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	6.4
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	13.8
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	5.9
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	4.2
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	9.2
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	8.8
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	50.6

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3 S. Cameron 16/12/2019 Location: 1026386

		CLIENT SAMPLE ID			23-Se0034833	23-Se0034834	23-Se0034835	23-Se0034836
			DE	PTH	S-17	S-18	S-19	S-20
Test Parameter	Method Description	Method Reference	Units	LOR	231712-17	231712-18	231712-19	231712-20
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	NA
Emerson Aggregate Test	Class	PMS-21	Number	na	5	3b	5	3b
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA

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Document ID:

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3 S. Cameron 16/12/2019 Location: 1026386

		CLIENT SAMPLE ID			23-Se0034837	23-Se0034838	23-Se0034839	23-Se0034840
			DE	РТН	S-21	S-22	S-23	S-24
Test Parameter	Method Description	Method Reference	Units	LOR	231712-21	231712-22	231712-23	231712-24
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	7.5YR 3/3
Emerson Aggregate Test	Class	PMS-21	Number	na	5	5	5	4
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	0.5
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	<0.1
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	3.2
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	8.7
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	5.2
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	4.1
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	6.3
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	10.4
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	61.5

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PROJECT NO: EW231712

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3 S. Cameron 16/12/2019 Location: 1026386

		CLIENT SAMPLE ID			23-Se0034841	23-Se0034842	23-Se0034843	23-Se0034844
			DE	PTH	S-25	S-26	S-27	S-28
Test Parameter	Method Description	Method Reference	Units	LOR	231712-25	231712-26	231712-27	231712-28
Soil Colour	Munsell	Munsell	Class	na	NA	NA	NA	NA
Emerson Aggregate Test	Class	PMS-21	Number	na	5	3b	5	5
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	NA	NA
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	NA	NA

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PROJECT NO: EW231712

Location: 1026386

	CLIENT SAMPLE ID				23-Se0034845	23-Se0034846	
			DE	ЕРТН	S-29	S-30	
Test Parameter	Method Description	Method Reference	Units	LOR	231712-29	231712-30	
Soil Colour	Munsell	Munsell	Class	na	NA	NA	
Emerson Aggregate Test	Class	PMS-21	Number	na	7	5	
Gravel 2.36-4.75mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Very Coarse Sand 1.18-2.36mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Coarse Sand 0.6-1.18mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Medium Sand 0.3-0.6mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Fine Sand 0.15-0.30mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Very Fine Sand 0.075-0.15mm	Sieve	AS1289.3.6.3	%	na	NA	NA	
Coarse Silt 0.02-0.075mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	
Fine Silt 0.002-0.020mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	
Clay <0.002mm	Hydrometer	AS1289.3.6.3	%	na	NA	NA	

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NB: LOR is the Lowest Obtainable Reading.

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ENV Services Pty Ltd Level 1, 2247 Gold Coast Highway Nobby Beach QLD 4218



Tim Bischof

Report Project name Project ID Received Date **1026386-S** CALALA SOIL SAMPLING 218049 Sep 15, 2023

Client Sample ID			S-01	S-02	S-03	S-04
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034817	B23- Se0034818	B23- Se0034819	B23- Se0034820
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	58	-	-	-
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	5.9	-	-	-
pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	0.1	pH Units	5.4	-	-	-
Colour (Pt/Co) true			See attached	-	-	-
Emerson Class Number	1	units	See attached	See attached	See attached	See attached
Particle Size Distribution			See attached	-	-	-
Cation Exchange Capacity						
Cation Exchange Capacity*	0.5	meq/100g	11	-	-	-

Client Sample ID			S-05	S-06	S-07	S-08
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034821	B23- Se0034822	B23- Se0034823	B23- Se0034824
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	-	-	96
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	-	5.2
pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	0.1	pH Units	-	-	-	5.0
Colour (Pt/Co) true			-	-	-	See attached
Emerson Class Number	1	units	See attached	See attached	See attached	See attached
Particle Size Distribution			-	-	-	See attached
Cation Exchange Capacity						
Cation Exchange Capacity*	0.5	meq/100g	-	-	-	11





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Client Sample ID			S-09	S-10	S-11	S-12
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034825	B23- Se0034826	B23- Se0034827	B23- Se0034828
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Emerson Class Number	1	units	See attached	See attached	See attached	See attached

