Appendix J

Soils and Land Suitability Assessment

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

WHITEHAVEN COAL

Resource Strategies

Soils and Land Suitability Assessment

Winchester South Project
Whitehaven WS Pty Ltd

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EXECUTIVE SUMMARY

GT Environmental Pty Ltd was commissioned by Whitehaven WS Pty Ltd, a wholly owned subsidiary of Whitehaven Coal Limited, to conduct a soils and land suitability assessment for the Winchester South Project (the Project) to form part of an Environmental Impact Statement under the Coordinator-General's assessment process.

The Project involves the development of an open cut coal mine and associated infrastructure within the Bowen Basin, located approximately 30 kilometres (km) south-east of Moranbah. The Project is forecast to extract 15 million tonnes per annum (Mtpa) of run-of-mine coal, with a forecast peak extraction of up to 17 Mtpa, for approximately 30 years. The Project study area consists of Mining Lease Application (MLAs) 700049, 700050, 700051 and MLA 700065, and three potential infrastructure corridors and a buffer to account for any future changes to potential alignments.

The study area covers an area of approximately 13,601 hectares (ha), of which approximately 7,130 ha is proposed to be disturbed by infrastructure and mining activities.

This soils and land suitability survey was scoped and conducted in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008). These Guidelines were developed to provide a consistent approach to soil survey methodology across Australia. Soil Characteristics and Soil Profiles have been described in accordance with the *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009) and *Australian Soil and Land Survey: Guidelines for Conducting Surveys* (Gunn et al., 1988).

Collection of soil samples for laboratory analysis was undertaken in line with the Land Suitability Assessment Techniques (LSAT) outlined in the Department of Minerals and Energy (DME) guideline *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME, 1995).

Determination of land suitability within the study area has been conducted based on the *Guidelines for Agricultural Land Evaluation in Queensland* (GALE) (Department of Science, Information Technology and Innovation [DSITI] and the Department of Natural Resources and Mines [DNRM], 2015) and *Regional Land Suitability Frameworks for Queensland* (Regional Frameworks) (DSITI and DNRM, 2013). Where guidance is not specifically provided in the GALE or Regional Frameworks, reference and assessment were also made in reference to the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).

The following conclusions have been made:

- Fifteen soil mapping units (SMUs) are present in the study area.

- The study area includes areas of flat to gently undulating plains dominated by uniform and gradational clays with microrelief (C1-BL, C1-BR and C4), uniform and gradational clays (C3-BL, C3-BR and C5), texture contrast soils on gently undulating plains (R3, S1, T1-R, T1-B, T2 and T3), texture contrast soils on wide crests (S3), uniform sands on plains (S4) and shallow sandy earths (K1).
- Land use suitability assessment of the fifteen SMUs was determined against the Regional Frameworks (DSITI and DNRM, 2013), GALE (DSITI and DNRM, 2015) and *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).
    - SMUs C3-BL, C4, and T2 present moderate limitations for cropping land uses. Limitations include plant available water content, erosion hazards, surface conditions and moisture range.

      SMUs C3-BL and C4 were assessed as Agricultural Land Class (ALC) rating A1 and suitable for a wide range of current and potential broadacre and horticultural crops.

      SMU T2 was assessed as ALC rating B and is suitable for a narrow range of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops.
    - The remaining SMUs were assessed as unsuitable for cropping land uses and suitable for beef cattle grazing land use.

      SMUs C1-BL, C1-BR, C3-BR, C5, K1, R3, S1, S3, S4, T1-B, T1-R and T3 were assessed as ALC rating C2 and are suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
    - Disturbed areas consist of 25 ha.
- Topsoil for rehabilitation use (e.g. able to support the establishment of native vegetation and grasses, or other appropriate species) is available from all SMUs, with S3 recommended to be analysed once stripping commences prior to use for rehabilitation due to the potential for high salinity in the topsoil. SMUs recommended for level plains or sloped backfill batters above 3% include C3-BL, C3-BR, C4, C5 and S3. SMUs recommended for level plains or slopes equal to or less than 3% include C1-BL, C1-BR, K1, R3, S1, S4, T1-B, T1-R, T2 and T3, with R3, S1, S4, T1-B, T1-R, T2 and T3 available for use on slopes above 3% with appropriate management such as the application of gypsum ameliorants, surface preparation including ripping of topsoils, erosion and sediment controls, reduced exposure time of bare soils and vegetation establishment of rehabilitated areas.
- Subsoil suitable for supporting the establishment of natural vegetation growth with additional soil fertility conditioning and the potential to increase topsoil reserves is limited due to dispersive and salinity attributes for most SMUs. SMUs C4, C5, R3, S1, S3, S4, T1-B, T1-R and T2 may provide suitable subsoils for rehabilitation use. All remaining SMUs are not suitable for rehabilitation use and more suited as potential capping of waste rock.

- No areas of regional interest, including any strategic cropping areas or priority agricultural areas, are located within the Project area.
- Acid sulfate soils were not observed during the survey and it is highly unlikely that the study area would include actual acid sulfate soils (AASS) and/or potential acid sulfate soils (PASS). In the unlikely event conditions of the soil during the Project's life present attributes of PASS or AASS, an ASS environmental management plan should be prepared and implemented.
- The proposed post-mining final land use for most of the study area may include beef cattle grazing activities and cropping activities. It has been assumed that part of the residual void areas (e.g. steep sections of the low-wall [>18% slope], the highwalls and pit lake) would be unsuitable for beef cattle grazing or cropping activities. It is expected that undisturbed areas of the study area would remain the same classes identified pre-mine.

1 INTRODUCTION

1.1 Project Details

Whitehaven WS Pty Ltd (Whitehaven WS), a wholly owned subsidiary of Whitehaven Coal Limited, proposes to develop the Winchester South Project (the Project), a coal mine and associated infrastructure within the Bowen Basin, located approximately 30 kilometres (km) south-east of Moranbah, within the Isaac Regional Council (IRC) Local Government Area (Figure 1).

The Project involves the development of an open cut coal mine in an existing mining precinct for export of coal products. The Project would include construction and operation of a mine infrastructure area, including a coal handling and preparation plant (CHPP), train load-out facility and rail spur, which would be used for the handling, processing and transport of coal. An infrastructure corridor would also form part of the Project, including a raw water supply pipeline connecting to the Eungella pipeline network, an electricity transmission line and a mine access road (Figure 2).

The Project is forecast to extract approximately 15 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal, with a forecast peak extraction rate of up to 17 Mtpa, for approximately 30 years. The coal resource would be mined by open cut mining methods, with product coal to be transported by rail to port for export.

GT Environmental Pty Ltd (GTE) was commissioned by Whitehaven WS to conduct a Soils and Land Suitability Assessment of the Project *study area*, consisting of Mining Lease Application (MLA) 700049, MLA 700050, MLA 700051 and MLA 700065, three potential infrastructure corridors and a buffer to account for any future changes to potential alignments (Figure 3).

The study area covers an area of approximately 13,601 hectares (ha), of which approximately 7,130 ha is proposed to be disturbed by infrastructure and mining activities.

1.2 Scope of Report

This report provides a baseline assessment of the soil and land suitability for the study area and includes:

- overview of the local setting and regulatory requirements (Sections 1 and 2);
- review of available background material (Section 3.1);
- overview of the field work methodology (Section 3.2);
- identification and description of soil mapping units (SMUs) and their distribution across the study area (Section 4);
- assessment of the Agricultural Land Classes (ALC) and land suitability of each SMU (Section 5);

- assessment of areas of regional interest including strategic cropping areas (SCAs) and priority agricultural areas (PAAs) (Section 6);
- assessment of the potential for acid sulfate soils (Section 7);
- assessment of the suitability of each SMU for reuse in mine rehabilitation activities, including determination of soil stripping volumes, recommended rehabilitation uses and soil amelioration (Section 8); and
- assessment of the proposed land use and indicative assessment of final land use (Section 9).

This assessment forms part of an Environmental Impact Statement (EIS) which has been prepared in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971*. This assessment has been prepared to satisfy the requirements of the *Terms of reference for an environmental impact statement – Winchester South Project* issued by the Coordinator-General on 4 September 2019.

1.3 Regulatory Requirements

This soils and land suitability survey was scoped and conducted in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008). These Guidelines were developed to provide a consistent approach to soil survey methodology across Australia. Soil characteristics, profiles and survey methods have been described in accordance with the *Australian Soil and Land Survey: Field Handbook* (National Committee on Soil and Terrain, 2009) and *Australian Soil and Land Survey: Guidelines for Conducting Surveys* (Gunn et al., 1988).

The soil survey for the three potential infrastructure corridors has been scoped and conducted in accordance with guidance provided by Forster (2011) *Draft for Discussion: Soil Survey Methodology along Linear Features* and Soil Science Australia (2015) *Guidelines for Soil Survey along Linear Features*. These documents provide information about the assessment of linear features for the purpose of soil surveys. In addition, GTE has participated in recent discussions with the Queensland Department of Natural Resources and Mines (DNRM) (now Department of Natural Resources, Mines and Energy) regarding their requirements for soils surveys of linear features.

Soils have been grouped according to their parent material and position in the landscape and classified in accordance with the *Australian Soil Classification* (Isbell, 2016). Soils have also been correlated to soils identified within key regional soil assessments, the major assessment being *Lands of Isaac-Comet Area, Queensland* (Gunn et al., 1967).

Collection of soil samples for laboratory analysis was undertaken in line with the Land Suitability Assessment Techniques (LSAT) outlined in the Department of Minerals and Energy (DME) guideline *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME, 1995).

Determination of land suitability in the study area has been conducted based on the *Guidelines for Agricultural Land Evaluation in Queensland* (GALE) (Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines [DSITI and DNRM], 2015) and *Regional Land Suitability Frameworks for Queensland* (Regional Frameworks) (DSITI and DNRM, 2013) with reference and assessment also made to the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).

Furthermore, the preparation of this soils and land suitability assessment has been conducted in accordance with *Application requirements for activities with impacts to land* (Department of Environment and Science [DES], 2017), *Land – EIS information guideline* (DES, 2020a), *Contaminated Land – EIS information guideline* (DES, 2020b), *EIS information guideline – Rehabilitation* (Department of Environment and Heritage Protection [EHP], 2016) and the *Terms of reference for an environmental impact statement – Winchester South Project* issued by the Coordinator-General on 4 September 2019.