Client Sample ID			S-13	S-14	S-15	S-16
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034829	B23- Se0034830	B23- Se0034831	B23- Se0034832
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	-	-	110
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	-	7.0
pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	0.1	pH Units	-	-	-	7.2
Colour (Pt/Co) true			-	-	-	See attached
Emerson Class Number	1	units	See attached	See attached	See attached	See attached
Particle Size Distribution			-	-	-	See attached
Cation Exchange Capacity						
Cation Exchange Capacity*	0.5	meq/100g	-	-	-	42

Client Sample ID			S-17	S-18	S-19	S-20
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034833	B23- Se0034834	B23- Se0034835	B23- Se0034836
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Emerson Class Number	1	units	See attached	See attached	See attached	See attached

Client Sample ID			S-21	S-22	S-23	S-24
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034837	B23- Se0034838	B23- Se0034839	B23- Se0034840
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	-	-	99
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	-	7.4
pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	0.1	pH Units	-	-	-	7.5
Colour (Pt/Co) true			-	-	-	See attached
Emerson Class Number	1	units	See attached	See attached	See attached	See attached
Particle Size Distribution			-	-	-	See attached
Cation Exchange Capacity						
Cation Exchange Capacity*	0.5	meq/100g	-	-	_	52



Client Sample ID			S-25	S-26	S-27	S-28
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23- Se0034841	B23- Se0034842	B23- Se0034843	B23- Se0034844
Date Sampled			Jul 07, 2023	Jul 07, 2023	Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit				
Emerson Class Number	1	units	See attached	See attached	See attached	See attached

Client Sample ID			S-29	S-30
Sample Matrix			Soil	Soil
Eurofins Sample No.			B23- Se0034845	B23- Se0034846
Date Sampled			Jul 07, 2023	Jul 07, 2023
Test/Reference	LOR	Unit		
Emerson Class Number	1	units	See attached	See attached



Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Sep 16, 2023	7 Days
- Method: LTM-INO-4030 Conductivity			
Cation Exchange Capacity	Melbourne	Sep 19, 2023	28 Days
- Method: LTM-MET-3060 Cation Exchange Capacity by bases & Exchangeable Sodium Percentage			
pH (1:5 Aqueous extract at 25 °C as rec.)	Melbourne	Sep 16, 2023	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	Melbourne	Sep 18, 2023	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			

ABN: 50 005 085 521													Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Envi NZBN: 94290460	Conment Testing N 24954	IZ Ltd
Websourne 6 Monterey I Dandenong VIC 3175 Tel: +61 3 82 email: EnviroSales@eurofins.com NATA# 1261 Site# 1254		Melbourne 6 Monterey Roa Dandenong Sou VIC 3175 Tel: +61 3 8564 NATA# 1261 Site# 1254	Geelong d 19/8 Lewalan th Grovedale VIC 3216 5000 Tel: +61 3 856 NATA# 1261 Site# 25403	Sydney Canberra 179 Magowar Road Unit 1,2 Dacro Girraween Mitchell NSW 2145 ACT 2911 564 5000 Tel: +61 2 9900 8400 Tel: +61 2 61 1 NATA# 1261 NATA# 1261 Site# 18217 Site# 25466		a Dacre S 1 2 6113 1261 466	Brisbane Newcastle re Street 1/21 Smallwood Place 1/2 Frost Drive Murarrie Mayfield West NSW 2304 QLD 4172 Tel: +61 2 4968 8448 113 8091 Tel: +61 7 3902 4600 NATA# 1261 NATA# 1261 Site# 25079 & 25289 Site# 20794 Site# 20794			Newcastle lace 1/2 Frost Drive Mayfield West NSW 2304 Tel: +61 2 4968 8448 500 NATA# 1261 Site# 25079 & 25289	Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 51 Tel: +64 3 343 520 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, Tauranga 3112 1 Tel: +64 9 525 0568 IANZ# 1402		
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Pro Pro	oject Name: oject ID:	CALALA SC 218049	DIL SAMPLIN	G									Eurofins Analy	/tical Services	Manager : Alar	a Wadsworth
		Sa	ample Detail			Colour (Pt/Co) true	Emerson Class Number	Particle Size Distribution	pH (1:5 Aqueous extract at 25 °C as rec.)	pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	Cation Exchange Capacity					
Melk	oourne Laborate	ory - NATA # 12	261 Site # 12	54					Х	Х	Х					
Exte	rnal Laboratory	/	1	I	1	Х	X	Х								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID											
1	S-01	Jul 07, 2023		Soil	B23-Se0034817	Х	X	Х	Х	Х	Х					
2	S-02	Jul 07, 2023		Soil	B23-Se0034818		X									
3	S-03	Jul 07, 2023		Soil	B23-Se0034819		X									
4	S-04	Jul 07, 2023		Soil	B23-Se0034820		X									
5	S-05	Jul 07, 2023		Soil	B23-Se0034821		X									
6	S-06	Jul 07, 2023		Soil	B23-Se0034822		X									
7	S-07	Jul 07, 2023		Soil	B23-Se0034823		X									
8	S-08	Jul 07, 2023		Soil	B23-Se0034824	X	X	X	X	X	X					
9	S-09	Jul 07, 2023		Soil	B23-Se0034825											
10	5-10	Jul 07, 2023		Soil	B23-Se0034826											
11	5-11	Jul 07, 2023		Sol	B23-Se0034827		X			-						
12	5-12	Jul 07, 2023		5011	B23-Se0034828	+				+	$\left - \right $					
13	5-13	Jul 07, 2023		2011	<u> B23-Se0034829</u>											

ABN: 50 005 085 521												ABN: 91 05 0159 898	NZBN: 94290460	onment Testing N 24954	IZ Ltd
web: www.eurofins.com.au email: EnviroSales@eurofins.com		Melbourne 6 Monterey Road Dandenong South VIC 3175 Tel: +61 3 8564 500 NATA# 1261 Site# 1254	lelbourne Geelong Sydney Canberra Brisbane Newcastle Monterey Road 19/8 Lewalan Street 179 Magowar Road Unit 1,2 Dacre Street 1/21 Smallwood Place 1/2 Frost Drive iandenong South Grovedale Girraween Mitchell Murarrie Mayfield West NSW 2304 'IC 3175 VIC 3216 NSW 2145 ACT 2911 QLD 4172 Tel: +61 2 4968 8448 'el: +61 3 8564 5000 Tel: +61 3 8564 5000 Tel: +61 2 9900 8400 Tel: +61 7 3902 4600 NATA# 1261 NATA# 1261 NATA# 1261 NATA# 1261 NATA# 1261 NATA# 1261 Site# 25406 Site# 25079 & 25289 Site# 1254 Site# 25403 Site# 18217 Site# 25466 Site# 20794 Site# 20794		Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 51 Tel: +64 3 343 520 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, Tauranga 3112 1 Tel: +64 9 525 0568 IANZ# 1402							
Company Nar Address:	ne: ENV Servi Level 1, 22 Nobby Bea QLD 4218	ces Pty Ltd 247 Gold Coast H ach	lighway			O R Pl Fa	rder N eport hone: ax:	No.: #:	1	02638	6	Receive Due: Priority: Contact	d: 5 2 Name: 7	Sep 15, 2023 12: Sep 19, 2023 2 Day Tim Bischof	18 PM
Project Name Project ID:	: CALALA S 218049	OIL SAMPLING										Eurofins Analy	rtical Services	Manager : Alan	a Wadsworth
	S	Sample Detail			Colour (Pt/Co) true	Emerson Class Number	Particle Size Distribution	pH (1:5 Aqueous extract at 25 °C as rec.)	pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	Cation Exchange Capacity					
Melbourne Lab	oratory - NATA #	1261 Site # 1254						х	х	Х					
14 S-14	Jul 07, 2023	S	oil B:	23-Se0034830		X									
15 S-15	Jul 07, 2023	S	oil B	23-Se0034831		X									
16 S-16	Jul 07, 2023	S	oil B:	23-Se0034832	X	X	X	Х	X	Х					
17 S-17	Jul 07, 2023	S	oil B:	23-Se0034833		X									
18 S-18	Jul 07, 2023	S	oil B:	23-Se0034834		X									
19 S-19	Jul 07, 2023	S	oil B:	23-Se0034835		X									
20 S-20	Jul 07, 2023	S	oil B	23-Se0034836		X									
21 S-21	Jul 07, 2023	S	oil B	23-Se0034837		X									
22 S-22	Jul 07, 2023	S	oil Bi	23-Se0034838		X									
23 S-23	Jul 07, 2023	S		23-Se0034839											
24 S-24	Jul 07, 2023	S		23-Se0034840	X		X	X	X	X					
25 S-25	Jul 07, 2023	S	oil Bi	23-Se0034841		X									
26 S-26	Jul 07, 2023	S	oil B:	23-Se0034842		X									
27 S-27	Jul 07, 2023	S	oil B	23-Se0034843		X									
28 S-28	Jul 07, 2023	S	oil B	23-Se0034844		X									
29 S-29	Jul 07, 2023	S	oil B	23-Se0034845	1	X		1							