2 BACKGROUND

2.1 Land Use and Vegetation

Grazing is the primary land use across the study area. No other agricultural activities were observed to be undertaken in, or in the vicinity of, the study area. Review of the *Mackay, Isaac and Whitsunday Regional Plan* (Department of Local Government and Planning, 2012) and *Isaac Regional Planning Scheme 2021* identify important agricultural areas/Class A and B agricultural land classification in the study area. Good quality agricultural land is capable of sustainable agricultural use without causing land degradation to other natural resources.

The land in and surrounding the study area comprises exotic grasslands, natural bushland, consisting of tall woodlands of *Eucalyptus populnea* (Poplar Box) and *E. crebra* (Narrow-leaved Ironbark), forests of *Acacia harpophylla* (Brigalow) and native grasses.

2.2 Topography and Hydrology

The landscape of the study area includes gently undulating plains with elevations in the range of approximately 190 to 200 metres (m) Australian Height Datum (Queensland Government, 2019).

Multiple unnamed drainage lines associated with Isaac River and Ripstone Creek are located across the study area. These drainage lines generally flow in a west to east direction towards Isaac River.

2.3 Regional Geology

Detailed surface geology (Queensland Government, 2019) indicates the site is underlain by black soils, colluvial, residual deposits, sandstone, mudstone, pebble conglomerate, tuff, carbonaceous shale and cherty tuff of the Triassic, Late Tertiary, Quaternary and Late Permian ages.

Soil mapping in the *Lands of the Isaac-Comet Area, Queensland* (Gunn et al., 1967) details substrate geology as tertiary sandstone, weathered tertiary clays and clay plains.

3 METHODOLOGY

The methodology for the baseline soil assessment, which involved a desktop review and field survey, is described below.

3.1 Desktop Review

GTE reviewed the available soils and land resources information for the study area to develop preliminary SMUs, determine their distribution and to inform the development of the field survey program.

3.1.1 Regional soils reports and available documentation

The following references were utilised for reviewing previous soils and land suitability fieldwork, recommendations and determining potential field sampling locations:

- Burgess J.W. (2003) *Land Resource Assessment of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments, Central Queensland*;

  The Windeyers Hill study provides a comprehensive baseline dataset of representative soil and landscape information that is suitable for future reinterpretation and modelling across almost 300,000 ha, 250 km south-west of Mackay. The data from the study assists in future assessments of cropping suitability, grazing productivity, fertility decline and landscape salinity hazard in the Isaac-Connors and Mackenzie River catchments.

- Gunn et al. (1967) *Lands of the Isaac-Comet Area, Queensland*;

  Commonwealth Scientific and Industrial Research Organisation land system boundaries are landscape patterns identified from air photo interpretation with few field descriptions. Based on Gunn et al. (1967), the study area is described as low stony hills and ridgelines into undulating sandy duplex plains and recent alluvial areas.

- Northcote et al. (1960-1968) *Atlas of Australian Soils*;

  The indicated soil classifications of the study area, as contained in the *Atlas of Australian Soils*, include Kandosols, Dermosols, Sodosols and Vertosols. Most of the study area consists of gently undulating clay plains with gilgai microrelief and gently undulating plains. Although these classifications are mapped at a broad scale (1:2,000,000), they are useful for identifying specific variants of these soil classes.

- GTE (2018) *Soil and Land Suitability Assessment, Olive Downs Coking Coal Project;*

  GTE conducted a soil and land suitability assessment of the Olive Downs Project (ODP) and assessed twelve SMUs. This assessment included 1,010 investigation sites, incorporating 192 detailed sites and 818 observation sites. Soils consisted of uniform to gradational clay soils, gilgai clays, duplex sandy soils and alluvial and low-lying plain soils.

  The ODP site is located to the east and the south of the study area and selected detailed sites have been used to assist with the assessment of SMUs in the study area.

3.1.2 Satellite imagery

Satellite imagery from Google Earth™ and Queensland Globe (accessed September 2019) was reviewed as part of the desktop assessment. Initial SMUs and boundaries were identified using this satellite imagery.

3.2 Field Work

3.2.1 Survey timing

Detailed field surveys of the study area were undertaken over the dates 20 to 22 September 2019 and 7 to 16 October 2019.

3.2.2 Survey team

The fieldwork was led by associate environmental consultant Reece McCann and assisted by environmental consultant Greg Tuck.

3.2.3 Survey techniques

Survey techniques were based on pre-determined sampling locations derived from the desktop review of background information, existing available soils information and an examination of aerial photography terrain patterns. The specific locations of the survey sites were further refined in the field based on available site access, and the location being a sound representation of the SMU being described.

The sampling used free survey techniques (McKenzie et al., 2008 and Gunn et al., 1988) to verify proposed SMUs and assign boundaries to each. Free survey is a commonly used method in broader scale land assessment as it enables flexibility in site selection (over grid mapping techniques), to achieve a more accurate and time effective result. The soil assessment program considered the use of existing access and drilling tracks to ensure greater efficiency in the field. Where existing access and tracks were unavailable, transects across existing observations sites and landforms were used to extrapolate across these areas.

Sampling along the three potential infrastructure corridors was conducted by utilising existing soils information, aerial photography review and free survey techniques. This determined intervals along the linear infrastructure at which SMUs would be surveyed.

Two types of observation sites were surveyed; detailed sites and check sites. These are described below. Detailed site descriptions and observation site descriptions are presented within Appendix A and Appendix B, respectively.

Notes on vegetation present during the surveys were also taken. These are used in the detailed descriptions presented in Appendices A and B and summarised in Section 4. However, the comments on vegetation are cursory in nature and a full detailed assessment of vegetation present at the Project is provided in the Terrestrial Ecology Assessment (E2M Pty Ltd, 2021).

Detailed Sites

Detailed site locations were selected initially based on the desktop review of existing soils data, topography and geology information. Once fieldworks commenced, detailed sites were adjusted based on observations in the field of landform, vegetation, rockiness, topsoil colours, textures and site accessibility.

Detailed sites were undertaken at 99 locations; 82 new detailed sites were conducted in the study area, with an additional 17 detailed sites included from ODP (detailing SMUs located on the boundary of the study area).

Soil profiles were sampled using a 50 millimetres (mm) diameter hand auger. The hand auger method is a technically suitable method and was undertaken in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008).

Soil samples were collected from 15 of the detailed sites for laboratory analysis. Representative sites selected were reviewed against the other detailed sites in the SMU and selected as representing the dominant soil attributes which make up the SMU.

Soil sampling of profiles was conducted as per McKenzie et al. (2008), with samples taken with reference to standard depths incorporating the surface and every horizon change in the soil profile (typically at depths of 0.0-0.10 m, 0.20-0.30 m, 0.50-0.60 m, 0.80-0.90 m and 0.90-1.00 m). Depths were modified at sites where field observations identified soil horizons intersecting at these nominated depths, to ensure samples were collected within each separate horizon, and not across multiple horizons or in sub-horizon boundaries.

Detailed sites describe the range of soil profile morphological attributes as per National Committee on Soil and Terrain (2009) guidelines (including soil colour as per *Munsell Soil Colour Charts* [Munsell, 2009]), in addition to landforms, slope, surface conditions, rock cover and major vegetation. The major information recorded for detailed sites included:

- location (GDA94) and type of soil observation (e.g. erosion exposed cutting or hand auger);
- major vegetation types;
- landform type, position of the site and slope gradient;
- surface condition (e.g. presence of cracks, surface crust, rocks, stones and cobbles, erosion status, microrelief);
- types and vertical extent of soil horizons;
- colour (Munsell, 2009) and mottling of each horizon;
- observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence, pedality and moisture content for each horizon;

- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining, and field pH; and
- photographs of the soil profile, surface and surrounding landscape.

Detailed site descriptions for the Project are presented in Appendix A and the locations are presented on Figure 3.

Check Sites

Check sites were undertaken at 311 locations, 292 new check sites were conducted in the study area, with an additional 19 check sites included from ODP (near the boundary of the study area). These sites were used to confirm SMU type and refine mapped soil boundaries.

Check sites documented attributes such that an assessment of an SMU may be made. Attributes recorded may include but are not limited to surface conditions including rock, slope percentage, landform type and position, major vegetation, land condition, boundary and indicative useable topsoil stripping depth, with basic soil attributes being confirmed.

Check site descriptions for the Project are presented in Appendix B and the locations are presented on Figure 3.

3.2.4 Laboratory analysis

Soil samples were collected from sites considered to be most representative of SMUs found in the study area and submitted to Environmental Analysis Laboratory for analysis. The laboratory holds National Association of Testing Authority (NATA) accreditation and is certified by the Australasian Soil and Plant Analysis Council (ASPAC).

Laboratory analysis was undertaken to assist in determining the overall characterisation of the soils and to establish their physical and chemical limitations. Laboratory testing was also used to identify soils that may require specific management measures. For each SMU, the topsoil horizon was sampled and analysed for the following parameters.

- pH (1:5);
- Electrical Conductivity (EC [1:5]);
- chloride;
- bicarbonate extractable P (Bicarb. extr. P);
- Exchangeable Cations (Calcium [Ca], Magnesium [Mg], Sodium [Na], Potassium [K]);
- Cation Exchange Capacity (CEC);
- Calcium/Magnesium (Ca/Mg) Ratio;
- Exchangeable Sodium Percentage (ESP);
- nitrates;
- organic matter content;
- Particle Size Analysis (PSA) - Hydrometer Method (Coarse Sand [CS], Fine Sand, Silt, Clay);

- dispersion ratio (R1);
- sulfate; and
- metals - total (Manganese [Mn], Boron [B], Copper [Cu], Iron [Fe], Zinc [Zn]).

Subsequent subsoil samples were analysed for a limited suite of parameters (pH, EC, chloride, CEC, Ca/Mg Ratio, ESP, PSA, R1 dispersion).

This limited suite is sufficient to determine reuse potential for rehabilitation of disturbed areas based on assessing the soil acidity, salinity, behaviour and stability. The rationale for the selection of individual analyses is presented in Table 3-1. Identified variants of major SMUs were assessed using a limited laboratory suite which exclude PSA and R1 dispersion.

The laboratory analytical results were used in conjunction with the field assessment results to determine the depth of soil material suitable for stripping and reuse during rehabilitation.

The laboratory results are summarised in Section 4 and detailed in Appendix C.