Eurofins Environment Testing Australia Pty Ltd ABN: 50 005 085 521												Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environment Testing NZ Ltd NZBN: 9429046024954		
web: www.eurofins.com.au email: EnviroSales@eurofins.co	com	Melbourne Geelong Sydney Canberra Brisbane Newcastle Perth 6 Monterey Road 19/8 Lewalan Street 179 Magowar Road Unit 1,2 Dacre Street 1/21 Smallwood Place 1/2 Frost Drive 46-48 Banksia Road Dandenong South Grovedale Girraween Mitchell Murarrie Mayfield West NSW 2304 Welshpool VIC 3175 VIC 3216 NSW 2145 ACT 2911 QLD 4172 Tel: +61 2 4968 8448 WA 6106 Tel: +61 3 8564 5000 Tel: +61 2 9900 8400 Tel: +61 2 6113 8091 Tel: +61 7 3902 4600 NATA# 1261 Tel: +61 8 6253 4444 NATA# 1261 NATA# 1261 NATA# 1261 NATA# 1261 NATA# 2377 Site# 1254 Site# 25403 Site# 18217 Site# 25466 Site# 20794 Site# 2370		Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 455 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 767 51 Tel: +64 3 343 52 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, 5 Tauranga 3112 201 Tel: +64 9 525 0568 IANZ# 1402								
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Project Name: Project ID:	CALALA SO 218049	DIL SAMPLING										Eurofins Analy	tical Services	Manager : Ala	na Wadsworth
	S	ample Detail			Colour (Pt/Co) true	Emerson Class Number	Particle Size Distribution	pH (1:5 Aqueous extract at 25 °C as rec.)	pH (units)(1:5 soil:CaCl2 extract at 25 °C as rec.)	Cation Exchange Capacity					
Melbourne Laborator	ry - NATA # 1	261 Site # 1254						х	Х	Х					
30 S-30	Jul 07, 2023	Sc	bil B23	3-Se0034846		Х									
Test Counts					4	30	4	4	4	4					



Internal Quality Control Review and Glossary

General

- 1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- 2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- 3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- 4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- 5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- 6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- 7. Samples were analysed on an 'as received' basis.
- 8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
- 9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	μg/L: micrograms per litre
ppm: parts per million	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
coc	Chain of Custody
СР	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
твто	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 - 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- 1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- 2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- 3. pH and Free Chlorine analysed in the laboratory Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- 4. Recovery Data (Spikes & Surrogates) where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- 5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- 6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.



Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code		
Method Blank									
Conductivity (1:5 aqueous extract at	: 25 °C as rec.)		uS/cm	< 10			10	Pass	
Method Blank									
Cation Exchange Capacity									
Cation Exchange Capacity*			meq/100g	< 0.5			0.5	Pass	
LCS - % Recovery	LCS - % Recovery								
Conductivity (1:5 aqueous extract at	: 25 °C as rec.)		%	99			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate	•								
Cation Exchange Capacity				Result 1	Result 2	RPD			
Cation Exchange Capacity*	M23-Se0033696	NCP	meq/100g	40	40	<1	30%	Pass	
Duplicate							_	_	
Cation Exchange Capacity					Result 2	RPD			
Cation Exchange Capacity*	B23-Se0034840	CP	meq/100g	52	55	7.2	30%	Pass	



Comments

Analysis of PSD, Colour and Emerson Class has been completed by East West, report reference EW231712

Sample Integrity	
Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	Yes

Authorised by:

Alana Wadsworth Caitlin Breeze Mary Makarios Analytical Services Manager Senior Analyst-Inorganic Senior Analyst-Metal

Glenn Jackson Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

- * Indicates NATA accreditation does not cover the performance of this service
- Measurement uncertainty of test data is available on request or please click here.

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APPENDIX C

Soil Survey Technical Report



SITE DETAILS

Site Location:	PAD 23: SW QUAD, 60MW & 40MS OF CORNER					
Profile Details:	SOIL SURVEY OF TAMWORTH ARC Survey (1000976), Profile 204, collected from a core sample by Miss Belinda Lake on 01 July, 1979					
Map Reference:	MGA Grid Reference: Zone 56, 306185E, 6553069N. 9035 TAMWORTH (1:100000) map sheet.					
Physiography:	other lithology and used for cropping. elevation 408.0 m, aspect south east. Surface condition is recently cultivated, profile is well drained, erosion hazard is high					
Vegetation/Land Use:	irrigated cultivation at the site, used for cropping, with cropping, improved pasture in the general area					
Surface Condition:	recently cultivated when described, expected to be cracked when dry					
Erosion/Land Degradation:	high					
Soil Hydrology:	profile is well drained,					
Soil Type:	Incomplete					
Base of observation:	layer continues					
Profile Field Notes:	Red brown earth, Haplic phaeozem. Parent material: Clg, C-Dt, arenites. Pedologist: Alex Riddler.					