Table 3-1: Analytical Program and Number of Samples

Test	Number of Samples Tested	Application	Justification
Field pH	339	Indication of possible limitations from pH.	Used for 'on the spot' estimates of possible pH limitations and to confirm the effective soil depth.
pH	90	Nutrient availability, nutrient fixation, toxicities (Al, Mn), liming, sodicity and correlation with other physical, chemical and biological properties.	Measurement of pH is a useful indicator of various soil properties (e.g. values >8.5 usually indicate high exchangeable sodium levels and the presence of carbonates and nutrient availability limitations).
EC	90	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts.	The measure of electrical conductivity is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.
Chloride Content	90	The concentration of chloride is usually an indicator of the severity of potential salinity.	The chloride anion is usually present in soil associated with sodium. It is highly mobile making it a valuable indicator of salt and water movement. It provides additional confirmation of salinity risk.
Bicarb. Extr. P (Colwell)	18	Measurement of the total phosphorus in the soil.	While both acid extractable P (acid extr. P) and Bicarb. extr. P are routinely measured, only Bicarb. extr. P has been used to assess P fertility. Because the Bicarb. extr. P test provides reliable and consistent data across a wide range of pH values from strongly acid to strongly alkaline; it is far more useful than the acid extr. P.
CEC, Exchangeable Cations, Ca/MG ratio, ESP	90	Fertile soils have moderate to high CEC. Infertile soils have low CEC. Nutrient status, calculation of ESP, assessment of other physical and chemical properties, dispersivity, shrink - swell, water movement and aeration.	The amounts and relative proportions of the exchangeable cations in soil have important effects on both physical and chemical properties. High levels of exchangeable sodium cause dispersion and increased swelling, reducing water movement and affecting near surface aeration whereas exchangeable calcium flocculates colloids and will reduce swelling tendencies. Excessively high or low concentrations of one or the other of the cations may impact buffering capacity and as a result, soil nutrient availability.

Test	Number of Samples Tested	Application	Justification
Available Nitrates	18	Presence of nitrogen in an available form for plant uptake.	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Organic Matter	18	Soil organic matter comprises an accumulation of partially disintegrated and decomposed plant and animal residues and other organic compounds synthesised by the soil microbes as the decay occurs. Soil organic matter forms a substantial reserve of potentially mineralisable nitrogen, sulfur and other nutrients.	Testing for soil organic matter provides an indication of the general fertility of soils and thus suitability as a topdressing agent. It also provides information on stored potential nutrients which may not yet be accessible to plants but may become available in the future.
PSA (<2 mm)	63	Nutrient retention, exchange properties, erodibility, doughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil attributes.	Particle size distribution data provides an assessment of the composition of a soil (based on the dominant grain size in a soil). This assists with confirmation of field observations as well as providing better grounds for identification of SMU and water holding capacity.
R1 Dispersion	63	Measurement of the amount of silt and clay that disperses during testing as a percent.	The measure of R1 dispersion is useful when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour.
Selected Metals	18	Detection of heavy metals.	The analysis of copper, zinc, manganese and iron will assess potential natural concentrations of these select heavy metals in the soil as well as any phytotoxicity issues that may exist.
Sulfur	18	Measurement of total sulfur in soil.	Total levels of sulfur help identify whether organic matter or gypsum are present in a profile.

3.3 General Soil Assessment

Major soil characteristics and chemistry in Section 4 were determined against criteria outlined in the tables below.

3.3.1 Soil pH (1:5 soil/water)

Table 3-2 presents the pH ratings used to interpret pH data (Bruce and Rayment, 1982).

Table 3-2: pH 1:5 Soil/Water Ratings

Rating	pH
strongly acidic	<5.5
acidic	5.6-6.5
neutral	6.6-7.5
alkaline	7.6-8.5
strongly alkaline	>8.5

3.3.2 Electrical conductivity (1:5 soil/water)

Table 3-3 presents the EC 1:5 salinity ratings used to assess the significance of laboratory measured EC 1:5 data where clay content was known (Shaw, 1988).

Table 3-3: Electrical Conductivity Ratings

Rating	**EC 1:5** deciSiemens per metre **(dS/m)**			
	10-20 per cent (%) clay	**20-40% clay**	**40-60% clay**	**60-80% clay**
Very low	<0.05	<0.08	<0.12	<0.18
Low	0.05-0.10	0.08-0.17	0.12-0.25	0.18-0.37
Moderate	0.10-0.25	0.17-0.40	0.25-0.58	0.37-0.85
High	0.25-0.45	0.40-0.67	0.58-1.00	0.85-1.5
Very high	0.45-0.70	0.67-1.05	1.00-1.58	1.5-2.4
Extreme	>0.70	>1.05	>1.58	>2.4

3.3.3 Cation exchange capacity

Table 3-4 presents the ratings used to assess CEC levels in the topsoil as a guide to overall fertility status (Landon, 1991).

Table 3-4: Cation Exchange Capacity Ratings

Rating	**CEC/Equivalent CEC (milliequivalent [meq]/100 grams [g] of soil)**
Very low	<5
Low	5-15
Moderate	15-25
High	25-40
Very high	>40

3.3.4 Cation dominance - exchangeable sodium percentage

Table 3-5 presents the ratings used to interpret sodicity levels (Baker and Eldershaw, 1993).

Table 3-5: Exchangeable Sodium Percentage Ratings

Rating	**ESP (%)**
Non-sodic (low)	<6
Sodic (moderate)	6-15
Strongly sodic (high)	15-20
Extremely sodic (very high)	>20

3.3.5 Calcium/magnesium ratio

Table 3-6 presents the ratings used to interpret Ca/Mg ratios (Baker and Eldershaw, 1993). Soils that disperse readily but have low ESP levels often have high levels of Mg relative to the other cations. The ratio of Ca to Mg provides a guide to the relative abundance of the two major cations and is useful when used in conjunction with ESP and R1 ratio for predicting soil physical behaviour.

Table 3-6: Ca:Mg Ratio Ratings

Rating	Ca/Mg Ratio	Comments
Very low	<0.10	Mg is >10 times more dominant than Ca
Low	0.10-0.50	Mg is 5-10 times more dominant than Ca
Moderate	0.51-1.0	Ca and Mg becoming co-dominant
High	1.1-2	Ca more dominant than Mg
Very high	>2	Ca >2 times more dominant than Mg

3.3.6 Dispersion ratio

Table 3-7 presents the ratings used to interpret the R1 ratios (Baker and Eldershaw, 1993). The R1 ratio is a measure of the amount of silt and clay that disperses during testing compared with the total amount of silt and clay present. As such, it is a direct laboratory measure of soil dispersion and is useful when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour

Table 3-7: Dispersion Ratio

Rating	R1 Ratio
Low	<0.6
Moderate	0.6-0.8
High	0.8-0.95
Very high	>0.95

3.3.7 Available phosphorus

Table 3-8 presents Bicarb. extr. P categories presented by Ahern et al. (1994). The ratings were used to assess available Bicarb. extr. P levels.

Table 3-8 Available Phosphorus

Rating	Bicarb extr. P
Very low	<5
Low	6-9
Moderate	10-15
High	16-40
Very high	>40

3.3.8 Potential erosion rate

Potential erosion rates of the topsoil and subsoils has been assessed by reviewing the laboratory data including PSA, EC, ESP, Ca:Mg ratio, R1, soil erodibility k-factor as well as landform factors.

Soil erodibility factor (k-factor) of topsoil was calculated using the soil erodibility nomograph (Foster et al., 1981) which uses the silt and sand percentage, organic matter, soil structure and permeability to calculate a k-factor. The results were interpreted by ratings for K of the Universal Soil Loss Equation (Rosewell and Loch, 2002). Where soil texture laboratory was not available i.e. particle size analysis, k-factor was reviewed using suggested k-factor (Rosewell, 1993).

3.4 Land Suitability and Agricultural Land Assessment

Land suitability is primarily based upon classifications provided within the GALE (DSITI and DNRM, 2015) and Regional Frameworks (DSITI and DNRM, 2013), with reference to the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) for assessing suitability for beef cattle grazing.

ALC are based on a simple hierarchical scheme that is applicable across Queensland. It allows the interpreted land evaluation data to indicate the location and extent of agricultural land that can be used for a wide range of land uses with minimal land degradation.

This evaluation scheme has evolved through various guidelines and state planning policies and is currently referenced in regional shire council planning schemes. ALC assessment guidelines are presented in Section 5.2.

3.5 Regional Planning Interests Assessment

This soils and land suitability assessment has been conducted in accordance with the *Regional Planning Interests Act 2014* (RPI Act) and *Regional Planning Interests Regulation 2014* (RPI Regulation) which identify and protect areas of Queensland that are of regional interest.

The RPI Act protects priority living areas (PLAs), strategic environmental areas (SEAs), PAAs and SCAs.

3.6 Acid Sulfate Soils Assessment

This soils and land suitability assessment includes a review of the Australian Soil Resource Information System (ASRIS), including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken. The Acid Sulfate Soils mapping is classified with a national consistent legend that includes a risk assessment.

4 RESULTS

4.1 Soil Mapping Units

A total of 374 observation sites (82 detailed and 292 check sites), 15 SMUs and 67 Unique Mapping Areas (UMAs) were identified in the study area. The SMUs are presented on Figure 3. As discussed in Section 3.2.3, 17 detailed sites completed for the ODP were also identified in the vicinity of the Project, primarily to the north and east.

The SMUs have been grouped according to basic soil morphology, position in the landscape, and parent material. Individual SMUs have been classified in accordance with *The Australian Soil Classification* (Isbell, 2016). Comparable land systems, as described by Gunn et al. (1967), are also provided in Table 4-1.