SOIL DESCRIPTION

Layer 0		
0.00 - 0.00 m		
Layer 1	Horizon: Ap (ploughing	or tillage practices)
0.00 - 0.05 m	Texture:	light clay
	Colour:	dark reddish brown (5YR 3/3) [moist] or reddish brown (dull reddish brown) (5YR 4/4) [dry] with no recorded mottles
	Structure:	strong pedality
	Pans:	other also other
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	dry,
	Field chemical tests:	Field pH is 8.0 (Raupach),
	Sample taken:	undisturbed

Layer 2	Horizon: Ap (ploughing	or tillage practices)
0.05 - 0.14 m	Texture:	light clay
	Colour:	(very dark reddish brown) (2.5YR 2/4) [moist] with 2% - 10% distinct unspecified dark mottles
	Structure:	weak pedality (fabric is earthy)
	Coarse Fragments:	few (2-10%), not identified, fine gravel (2-6 mm),
	Roots:	common (10-25/10x10cm) (Root size 2-5 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	moderately moist,
	Field chemical tests:	Field pH is 8.0 (Raupach),
	Sample taken:	undisturbed
	Layer Notes:	No peds evident. Some inclusions of red brown clays.
Layer 3	Horizon: B2	
0.14 - 0.57 m	Texture:	light medium clay
	Colour:	dark yellowish brown (dark brown) (10YR 3/4) [moist] with no recorded mottles
	Structure:	weak pedality stress cutans, few (< 10%), distinct
	Coarse Fragments:	few (2-10%), not identified, weakly weathered, fine gravel (2-6 mm),
	Roots:	many (25-100/10x10cm) (Root size <1 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	moderately moist,
	Field chemical tests:	Field pH is 8.5 (Raupach),
	Sample taken:	undisturbed
	Layer Notes:	occasional galebules of cays. Some browninclusions along old root channels. Some small carbonate concretions.
Layer 4	Horizon: B3	
0.57 - 1.40 m	Texture:	light medium clay
	Colour:	dark yellowish brown (dark brown) (10YR 3/4) [moist] with no recorded mottles
	Structure:	weak pedality
	Coarse Fragments:	few (2-10%), not identified, weakly weathered, fine gravel (2-6 mm),
	Pans:	other
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	moderately moist,
	Field chemical tests:	Field pH is 8.5 (Raupach),
	Sample taken:	undisturbed
	Layer Notes:	Occasional old-root channel filled with surface material. Occasional clay glaebules. Occasional manganese staining (1mm). Some small carbonate concretions.
Layer 5	Horizon: C1	
1.40 - 1.46 m	Texture:	light medium clay

	Colour:	dark yellowish brown (dark brown) (10YR 3/4) [moist] with no recorded mottles
	Structure:	weak pedality stress cutans, few (< 10%), distinct
	Coarse Fragments:	few (2-10%), not identified, weakly weathered, fine gravel (2-6 mm),
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Moisture/Consistence:	moderately moist,
	Field chemical tests:	Field pH is 8.5 (Raupach),
	Sample taken:	undisturbed
	Layer Notes:	Slight small manganese staining. Some small carbonate concretions.
Layer 6	Horizon: C2	
1.46 - 1.47 m		
	Colour:	colour not recorded with no recorded mottles
	Structure:	weak pedality
	Soil fauna:	Activity is nil
	Cracks/Macropores:	Cracks are nil, macropores are nil
	Sample taken:	undisturbed
	Layer Notes:	Maximum, not penetrable; dense clays.

LABORATORY TESTS

Sample Code:	WEL/79/7/542(1)	Upper bound: 0.00	Lower bound: 0.05	
Name			Value	Unit of measure
3A1 [EC of 1:5 soil	/water extract]		1.8	dS/m
4B1 [pH of 1:5 soil	/0.01M CaCl2 extract - d	irect, no stir]	7.3	рН
7A1 [Total nitroger	n- semimicro Kjeldahl,ste	am distillation]	0.14	%
9E1 [Fluoride-extra	actable P (Bray 1-P) - ma	anual colour]	3	mg/kg

Sample Code:	WEL/79/7/543(1)	Upper bound: 0.05	Lower bound: 0.14	
Name			Value	Unit of measure
3A1 [EC of 1:5 soil	/water extract]		1.1	dS/m
4B1 [pH of 1:5 soil	/0.01M CaCl2 extract - di	rect, no stir]	7	рН
7A1 [Total nitroger	n- semimicro Kjeldahl,stea	am distillation]	0.13	%
9E1 [Fluoride-extra	actable P (Bray 1-P) - ma	nual colour]	2	mg/kg