Table 4-1: Summary of Identified Soil Mapping Units

SMU	Concept Summary	Land Systems (Gunn et al., 1967)	UMAs	Detailed sites (*Laboratory site)
Winchester South Project				
C1-BL	Moderate to deep black clay soils on flat plains with melon hole microrelief	Humboldt, Connors, Somerby	9	2*, 3, 4, 5, 15, 18, 32, 65
C1-BR	Moderate to deep brown clay soils on flat plains with melon hole microrelief	Monteagle, Humboldt, Girrah, Connors, Somerby	7	7, 8, 9*, 11, 12, 14, 17, 20, 21, 22, 24, 25, 40, 59, 66, 67
C3-BL	Moderate to deep black clay soils on gently undulating plains	Monteagle, Humboldt, Girrah, Somerby	11	28, 29, 44, 48, 51*, 53, 56, 57, 60, 74, 81
C3-BR	Moderate to deep brown clay soils on gently undulating plains	Humboldt, Girrah, Somerby	8	16, 26, 27, 37*, 38, 39, 41, 45, 49, 50, 52, 61, 62, 63, 64
C4	Moderate to deep black clay soils on gently undulating plains with linear microrelief	Girrah	2	33, 34, 35*, 47, 77
C5	Moderate to deep black clay soils on alluvial plains	Humboldt	2	70*, 76
K1	Very shallow sandy loams on wide crests	Humboldt	1	55*
R3	Deep brown sandy to loam soils on flat plains	Humboldt	1	31*
S1	Brown texture contrast loamy soils on gently undulating plains	Monteagle, Humboldt, Connors	9	1*, 19, 30, 58, 79, 80
S3	Texture contrast loams on clays on flat to gently undulating plains	Humboldt, Somerby	7	10*, 13, 23, 71, 72
S4	Deep sandy earths on flat plains	Monteagle, Connors	3	68*, 69
T1-B	Texture contrast brown clay soils on gently undulating plains	Humboldt	3	42*, 43

SMU	Concept Summary	Land Systems (Gunn et al., 1967)	UMAs	Detailed sites (*Laboratory site)
T1-R	Texture contrast brown to red clay soils on wide crests	Girrah	3	36*
T2	Texture contrast massive structure clay soils on gently undulating plains	Humboldt	2	46, 73, 75*, 82
T3	Gradational alkaline silty clay soils on flat plains	Humboldt	4	6*, 54, 78
Olive Downs Project – SMUs adjacent to the northern, southern and eastern boundaries of the study area.				
B1	Black, to brown, grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams	Somerby, Monteagle, Humboldt	-	OD-28
B2	Brown silty loams to light clays with cracking surface on lower flat plains	Somerby, Connors, Humboldt, Blackwater	-	OD-187
S1	Brown shallow to deep duplex loamy sands to clay loam sandy earths	Somerby, Monteagle, Connors, Humboldt, Blackwater	-	OD-15, OD-170, OD-180, OD-181, OD-182, OD-189, OD-190
S2	Brown gradational sands, loamy to clayey sands	Somerby, Monteagle, Connors, Humboldt, Blackwater	-	OD-31, OD-184, OD-188
C2	Grey to brown light to medium clay with normal gilgai microrelief	Somerby, Monteagle, Connors, Humboldt, Blackwater	-	OD-26, OD-34, OD-94, OD-183

4.1.1 C1-BL: Black Vertosol - Moderate to deep black clay soils on flat plains with melon hole microrelief

Overview

The SMU is associated with flat to gently undulating black clay plains with prominent melon hole microrelief. This SMU is predominantly in the south-eastern and south-western areas of the study area. Vegetation typically includes *Eucalyptus cambageana* (Dawson Gum) and Brigalow regrowth.

C1-BL soils in depression positions are firm, with a cracking and crusting surface, featuring uniform dark clays extending 1.0 m below the surface. Soils are dominant black clays with minor interfingering sub-dominant brown clays. Soils associated with mound positions are similar but with higher likelihood of poorer quality subsoils from increased salt, sodium and sodic attributes. This SMU is suitable for light grazing of native pastures.

Soil characteristics and chemistry

The major characteristics from the laboratory data of the mound and depression indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) ranges from neutral in topsoil to acidic in subsoils in mound positions and acidic in topsoil to neutral to alkaline in subsoils in depression positions;
- moderate electrical conductivity in the surface, increases in subsoils to high and very high from 0.2 metres below ground level (mbgl) in the mound position and to high from 0.50 mbgl in the depression position;
- CEC is moderate in the surface and decreases to low in subsoils of mound positions, and low to moderate throughout in depression positions;
- ESP is non-sodic increasing to extremely sodic in subsoils at 0.20 mbgl in mound positions and non-sodic increasing to sodic and extremely sodic in depression positions;
- Ca:Mg ratio is high in topsoil decreasing to low in mound positions and moderate in depression positions;
- R1 dispersion levels are low in topsoil increasing to high in subsoils; and
- the level of extractable phosphorus present is moderate in the mound position and very high in the depression position.

Representative site

Site 2 was selected as a representative site of this SMU for chemical analysis with the mound and depression locations analysed. Particle size analysis was only conducted on the mound position.

A site description summarising mound and depression positions is presented in Table 4-2, with a soil profile morphology summary presented in Table 4-3 and 4-4, for the mound and depression positions, respectively. The soil chemistry results for the mound and depression positions of this SMU are presented in Tables 4-5 and 4-6, respectively. The site profile and laboratory analysis for the mound and depression is presented in Appendix A and C.

Table 4-2: Land Summary SMU C1-BL

Item	Description
Representative site	2
Representative site photograph	
Location GDA94 ZONE 55	638156 mE 7542869 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Dawson Gum and Brigalow regrowth
Disturbance	Semi-disturbed
Landform element /pattern	Flat Plain
Micro relief	Melon hole 40% coverage, 3-10 m wide, 0.3-0.6 m deep
Permeability	Slowly permeable
Drainage	Moderate
Erosion	Nil erosion
Slope (%)	1.0%/<1.0%
Surface coarse fragments	Nil coarse fragments
Surface condition	Firm, cracking

Item	Description
Australian Soil Class (ASC) order (s)	Black Vertosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: Mound position, 118 mm/100 cm. Depression position, 118 mm/100 cm **Identified Physical and/or Chemical Limitation**: Mound position, Chloride 1215 at mg/kg, ESP at 19.8% in sample depth 0.20-0.30 mbgl. Depression position, Chloride 849 at mg/kg, ESP at 20.8% in sample depth 0.50-0.60 mbgl **Estimated effective rooting depth**: Mound position, 0.20 mbgl, depression position, 0.50 mbgl **Estimated soil water storage**: Mound position, 20 mm, depression position, 56 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2
Erosion potential	The assessment included reviewing the laboratory data and landform factors: • Texture: clays • Sodicity / ESP: non-sodic increasing to extremely sodic in subsoils at 0.20 mbgl in mound positions and non-sodic increasing to sodic and extremely sodic in depression positions • Ca:Mg: high in topsoil decreasing to low in mound positions and moderate in depression positions • R1 Dispersion: low levels in topsoil increasing to high in subsoils • K-factor: 0.039, moderate, (Foster et al., 1981) • Landform: flat to gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 4 Erosion potential through dispersion is assessed as low to moderate in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl (mound positions). 0.00-0.30 mbgl (depression positions). **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains. **Recommended subsoil strip depth**: 0.00 mbgl. **Recommended subsoil use**: no rehabilitation stripping recommendations for subsoils. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.
ASS/PASS field assessment	Low field indication of potential acid sulfate soil (PASS). No field indicators of actual acid sulfate soil (AASS).
Total area (ha)	670

Table 4-3: Soil Profile Morphology Summary SMU C1-BL - Mound position

Site 2-m								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.12 Abrupt	Medium clay / Silty clay	Moderate, very firm, subangular <10 mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.05 / 5.5-6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.12-0.50 Abrupt	Medium heavy clay / Medium clay	Moderate, very firm, subangular <20 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0	
B22 0.50-100 End of Borehole (EOBH)	Medium heavy clay / Medium clay	Moderate, very firm, subangular <40 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5	

Table 4-4: Soil Profile Morphology Summary SMU C1-BL – Depression position

Site 2-d								
Horizon Depth (m), Boundary	**Field Texture / Lab Texture[1]**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.13 Abrupt	Medium clay / Silty clay	Weak, very firm, subangular <10 mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.13-0.61 Abrupt	Medium heavy clay / Medium clay	Moderate, very firm, subangular <20 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0	
B22 0.61-1.00 EOBH	Medium heavy clay / Medium clay	Moderate, very firm, subangular 10-30 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5	

1 – Laboratory textures (Particle size analysis) analysed for the mound position.

Table 4-5: Soil Chemistry Results for Representative Site 2 - Mound position

Analysis (Unit)	2-m-0.00-0.10	2-m-0.20-0.30	2-m-0.50-0.60	2-m-0.70-0.80	2-m-0.90-1.00
Soil pH	6.74	6.55	5.81	5.69	5.79
Soil EC (dS/m)	0.345	0.801	1.028	1.057	0.975
Soil Cl (milligrams per kilogram [mg/kg])	275	1215	1480	1555	1453
Exch. Ca (meq/100 g)	9.7	5.09	1.99	1.26	1.62
Exch. Mg (meq/100 g)	9.3	8.32	4.92	3.58	4.34
Exch. K (meq/100 g)	1.3	0.28	<0.12	<0.12	0.13
Exch. Na (meq/100 g)	0.40	3.39	2.65	2.15	2.46
CEC (meq/100 g)	21	17.07	9.66	7.06	8.54
ESP (%Na/CEC)	1.9	19.8	27.4	30.4	28.8
Ca/Mg (ratio)	1.0	0.6	0.4	0.4	0.4
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	81	-	-	-	-
Iron (mg/kg)	30	-	-	-	-
Copper (mg/kg)	1.6	-	-	-	-
Boron (mg/kg)	1.2	-	-	-	-
Silicon (mg/kg)	53	-	-	-	-
Org Matter (%)	4.0	-	-	-	-
Tot Org C (%)	2.3	-	-	-	-
Total N (%)	0.18	-	-	-	-
P (Colwell) (mg/kg)	12	-	-	-	-
Nitrate (mg/kg)	60	-	-	-	-
Total S (%)	244	-	-	-	-
Sulfate-S (mg/kg)	26	-	-	-	-
Air dried moisture content (ADMC) (%)	5	8	9	9	9
Gravel >2 mm (%)	1	3	14	17	15
CS >50 micrometre (µm) (%)	31	24	25	25	26
CS >20 µm (%)	32	31	34	32	33
2-50 µm-Silt (%)	29	29	28	25	29
2-20 µm-Silt (%)	27	22	20	18	22
Clay <2 µm (%)	40	48	46	50	45
Disp. Ratio (R1)	0.33	0.75	0.82	0.75	0.67

A '-' indicates laboratory analysis was not conducted for this sample.

Table 4-6: Soil Chemistry Results for Representative Site 2 – Depression position

Analysis (Unit)	2-d-0.00-0.10	2-d-0.20-0.30	2-d-0.50-0.60	2-d-0.70-0.80	2-d-0.90-1.00
Soil pH	6.44	7.03	7.66	7.57	7.57
Soil EC (dS/m)	0.040	0.363	0.548	0.767	0.869
Soil Cl (mg/kg)	25	633	849	1134	1406
Exch. Ca (meq/100 g)	8.0	7.92	7.71	4.09	4.16
Exch. Mg (meq/100 g)	8.0	7.88	7.10	5.28	5.96
Exch. K (meq/100 g)	0.62	0.23	0.13	0.05	0.07
Exch. Na (meq/100 g)	0.59	2.53	3.93	4.00	4.94
CEC (meq/100 g)	17	18.56	18.87	13.42	15.13
ESP (%Na/CEC)	3.4	13.6	20.8	29.8	32.6
Ca/Mg (ratio)	1.00	1.0	1.1	0.8	0.7
Zinc (mg/kg)	0.93	-	-	-	-
Mn (mg/kg)	57	-	-	-	-
Iron (mg/kg)	76	-	-	-	-
Copper (mg/kg)	2.9	-	-	-	-
Boron (mg/kg)	0.72	-	-	-	-
Silicon (mg/kg)	73	-	-	-	-
Org Matter (%)	2.7	-	-	-	-
Tot Org C (%)	1.6	-	-	-	-
Total N (%)	0.12	-	-	-	-
P (Colwell) (mg/kg)	50	-	-	-	-
Nitrate (mg/kg)	4.5	-	-	-	-
Total S (%)	122	-	-	-	-
Sulfate-S (mg/kg)	3.8	-	-	-	-

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.2 C1-BR: Brown Vertosol - Moderate to deep brown clay soils on flat plains with melon hole microrelief

Overview

The SMU is associated with flat to gently undulating brown clay plains with prominent melon hole microrelief. This SMU is situated in the southern areas of the study area with minor areas also located to the north. Vegetation typically includes Dawson Gum and Brigalow regrowth.

C1-BR soils in depression positions are firm, with a cracking and crusting surface, featuring uniform dark clays extending 1.0 m below the surface. Soils are dominant brown clays with minor interfingering sub-dominant black clays. Soils associated with mound positions are similar but with higher likelihood of poorer quality subsoils from increased salt, sodium and sodic attributes. This SMU is suitable for light grazing of native pastures.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) ranges from neutral in topsoil to strongly alkaline to acidic in subsoils in mound positions and acidic in topsoil to strongly acidic in subsoils in depression positions;
- very low electrical conductivity in the surface, increasing to high and very high from 0.2 mbgl in the mound position and high from 0.70 mbgl in the depression position;
- CEC is moderate in topsoil and decreases to low in subsoils in mound positions and low throughout in depression positions;
- ESP is non-sodic increasing to strongly/extremely sodic in subsoils at 0.20 mbgl in the mound position and sodic to extremely sodic in the depression position;
- Ca:Mg ratio is moderate decreasing to low in subsoils in mound positions and high decreasing to low in depression positions;
- R1 dispersion levels are low in topsoil increasing to high in subsoils; and
- the level of extractable phosphorus present is low in the mound position and high in the depression position.

Representative site

Site 9 was selected as a representative site of this SMU for chemical analysis with the mound and depression locations analysed. Particle size analysis was only conducted on the mound position.

A site description summarising mound and depression positions is presented in Table 4-7, with a soil profile morphology summary presented in Tables 4-8 and 4-9 for the mound and depression positions, respectively. The soil chemistry results for this SMU mound and depression positions are presented in Tables 4-10 and 4-11, respectively. The site profile and laboratory analysis for the mound and depression is presented in Appendix A and C.

Table 4-7: Land Summary SMU C1-BR

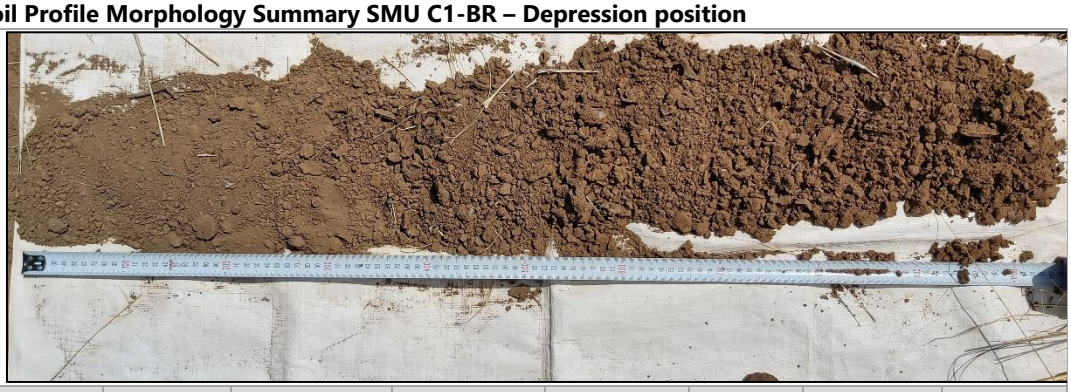
Item	Description
Representative site	9
Representative site photograph	
Location GDA94 ZONE 55	635942 mE 7541225 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Dawson Gum and Brigalow regrowth
Disturbance	Semi-disturbed
Landform element /pattern	Midslope
Micro relief	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep
Permeability	Slowly permeable
Drainage	Moderate
Erosion	Nil erosion
Slope (%)	<2.0%/1.0%
Surface coarse fragments	Nil coarse fragments
Surface condition	Cracking
ASC order (s)	Brown Vertosol

Item	Description
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: Mound position, 118 mm/100 cm. Depression position, 118 mm/100 cm **Identified Physical and/or Chemical Limitation**: Mound position, Chloride 1040 mg/kg, ESP at 18% in sample depth 0.20-0.30 mbgl. Depression position, ESP at 22.6% in sample depth 0.50-0.60 mbgl **Estimated effective rooting depth**: Mound position, 0.20 mbgl. Depression position, 0.50 mbgl **Estimated soil water storage**: Mound position, 20 mm. Depression position, 50 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2
Erosion potential	The assessment included reviewing the laboratory data and landform factors: • Texture: clays • Sodicity / ESP: non-sodic increasing to strongly/extremely sodic in subsoils at 0.20 mbgl in the mound positions and sodic to extremely sodic in the depression positions • Ca:Mg: moderate decreasing to low in subsoils in mound positions and high decreasing to low in depression positions • R1 Dispersion: low levels in topsoil increasing to high in subsoils • K-factor: 0.031, moderate (Foster et al., 1981) • Landform: flat to gently undulating plains • Water Erosion - Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 4 Erosion potential through dispersion is assessed as low to moderate in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl (mound positions), 0.30 mbgl (depression positions). **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains. **Recommended subsoil strip depth**: 0.00 mbgl. **Recommended subsoil use**: no rehabilitation stripping recommendations for subsoils. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.
ASS/PASS field assessment	Low field indication of PASS. No field indicators of AASS.
Total area (ha)	3,189

Table 4-8: Soil Profile Morphology Summary SMU C1-BR - Mound position

Site 9-m								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.09 Abrupt	Light clay / Light medium clay	Weak, firm, subangular <10 mm	<2% manganese nodules	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.09 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.09-0.60 Abrupt	Light medium clay / Medium clay	Weak, firm, subangular <10 mm	<1% manganese nodules	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5	
B22 0.60-1.00 EOBH	Light medium heavy clay / Medium clay	Weak, firm, subangular 10-20 mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5	

Table 4-9: Soil Profile Morphology Summary SMU C1-BR – Depression position

Site 9-d								
Horizon Depth (m), Boundary	**Field Texture/ Lab Texture[1]**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.12 Abrupt	Light clay / Light medium clay	Weak, weak, subangular <10 mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 4.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.12-0.38 Abrupt	Light medium clay / Medium clay	Moderate, weak, subangular <10 mm	<1% manganese nodules	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5 0.60 / 5.5	
B22 0.38-1.00 EOBH	Medium clay / Medium clay	Moderate, firm, subangular 10-20 mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 5.5	

1 – Laboratory textures (Particle size analysis) analysed for the mound position.

Table 4-10: Soil Chemistry Results for Representative Site 9 - Mound position

Analysis (Unit)	9-m-0.00-0.10	9-m-0.20-0.30	9-m-0.50-0.60	9-m-0.70-0.80	9-m-0.90-1.00
Soil pH	7.10	8.63	8.35	7.63	6.22
Soil EC (dS/m)	0.051	0.784	1.067	1.248	1.352
Soil Cl (mg/kg)	45	1040	1480	1710	1875
Exch. Ca (meq/100 g)	7.3	5.22	2.84	2.16	1.16
Exch. Mg (meq/100 g)	8.0	6.60	5.70	5.35	3.02
Exch. K (meq/100 g)	0.33	0.08	0.05	0.07	<0.12
Exch. Na (meq/100 g)	0.64	2.61	3.15	3.02	1.90
CEC (meq/100 g)	16	14.52	11.75	10.61	6.16
ESP (%Na/CEC)	3.9	18.0	26.8	28.5	30.9
Ca/Mg (ratio)	0.91	0.8	0.5	0.4	0.4
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	38	-	-	-	-
Iron (mg/kg)	25	-	-	-	-
Copper (mg/kg)	1.7	-	-	-	-
Boron (mg/kg)	0.89	-	-	-	-
Silicon (mg/kg)	58	-	-	-	-
Org Matter (%)	1.8	-	-	-	-
Tot Org C (%)	1.0	-	-	-	-
Total N (%)	0.08	-	-	-	-
P (Colwell) (mg/kg)	8.2	-	-	-	-
Nitrate (mg/kg)	3.5	-	-	-	-
Total S (%)	75	-	-	-	-
Sulfate-S (mg/kg)	3.3	-	-	-	-
ADMC (%)	4	8	8	10	10
Gravel >2 mm (%)	3	4	6	6	4
CS >50 µm (%)	29	27	28	20	22
CS >20 µm (%)	44	33	36	27	31
2-50 µm-Silt (%)	29	26	23	31	29
2-20 µm-Silt (%)	13	19	14	24	20
Clay <2 µm (%)	43	48	49	49	49
Disp. Ratio (R1)	0.39	0.62	0.82	0.74	0.80

A '-' indicates laboratory analysis was not conducted for this sample.