Sample Code:	WEL/86/7/544(1)	Upper bound: 0.14	Lower bound: 0.40	
Name			Value	Unit of measure
3A1 [EC of 1:5 so	il/water extract]		1.26	dS/m
4B1 [pH of 1:5 soi	I/0.01M CaCl2 extract - d	irect, no stir]	7.6	рН

Sample Code:	WEL/86/7/545(1)	Upper bound: 1.00	Lower bound: 1.40	
Name			Value	Unit of measure

3A1 [EC of 1:5 soil/water extract]	1.89	dS/m
4B1 [pH of 1:5 soil/0.01M CaCl2 extract - direct, no stir]	8	pН

For information on laboratory test data and units of measure, please see: Soil survey standard test methods

Report generated on 15/09/2023 at 01:48 PM

To contact us, email: soils@environment.nsw.gov.au

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Soil Profile Report

23042





SITE DETAILS:

Survey:	SOIL SURVEY OF TAMWORTH ARC (1000976)
Profile:	204
Location:	PAD 23: SW QUAD, 60MW & 40MS OF CORNER

PROFILE MAP DETAILS:

1:100,000 Mapsheet:	TAMWORTH (9035)	Locational Accuracy:	1:100 000
MGA Easting:	306185	MGA Northing:	6553069
MGA Zone:	56		

PROFILE DETAILS:

Described by:	Miss Belinda Lake	Profile Date:	01 July, 1979
Nature of Exposure:	core sample	Photo Taken:	
Base of observation:	layer continues	No of Layers:	8
SOIL AND MAP C	ODES:		
Geology Map Code:		Soil Map Code:	
Aust. Soil Classification:			
Great Soil Group:		Northcote PPF:	Uf6.31

Atlas(Northcote)

Code:

Soil Taxonomy:

Atlas (A&M) Code:

Soil Type: Incomplete

TOPOGRAPHY:

Slope:			
Elevation:	408.0 m	Aspect:	south east
LANDFORM:			
Site Morphology:	lower slope	Site Process:	alluvial
Slope Morphology:		Local Relief:	
Landform Pattern:		Landform Element:	
Plan Curvature:		Position in Landform Element:	

Microrelief:

Microrelief extent:

LITHOLOGY:

Solum PM:

Rock Outcrop:

Nil

Outcrop Same As:

Weathering & Alteration:

Discontinuities:

Fragment Amount:

VEGETATION:

Vegetation Formation:

Vegetation Community:

Growth Form(s):

Crown Separation Ratio:

Upper Stratum Height:

SITE CONDITION:

recently cultivated

Ground Cover %:

Current Condition:

Microrelief depth:

Substrate: other Rock Outcrop (BSAL): Substrate Strength:

Site Disturbance:

irrigated cultivation

cropping, improved pasture

Expected Dry Condition:

cracked

Estimated Effective Rooting Depth:

General Area:

LAND USE:

Expected Wet

Condition:

Site: cropping

Land Use Vegetation Species: Prior Land Use:

HYDROLOGY:

Presence of Free Free Water Depth: Water: Run-on: Runoff: Permeability: **Profile Drainage:** well drained Free Water pH: Free Water EC:

EROSION:

Wind exposure:

Erosion Hazard:	high		
SALINITY:			
Salinity:			
Salt Outbreak Mapping:		Salt Outb Vegetatic	oreak on Species:
EM Measurement 1 Type:		EM Meas horizonta	surement 1 I:
EM Measurement 1 vertical:			
EM Measurement 2 Type:		EM Meas horizonta	surement 2 I:
EM Measurement 2 vertical:			
FIELD NOTES:	Red brown earth, Hapli arenites. Pedologist: A	c phaeozem. Alex Riddler.	Parent material: Clg, C-Dt,
LAYER 0			
Depth:	0.00 - 0.00 m		
Layer Notes:			
Vesicles:		Ped poros	sity:
LAYER 1	Ap horizon (ploughin	g or tillage prac	ctices)
Depth:	0.00 - 0.05 m		
Layer Notes:			
TEXTURE:	light clay		
COLOUR:			
Moist:	dark reddish brown (5YR 3/3)	
Dry:	reddish brown (dull re	eddish brown)	(5YR 4/4)
FIELD CHEMICAL TESTS:			
pH:	8.0 (Raupach)	Field EC:	
HCI:		H2O2:	
AgNO3:			
STRUCTURE:			
Grade of Pedality:	strong pedality	Fabric:	
Dominant Peds:		Subdomin	ant Peds:
Artificial Aggregates:		SOILpak s	score:
Vesicles:	slightly vesicular	Ped poros	sity:
PANS:			
Туре:	other	Cementa	tion:

Continuity: PANS:		Structure:	massive
Туре:	other	Cementation:	
Continuity:		Structure:	vesicular
SOIL WATER STATUS:	dry		
SAMPLE TAKEN:	undisturbed		
LAYER 2	Ap horizon (ploughing or	tillage practices)	
Depth:	0.05 - 0.14 m		
Layer Notes:	No peds evident. Some ir	nclusions of red brown cl	ays.
TEXTURE:	light clay		
COLOUR:			
Moist:	(very dark reddish brown)) (2.5YR 2/4)	
MOTTLES:			
Dominant Mottles:			
Туре:	unspecified	Colour:	dark
Contrast:	distinct	Abundance:	2% - 10%
FIELD CHEMICAL TESTS:			
pH:	8.0 (Raupach)	Field EC:	
HCI:		H2O2:	
AgNO3:			
STRUCTURE:			
Grade of Pedality:	weak pedality	Fabric:	earthy
Dominant Peds:		Subdominant Peds:	
Artificial Aggregates:		SOILpak score:	
Vesicles:		Ped porosity:	porous
COARSE FRAGMENTS:			
Туре:	not identified	Amount:	few (2-10%)
Distribution:		Orientation:	
Weathering:		Shape:	
Size:	fine gravel (2-6 mm)		
ROOTS:			
<1 mm size:		1-2 mm size:	
2-5 mm size:	common (10- 25/10x10cm)	>5 mm size:	
SOIL WATER STATUS:	moderately moist		

SAMPLE TAKEN:	undisturbed			
LAYER 3	B2 horizon			
Depth:	0.14 - 0.57 m			
Layer Notes:	occasional galebules of cays. Some browninclusions along old root channels. Some small carbonate concretions.			
TEXTURE:	light medium clay			
COLOUR:				
Moist:	dark yellowish brown (da	rk brown) (10YR 3/4)		
FIELD CHEMICAL TESTS:				
pH:	8.5 (Raupach)	Field EC:		
HCI:		H2O2:		
AgNO3:				
STRUCTURE:				
Grade of Pedality:	weak pedality	Fabric:		
Dominant Peds:		Subdominant Peds:		
Artificial Aggregates:		SOILpak score:		
Vesicles:		Ped porosity:		
PED COATING:				
Туре:	stress cutans	Amount:	few (< 10%)	
Distinctiveness:	distinct			
COARSE FRAGMENTS:				
Туре:	not identified	Amount:	few (2-10%)	
Distribution:		Orientation:		
Weathering:	weakly weathered	Shape:		
Size:	fine gravel (2-6 mm)			
ROOTS:				
<1 mm size:	many (25-100/10x10cm)	1-2 mm size:		
2-5 mm size:		>5 mm size:		
SOIL WATER STATUS:	moderately moist			
SAMPLE TAKEN:	undisturbed			
LAYER 4	B3 horizon			
Depth:	0.57 - 1.40 m			
Layer Notes:	Occasional old-root chan glaebules. Occasional carbonate concretions.	nel filled with surface ma manganese staining	aterial. Occasional clay g (1mm). Some small	
TEXTURE:	light medium clay			

COLOUR:			
Moist:	dark yellowish brown (da	rk brown) (10YR 3/4)	
FIELD CHEMICAL TESTS:			
pH:	8.5 (Raupach)	Field EC:	
HCI:		H2O2:	
AgNO3:			
STRUCTURE:			
Grade of Pedality:	weak pedality	Fabric:	
Dominant Peds:		Subdominant Peds:	
Artificial Aggregates:		SOILpak score:	
Vesicles:		Ped porosity:	
COARSE FRAGMENTS:			
Туре:	not identified	Amount:	few (2-10%)
Distribution:		Orientation:	
Weathering:	weakly weathered	Shape:	
Size:	fine gravel (2-6 mm)		
PANS:			
Туре:	other	Cementation:	
Continuity:		Structure:	vesicular
SOIL WATER STATUS:	moderately moist		
SOIL WATER STATUS: SAMPLE TAKEN:	moderately moist undisturbed		
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY:	moderately moist undisturbed		
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness:	moderately moist undisturbed gradual (50-100 mm)	Shape:	
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5	moderately moist undisturbed gradual (50-100 mm) C1 horizon	Shape:	
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m	Shape:	
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese	Shape: staining. Some small car	ponate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay	Shape: staining. Some small carl	ponate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay	Shape: staining. Some small carl	conate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da	Shape: staining. Some small carl rk brown) (10YR 3/4)	oonate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL TESTS:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da	Shape: staining. Some small carl rk brown) (10YR 3/4)	oonate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL ESTS: pH:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da 8.5 (Raupach)	Shape: staining. Some small carl rk brown) (10YR 3/4) Field EC:	conate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL TESTS: pH: HCI:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da 8.5 (Raupach)	Shape: staining. Some small carl rk brown) (10YR 3/4) Field EC: H2O2:	oonate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL FIELD CHEMICAL PH: HCI: AgNO3:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da 8.5 (Raupach)	Shape: staining. Some small carl rk brown) (10YR 3/4) Field EC: H2O2:	oonate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL TESTS: pH: HCI: AgNO3: STRUCTURE:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da 8.5 (Raupach)	Shape: staining. Some small carl rk brown) (10YR 3/4) Field EC: H2O2:	oonate concretions.
SOIL WATER STATUS: SAMPLE TAKEN: BOUNDARY: Distinctiveness: LAYER 5 Depth: Layer Notes: TEXTURE: COLOUR: Moist: FIELD CHEMICAL STRUCTURE: AgNO3: STRUCTURE: Grade of Pedality:	moderately moist undisturbed gradual (50-100 mm) C1 horizon 1.40 - 1.46 m Slight small manganese light medium clay dark yellowish brown (da 8.5 (Raupach) weak pedality	Shape: staining. Some small carl rk brown) (10YR 3/4) Field EC: H2O2: Fabric:	oonate concretions.

Dominant Peds: Artificial Aggregates: Vesicles:		Subdominant Peds: SOILpak score: Ped porosity:	
PED COATING:			
Туре:	stress cutans	Amount:	few (< 10%)
Distinctiveness:	distinct		
COARSE FRAGMENTS:			
Туре:	not identified	Amount:	few (2-10%)
Distribution:		Orientation:	
Weathering:	weakly weathered	Shape:	
Size:	fine gravel (2-6 mm)		
SOIL WATER STATUS:	moderately moist		
SAMPLE TAKEN:	undisturbed		
LAYER 6	C2 horizon		
Depth:	1.46 - 1.47 m		
Layer Notes:	Maximum, not penetrable; dense clays.		
STRUCTURE:			
Grade of Pedality:	weak pedality	Fabric:	
Dominant Peds:		Subdominant Peds:	
Artificial Aggregates:		SOILpak score:	
Vesicles:		Ped porosity:	
SAMPLE TAKEN:	undisturbed		
LAYER 99			
Layer Notes:			
Vesicles:		Ped porosity:	

LABORATORY TESTS

Sample Code: WEL/79/7/542(1) Upper bound: 0.00 Lower bound: 0.05

Name	Value	Unit of measure
3A1 [EC of 1:5 soil/water extract]	1.8	dS/m
4B1 [pH of 1:5 soil/0.01M CaCl2 extract - direct, no stir]	7.3	рН
7A1 [Total nitrogen- semimicro Kjeldahl, steam distillation]	0.14	%
9E1 [Fluoride-extractable P (Bray 1-P) - manual colour]	3	mg/kg

Sample Code: WEL/79/7/543(1) Upper bound: 0.05 Lower bound: 0.14		
Name	Value	Unit of measure
3A1 [EC of 1:5 soil/water extract]	1.1	dS/m
4B1 [pH of 1:5 soil/0.01M CaCl2 extract - direct, no stir]	7	рН
7A1 [Total nitrogen- semimicro Kjeldahl, steam distillation]	0.13	%
9E1 [Fluoride-extractable P (Bray 1-P) - manual colour]	2	mg/kg
Sample Code: WEL/86/7/544(1) Upper bound: 0.14 Lower bound: 0.40		
Name	Value	Unit of measure
3A1 [EC of 1:5 soil/water extract]	1.26	dS/m
4B1 [pH of 1:5 soil/0.01M CaCl2 extract - direct, no stir]	7.6	рН
Sample Code: WEL/86/7/545(1) Upper bound: 1.00 Lower bound: 1.40		
Name	Value	Unit of measure
3A1 [EC of 1:5 soil/water extract]	1.89	dS/m
4B1 [pH of 1:5 soil/0.01M CaCl2 extract - direct, no stir]	8	рН

For information on laboratory test data and units of measure, please see: Soil survey standard test methods

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Soil technical Report