Table 4-11: Soil Chemistry Results for Representative Site 9 - Depression position

Analysis (Unit)	9-m-0.00-0.10	9-m-0.20-0.30	9-m-0.50-0.60	9-m-0.70-0.80	9-m-0.90-1.00
Soil pH	5.51	5.99	5.33	5.03	4.93
Soil EC (dS/m)	0.023	0.038	0.288	0.644	0.881
Soil Cl (mg/kg)	5.2	20	472	1084	1422
Exch. Ca (meq/100 g)	5.0	5.56	4.14	1.95	1.13
Exch. Mg (meq/100 g)	3.8	4.86	5.91	4.53	3.14
Exch. K (meq/100 g)	0.62	0.26	0.20	<0.12	<0.12
Exch. Na (meq/100 g)	0.30	1.06	2.99	2.66	2.36
CEC (meq/100 g)	11	11.74	13.25	9.24	6.71
ESP (%Na/CEC)	2.6	9.0	22.6	28.8	35.2
Ca/Mg (ratio)	1.3	1.1	0.7	0.4	0.4
Zinc (mg/kg)	2.3	-	-	-	-
Mn (mg/kg)	86	-	-	-	-
Iron (mg/kg)	206	-	-	-	-
Copper (mg/kg)	3.8	-	-	-	-
Boron (mg/kg)	0.72	-	-	-	-
Silicon (mg/kg)	62	-	-	-	-
Org Matter (%)	2.9	-	-	-	-
Tot Org C (%)	1.6	-	-	-	-
Total N (%)	0.13	-	-	-	-
P (Colwell) (mg/kg)	40	-	-	-	-
Nitrate (mg/kg)	1.8	-	-	-	-
Total S (%)	92	-	-	-	-
Sulfate-S (mg/kg)	6.4	-	-	-	-

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.3 C3-BL: Black Vertosol - Moderate to deep black clay soils on gently undulating plains

Overview

The SMU is associated with gently undulating black clay plains. This SMU is situated across the study area. Vegetation typically includes exotic grassland, with patches of remnant and regrowth eucalypt, Brigalow woodland, and native grassland.

C3-BL soils are firm, with a cracking surface, featuring uniform dark clays with unmappable, very minor microrelief observed extending 1.0 m below the surface. Soils are dominant black clays with minor interfingering sub-dominant brown clays. Soils have dispersive attributes in subsoils with minor salinity attributes increasing with depth. This SMU is suitable for a wide range of current and potential broadacre and horticultural crops.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) is alkaline in topsoil to strongly alkaline in subsoils;
- low electrical conductivity in the surface, increasing to high throughout the soil profile;
- CEC is high in the surface and very high in subsoils;
- ESP is non-sodic increasing to moderately sodic in subsoils at 0.50 mbgl;
- Ca:Mg ratio is very high decreasing to high in subsoils;
- R1 dispersion levels are low throughout; and
- the level of extractable phosphorus present is low.

Representative site

Site 51 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-12, with a soil profile morphology summary presented in Table 4-13. The soil chemistry results for this SMU are presented in Table 4-14.

Table 4-12: Land Summary SMU C3-BL

Item	Description
Representative site	51
Representative site photograph	
Location GDA94 ZONE 55	633162 mE 7547605 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Native grassland
Disturbance	Semi-/Extensive disturbed
Landform element /pattern	Simple / mid slope
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately well drained
Erosion	Nil erosion
Slope (%)	1.0%-2.0%
Surface coarse fragments	White nodules <1%
Surface condition	Firm, cracking
ASC order (s)	Black Vertosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 114 mm/100 cm **Identified Physical and/or Chemical Limitation**: Sodicity increasing at 0.60 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 114 mm **Land Suitability (Cropping) Class**: 3 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: A1

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: clays • Sodicity / ESP: non-sodic increasing to moderately sodic in subsoils at 0.50 mbgl • Ca:Mg: very high decreasing to high in subsoils; • R1 Dispersion: low levels throughout • K-factor: 0.025, moderate (Foster et al., 1981) • Landform: flat to gently undulating plains • Water Erosion - Topsoil (Regional Frameworks): 2 • Erosion Hazard - Subsoils (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low to moderate in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species. **Recommended subsoil strip depth**: 0.00 mbgl **Recommended subsoil use**: no rehabilitation stripping recommendations for subsoils. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.
ASS/PASS field assessment	No field indication of AASS/PASS.
Total area (ha)	3,870

Table 4-13: Soil Profile Morphology Summary SMU C3-BL

Site 51								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.12 Abrupt	Light clay / Light clay	Weak, very firm, sub-rounded peds <10 mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.12-0. 80 Abrupt	Light medium clay / Light to Medium clay	Moderate, very firm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well to moderately drained	Few	0.30 / 7.0 0.60 / 7.0	
B22 0.80-1.00 EOBH	Light medium clay / Medium clay	Moderate, very firm	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0	

Table 4-14: Soil Chemistry Results for Representative Site 51

Analysis (Unit)	51-0.00-0.10	51-0.20-0.30	51-0.50-0.60	51-0.70-0.80	51-0.90-1.00
Soil pH	8.42	9.02	9.05	8.94	8.86
Soil EC (dS/m)	0.117	0.167	0.406	0.635	0.835
Soil Cl (mg/kg)	25	99	313	574	770
Exch. Ca (meq/100 g)	28.14	26.70	21.10	20.19	19.32
Exch. Mg (meq/100 g)	6.41	13.11	16.14	17.35	17.66
Exch. K (meq/100 g)	1.01	0.20	0.17	0.17	0.20
Exch. Na (meq/100 g)	0.14	1.75	4.23	5.55	6.06
CEC (meq/100 g)	35.7	41.76	41.64	43.26	43.24
ESP (%Na/CEC)	0.4	4.2	10.2	12.8	14.0
Ca/Mg (ratio)	4.4	2.0	1.3	1.2	1.1
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	6.5	-	-	-	-
Iron (mg/kg)	12	-	-	-	-
Copper (mg/kg)	0.67	-	-	-	-
Boron (mg/kg)	0.32	-	-	-	-
Silicon (mg/kg)	18	-	-	-	-
Org Matter (%)	4.6	-	-	-	-
Tot Org C (%)	2.6	-	-	-	-
Total N (%)	0.17	-	-	-	-
P (Colwell) (mg/kg)	6.9	-	-	-	-
Nitrate (mg/kg)	5.0	-	-	-	-
Total S (%)	199	-	-	-	-
Sulfate-S (mg/kg)	5.9	-	-	-	-
ADMC (%)	9	12.5	14.9	14.4	14.3
Gravel >2 mm (%)	7	2.4	4.2	3.8	36.2
CS >50 µm (%)	33	40	35	34	29
CS >20 µm (%)	46	45	39	40	32
2-50 µm-Silt (%)	26	18	17	17	21
2-20 µm-Silt (%)	13	13	14	10	17
Clay <2 µm (%)	41	42	47	50	51
Disp. Ratio (R1)	0.27	0.39	0.44	0.49	0.51

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.4 C3-BR: Brown Vertosol - Moderate to deep brown clay soils on gently undulating plains

Overview

The SMU is associated with gently undulating brown clay plains. This SMU is situated across the study area with the majority located in the centre, north, and the south. Vegetation typically includes exotic grassland, with patches of remnant and regrowth Dawson Gum and Brigalow.

C3-BR soils are soft with a cracking surface, featuring uniform dark clays with unmappable, very minor microrelief observed extending 1.0 m below the surface. Soils are dominant brown clays with minor interfingering sub-dominant black clays. Soils have dispersive and salinity attributes in subsoils increasing with depth. This SMU is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) is neutral in topsoil to strongly alkaline in subsoils;
- very low electrical conductivity in the surface, increasing to very high in subsoils;
- CEC is moderate in the surface and high in subsoils;
- ESP is non-sodic increasing from moderately sodic to strongly sodic in subsoils from 0.50 mbgl;
- Ca:Mg ratio is very high decreasing to moderate in subsoils;
- R1 dispersion levels are low in topsoil and vary from low to moderate in subsoils; and
- the level of extractable phosphorus present is low.

Representative site

Site 37 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-15, with a soil profile morphology summary presented in Table 4-16. The soil chemistry results for this SMU are presented in Table 4-17. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-15: Land Summary SMU C3-BR

Item	Description
Representative site	37
Representative site photograph	
Location GDA94 ZONE 55	630899 mE 7545564 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Semi-disturbed
Landform element /pattern	Lower slope
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately well drained
Erosion	Nil erosion
Slope (%)	2.0%
Surface coarse fragments	Nil
Surface condition	Soft, cracking with crust
ASC order (s)	Brown Vertosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 96 mm/100 cm **Identified Physical and/or Chemical Limitation**: ESP at 17%, in sample depth 0.70-0.80 mbgl **Estimated effective rooting depth**: 0.70 mbgl **Estimated soil water storage**: 66 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors: • Texture: clays • Sodicity / ESP: non-sodic increasing from moderately sodic to strongly sodic in subsoils from 0.50 mbgl • Ca:Mg: very high decreasing to moderate in subsoils • R1 Dispersion: low levels in topsoil and vary from low to moderate in subsoils • K-factor: 0.028, moderate (Foster et al., 1981) • Landform: flat to gently undulating plains • Water Erosion - Topsoil (Regional Frameworks): 2 • Erosion Hazard - Subsoils (Regional Frameworks): 4 Erosion potential through dispersion is assessed as low in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species. **Recommended subsoil strip depth**: 0.00 mbgl **Recommended subsoil use**: no rehabilitation stripping recommendations for subsoils. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	3,219

Table 4-16: Soil Profile Morphology Summary SMU C3-BR

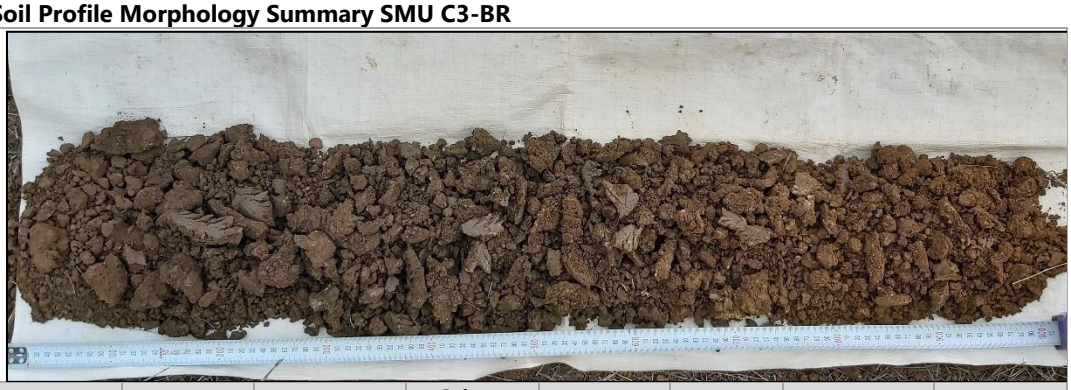
Site 37								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.10 Abrupt	Light clay / Clay loam	Weak, firm, subangular peds <20 mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 8.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.10-0.63 Gradual	Light medium clay / Light medium to medium clay	Moderate, firm, angular peds 20-40 mm, slickensides	<2% calcium carbonate <1% <2 mm coarse fragments	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 7.0 0.55 / 7.0	
B22 0.63-1.00 EOBH	Light medium clay / Medium to light medium clay	Moderate, firm, angular peds 20-40 mm, slickensides	Nil	10YR5/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Very few	0.90 / 7.0	

Table 4-17: Soil Chemistry Results for Representative Site 37

Analysis (Unit)	37-0.00-0.10	37-0.20-0.30	37-0.50-0.60	37-0.70-0.80	37-0.90-1.00
Soil pH	7.32	8.78	8.92	8.86	8.77
Soil EC (dS/m)	0.049	0.191	0.515	0.845	1.082
Soil Cl (mg/kg)	11	120	443	966	1105
Exch. Ca (meq/100 g)	15.25	17.17	12.71	10.70	10.49
Exch. Mg (meq/100 g)	4.52	7.78	10.54	10.92	11.49
Exch. K (meq/100 g)	0.90	0.24	0.16	0.30	0.19
Exch. Na (meq/100 g)	0.15	1.26	3.59	4.48	4.60
CEC (meq/100 g)	20.8	26.44	27.00	26.41	26.76
ESP (%Na/CEC)	0.7	4.8	13.3	17.0	17.2
Ca/Mg (ratio)	3.4	2.2	1.2	1.0	0.9
Zinc (mg/kg)	1.4	-	-	-	-
Mn (mg/kg)	30	-	-	-	-
Iron (mg/kg)	17	-	-	-	-
Copper (mg/kg)	1.7	-	-	-	-
Boron (mg/kg)	0.49	-	-	-	-
Silicon (mg/kg)	47	-	-	-	-
Org Matter (%)	3.8	-	-	-	-
Tot Org C (%)	2.2	-	-	-	-
Total N (%)	0.16	-	-	-	-
P (Colwell) (mg/kg)	6.2	-	-	-	-
Nitrate (mg/kg)	8.1	-	-	-	-
Total S (%)	172	-	-	-	-
Sulfate-S (mg/kg)	5.3	-	-	-	-
ADMC (%)	5	12	13	13	12.9
Gravel >2 mm (%)	2	8	4	2	0.9
CS >50 µm (%)	28	35	33	33	28
CS >20 µm (%)	44	42	36	36	35
2-50 µm-Silt (%)	36	20	21	21	27
2-20 µm-Silt (%)	20	13	18	17	20
Clay <2 µm (%)	35	45	46	47	45
Disp. Ratio (R1)	0.31	0.51	0.59	0.62	0.60

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.5 C4: Black Vertosol - Moderate to deep black clay soils on gently undulating plains with linear microrelief

Overview

The SMU is associated with gently undulating clay plains with linear microrelief present. This SMU is situated in the north-western and western portion of the study area. Vegetation typically includes remnant eucalypt woodland and native grassland, with patches of exotic grassland.

C4 soils are soft with a cracking surface, featuring uniform dark clays extending 1.0 m below the surface. Soils have dispersive and salinity attributes in subsoils increasing with depth. This SMU is suitable for a wide range of current and potential broadacre and horticultural crops.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) is neutral in topsoil to alkaline in subsoils in mound positions and alkaline in topsoil, varying from alkaline to strongly alkaline in subsoils, in depression positions;
- very low electrical conductivity in topsoil, increasing to high in subsoils in mound positions and extreme in topsoil to low in subsoils in depression positions;
- CEC is high in topsoil and varies between high and very high in subsoils for mound and depression positions;
- ESP is non-sodic increasing to sodic in subsoils from 0.50 mbgl for mound positions and varying between non-sodic to sodic for depression positions;
- Ca:Mg ratio is very high in topsoil decreasing to high in subsoils for mound positions and very high throughout for depression positions;
- R1 dispersion levels are low throughout; and
- the level of extractable phosphorus present is low in the mound position and very low in the depression.

Representative site

Site 35, mound position was selected as a representative site of this SMU for chemical analysis with the mound and depression locations analysed. Particle size analysis was only conducted on the mound position.

A site description summarising mound and depression positions is presented in Table 4-18, with a soil profile morphology summary presented in Tables 4-19 and 4-20, for the mound and depression positions, respectively. The soil chemistry results for this SMU mound and depression positions are presented in Tables 4-21 and 4-22, respectively. The site profile and laboratory analysis for the mound and depression is presented in Appendix A and C.

Table 4-18: Land Summary SMU C4

Item	Description
Representative site	35
Representative site photograph	
Location GDA94 ZONE 55	623121 mE 7550243 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Native grassland
Disturbance	Extensive disturbance
Landform element /pattern	Simple slope
Micro relief	Linear gilgai, 0.2 m deep, 40% coverage
Permeability	Slowly permeable
Drainage	Imperfectly drained
Erosion	Nil erosion
Slope (%)	2.0%/3.0%
Surface coarse fragments	Nil
Surface condition	Soft, cracking
ASC order (s)	Black Vertosol

Item	Description
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 120 mm/100 cm **Identified Physical and/or Chemical Limitation**: Mound Position, Chloride 1381 at mg/kg, in sample depth 1.10-1.20 mbgl. Depression position, Chloride 939 at mg/kg, in sample depth 1.10-1.20 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 120 mm **Land Suitability (Cropping) Class**: 3 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: A1
Erosion potential	The assessment included reviewing the laboratory data and landform factors: • Texture: clays • Sodicity / ESP: non-sodic increasing to sodic in subsoils from 0.50 mbgl for mound positions and varying between non-sodic to sodic for depression positions • Ca:Mg: very high in topsoil decreasing to high in subsoils for mound positions and very high throughout for depression positions • R1 Dispersion: low levels throughout • K-factor: 0.026, moderate (Foster et al., 1981) • Landform: flat to gently undulating plains • Water Erosion - Topsoil (Regional Frameworks): 3 • Erosion Hazard – Subsoils (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low to moderate in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl (mound position), 0.00-0.30 mbgl (depression position) **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species **Recommended subsoil strip depth**: 0.30-1.10 mbgl (mound position), 0.30-1.10 mbgl (depression position) **Recommended subsoil use**: Buried supporting subsoils for topsoil placement. Potential reuse as capping for waste rock due to limitations from 0.80 to 1.00 mbgl.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	430

Table 4-19: Soil Profile Morphology Summary SMU C4 - Mound position

Site 35 -m	

Horizon Depth (m), Boundary	Field / Lab Texture	Structure Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture Drainage	Roots	Depth (m) / Field pH	Samples (m)
A1 0.00-0.10 Abrupt	Light clay / Medium clay	Weak, moderate, sub-rounded peds <20 mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50
B21 0.10-0.42 Abrupt	Light medium clay / Medium to medium heavy clay	Moderate, firm, sub-angular peds <20 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Common	0.30 / 6.5	
B22 0.42-0.60 Clear	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 6.5	
B23 0.60-1.25 Gradual	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	<2% calcium carbonate	2.5YR3/2 Dusky red Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.5	
B24 1.25-1.50 EOBH	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	Nil	7.5YR4.3 Brown 20% light brown mottle / Nil bleaching	Dry, imperfectly drained	Nil	1.30 / 6.5	

Table 4-20: Soil Profile Morphology Summary SMU C4 - Depression position

Site 35 -d								
Horizon Depth (m), Boundary	**Field / Lab Texture [1]**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.10 Abrupt	Light clay / Medium clay	Weak, moderate, sub-rounded peds <20 mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50
B21 0.10-0.50 Abrupt	Light medium clay / Medium to medium heavy clay	Moderate, firm, sub-angular peds <20 mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Common	0.30 / 6.0	
B22 0.50-0.65 Clear	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 6.5	
B23 0.65-1.30 Gradual	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	<2% calcium carbonate	2.5YR3/2 Dusky red Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.5	
B24 1.30-1.50 EOBH	Medium clay / Medium heavy clay	Moderate, firm, sub-angular peds <20 mm	<2% calcium carbonate	7.5YR4.3 Brown 20% light brown mottle Nil bleaching	Dry, imperfectly drained	Nil	1.30 / 6.5	

1 – Laboratory textures (Particle size analysis) analysed for the mound position.

Table 4-21: Soil Chemistry Results for Representative Site 35 - Mound position

Analysis (Unit)	35-m-0.00-0.10	35-m-0.20-0.30	35-m-0.50-0.60	35-m-0.70-0.80	35-m-1.10-1.20	35-m-1.40-1.50
Soil pH	7.39	8.43	8.46	8.49	8.33	8.32
Soil EC (dS/m)	0.059	0.139	0.266	0.604	1.013	0.981
Soil Cl (mg/kg)	23	20	210	618	1381	941
Exch. Ca (meq/100 g)	23.80	29.07	24.07	26.70	23.54	20.62
Exch. Mg (meq/100 g)	9.56	11.62	11.07	12.43	12.43	10.84
Exch. K (meq/100 g)	0.80	0.46	0.30	0.27	0.35	0.39
Exch. Na (meq/100 g)	0.22	1.70	2.45	3.94	4.29	3.61
CEC (meq/100 g)	34.4	42.86	37.89	43.35	40.62	35.46
ESP (%Na/CEC)	0.6	4.0	6.5	9.1	10.6	10.2
Ca/Mg (ratio)	2.5	2.5	2.2	2.1	1.9	1.9
Zinc (mg/kg)	<0.5	-	-	-	-	-
Mn (mg/kg)	26	-	-	-	-	-
Iron (mg/kg)	15	-	-	-	-	-
Copper (mg/kg)	1.6	-	-	-	-	-
Boron (mg/kg)	0.44	-	-	-	-	-
Silicon (mg/kg)	41	-	-	-	-	-
Org Matter (%)	2.7	-	-	-	-	-
Tot Org C (%)	1.6	-	-	-	-	-
Total N (%)	0.11	-	-	-	-	-
P (Colwell) (mg/kg)	5.6	-	-	-	-	-
Nitrate (mg/kg)	8.9	-	-	-	-	-
Total S (%)	145	-	-	-	-	-
Sulfate-S (mg/kg)	3.8	-	-	-	-	-
ADMC (%)	6	12	13	14	16	15
Gravel >2 mm (%)	2	9	13	4	12	9
CS >50 µm (%)	18	26	18	22	16	20
CS >20 µm (%)	23	30	24	26	19	25
2-50 µm-Silt (%)	29	18	23	20	22	23
2-20 µm-Silt (%)	24	15	17	16	18	18
Clay <2 µm (%)	53	55	59	58	62	57
Disp. Ratio (R1)	0.28	0.38	0.44	0.45	0.41	0.42

A '-' indicates laboratory analysis was not conducted for this sample.

Table 4-22: Soil Chemistry Results for Representative Site 35 - Depression position

Analysis (Unit)	35-d-0.00-0.10	35-d-0.20-0.30	35-d-0.50-0.60	35-d-0.80-0.90	35-d-1.10-1.20	35-d-1.40-1.50
Soil pH	8.12	8.69	8.66	8.50	8.31	7.75
Soil EC (dS/m)	0.141	0.184	0.426	0.578	0.928	3.238
Soil Cl (mg/kg)	46	125	354	572	939	1131
Exch. Ca (meq/100 g)	27.42	25.02	22.87	25.98	23.11	26.22
Exch. Mg (meq/100 g)	8.72	9.93	10.50	11.34	11.60	9.90
Exch. K (meq/100 g)	0.80	0.30	0.30	0.38	0.41	0.39
Exch. Na (meq/100 g)	0.48	1.67	2.97	3.18	3.80	1.80
CEC (meq/100 g)	37.4	36.93	36.64	40.88	38.92	38.30
ESP (%Na/CEC)	1.3	4.5	8.1	7.8	9.8	4.7
Ca/Mg (ratio)	3.1	2.5	2.2	2.3	2.0	2.6
Zinc (mg/kg)	<0.5	-	-	-	-	-
Mn (mg/kg)	9.4	-	-	-	-	-
Iron (mg/kg)	13	-	-	-	-	-
Copper (mg/kg)	1.4	-	-	-	-	-
Boron (mg/kg)	0.53	-	-	-	-	-
Silicon (mg/kg)	20	-	-	-	-	-
Org Matter (%)	2.3	-	-	-	-	-
Tot Org C (%)	1.3	-	-	-	-	-
Total N (%)	0.08	-	-	-	-	-
P (Colwell) (mg/kg)	3.0	-	-	-	-	-
Nitrate (mg/kg)	32	-	-	-	-	-
Total S (%)	114	-	-	-	-	-
Sulfate-S (mg/kg)	7.2	-	-	-	-	-

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.6 C5: Black Vertosol - Moderate to deep black clay soils on alluvial plains

Overview

This minor SMU, potential variant to C3-BL, is associated with flat to gently undulating alluvial plains. This SMU comprises two UMAs located in the north-eastern and south-western portion of the study area. Vegetation consists of exotic grassland, with patches of eucalypt woodland.

C5 soils feature cracking uniform dark clays with calcium carbonate extending to 1.0 m below the surface. The SMU has limitations with dispersive attributes in subsoils at 0.90 mbgl. This SMU is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform clay textures;
- pH (laboratory analysis) is alkaline in topsoil to strongly alkaline in subsoils;
- very low electrical conductivity in topsoil, increasing to moderate in subsoils;
- CEC is high throughout;
- ESP is non-sodic increasing to sodic in subsoils from 0.90 mbgl;
- Ca:Mg ratio is very high throughout; and
- extractable phosphorus present is very low.

Representative site

Site 70, mound position was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-23, with a soil profile morphology summary presented in Table 4-24. The soil chemistry results for this SMU are presented in Table 4-25. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-23: Land Summary SMU C5

Item	Description
Representative site	70
Representative site photograph	
Location GDA94 ZONE 55	630784 mE 7552235 MN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Extensive disturbance
Landform element /pattern	Alluvial plain, flat wide depression
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Imperfectly drained
Erosion	Nil
Slope (%)	-
Surface coarse fragments	Nil
Surface condition	Cracking with crust
ASC order (s)	Black Vertosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 114 mm/100 cm **Identified Physical and/or Chemical Limitation**: Marginal dispersive attributes below 0.80 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 114 mm **Land Suitability (Cropping) Class**: 4 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: clays • Sodicity / ESP: non-sodic increasing to sodic in subsoils from 0.90 mbgl • Ca:Mg: very high throughout • K-factor: 0.015, low (Rosewell,1993) • Landform: flat to gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00 – 0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species. **Recommended subsoil strip depth**: 0.10 – 0.80 mbgl **Recommended subsoil use**: buried supporting subsoils for topsoil placement. Potential reuse as capping for waste rock due to limitations from 0.80 to 1.00 mbgl.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	141

Table 4-24: Soil Profile Morphology Summary SMU C5

Site 70								
Horizon Depth (m), Boundary	**Field / Lab Texture[1]**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.12 Abrupt	Medium clay / Light clay	Moderate, firm, subangular <20 mm	1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.12-0.88 Abrupt	Medium clay / Light to Medium clay	Moderate, firm, subangular 20-40 mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5	
B22 0.88-1.00 EOBH	Medium clay / Medium clay	Moderate, very firm, subangular 20-40 mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate to imperfect	Nil	0.90 / 7.5	

1 – Laboratory textures (Particle size analysis) analysed for SMU C3-BL. SMU C5 may be seen as a variant of C3-BL.

Table 4-25: Soil Chemistry Results for Representative Site 70

Analysis (Unit)	70-0.00-0.10	70-0.20-0.30	70-0.50-0.60	70-0.70-0.80	70-0.90-1.00
Soil pH	7.54	8.65	8.63	8.57	8.62
Soil EC (dS/m)	0.065	0.136	0.266	0.333	0.359
Soil Cl (mg/kg)	32	74	244	340	394
Exch. Ca (meq/100 g)	20.69	22.39	20.26	20.07	18.87
Exch. Mg (meq/100 g)	7.55	8.46	9.18	9.40	9.22
Exch. K (meq/100 g)	0.23	0.05	0.02	0.01	0.01
Exch. Na (meq/100 g)	0.39	0.78	1.33	1.41	3.75
CEC (meq/100 g)	28.9	31.67	30.79	30.89	31.84
ESP (%Na/CEC)	1.4	2.4	4.3	4.6	11.8
Ca/Mg (ratio)	2.7	2.6	2.2	2.1	2.0
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	10	-	-	-	-
Iron (mg/kg)	11	-	-	-	-
Copper (mg/kg)	0.83	-	-	-	-
Boron (mg/kg)	0.36	-	-	-	-
Silicon (mg/kg)	56	-	-	-	-
Org Matter (%)	2.7	-	-	-	-
Tot Org C (%)	1.6	-	-	-	-
Total N (%)	0.08	-	-	-	-
P (Colwell) (mg/kg)	4.6	-	-	-	-
Nitrate (mg/kg)	3.2	-	-	-	-
Total S (%)	<50	-	-	-	-
Sulfate-S (mg/kg)	3.9	-	-	-	-

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.7 K1: Very shallow Brown Tenosol – Very shallow sandy loams on wide crests

Overview

The SMU is associated with very shallow sandy loam soils with exotic grasslands. This SMU is the located on a wide crest landform between clay soils in the centre north of the study area.

K1 sandy loam soils are firm with coarse fragments and extend to approximately 0.10 mbgl. The SMU's major limitation is the very shallow soil profile. This SMU is suitable for light grazing of native pastures.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- very shallow sandy loams;
- pH (laboratory analysis) is acidic;
- very low electrical conductivity;
- CEC is low;
- ESP is non-sodic;
- Ca:Mg ratio is very high;
- R1 dispersion is low; and
- the level of extractable phosphorus present is low.

Representative site

Site 55 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-26, with a soil profile morphology summary presented in Table 4-27. The soil chemistry results for this SMU are presented in Table 4-28. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-26: Land Summary SMU K1

Item	Description
Representative site	55
Representative site photograph	
Location GDA94 ZONE 55	630779 mE 7550077 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Semi-disturbed
Landform element /pattern	Wide crest upper slope, 1-2%
Micro relief	Nil
Permeability	Highly permeable
Drainage	Rapid
Erosion	Nil erosion
Slope (%)	1.0%/2.0%
Surface coarse fragments	2% coarse fragments <10 mm
Surface condition	Firm
ASC order (s)	Very shallow Brown Tenosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 6 mm/100 cm **Identified Physical and/or Chemical Limitation**: Soil depth at 0.11 mbgl **Estimated effective rooting depth**: 0.10 mbgl **Estimated soil water storage**: 6 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: very shallow sandy loam • Sodicity / ESP: non-sodic • Ca:Mg: very high • R1 Dispersion: low levels • K-factor: 0.021, moderate (Foster et al., 1981) • Landform: wide crest areas • Water Erosion – Topsoil (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low to moderate. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains. **Recommended subsoil strip depth**: 0.00 mbgl **Recommended subsoil use**: nil subsoil encountered.
ASS/PASS	Low field indication of PASS. No field indicators of AASS.
Total area (ha)	16

Table 4-27: Soil Profile Morphology Summary SMU K1

Site 55									
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**	**Observations**
A1 0.00-0.11 EOBH	Sandy loam / Loam	Massive, loose	40% <10 mm coarse fragments 10% 10-20 mm coarse fragments	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.05 / 6.5	0.00-0.10	Auger refusal at 0.11 m, 5 attempts in the area

Table 4-28: Soil Chemistry Results for Representative Site 55

Analysis (Unit)	55-0.00-0.10
Soil pH	5.92
Soil EC (dS/m)	0.030
Soil Cl (mg/kg)	12
Exch. Ca (meq/100 g)	5.3
Exch. Mg (meq/100 g)	2.1
Exch. K (meq/100 g)	0.54
Exch. Na (meq/100 g)	0.23
CEC (meq/100 g)	8.3
ESP (%Na/CEC)	2.8
Ca/Mg (ratio)	2.5
Zinc (mg/kg)	<0.5
Mn (mg/kg)	35
Iron (mg/kg)	50
Copper (mg/kg)	1.1
Boron (mg/kg)	0.30
Silicon (mg/kg)	48
Org Matter (%)	2.5
Tot Org C (%)	1.4
Total N (%)	0.10
P (Colwell) (mg/kg)	9.2
Nitrate (mg/kg)	4.8
Total S (%)	95
Sulfate-S (mg/kg)	4.5
ADMC (%)	3
Gravel >2 mm (%)	13
CS >50 µm (%)	52
CS >20 µm (%)	64
2-50 µm-Silt (%)	33
2-20 µm-Silt (%)	21
Clay <2 µm (%)	15
Disp. Ratio (R1)	0.54

4.1.8 R3: Red Kandosol – Deep brown sandy to loam soils on flat plains

Overview

The SMU is associated with a flat plain and includes exotic grasslands. This SMU is situated in one UMA located in the eastern portion of the study area.

R3 soils are firm, no coarse fragments and extend to 1.0 m below the surface. The soil has limited plant available water capacity (PAWC) and is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast soils of loamy sands to sandy clay loams;
- pH (laboratory analysis) is acidic throughout;
- very low electrical conductivity throughout;
- CEC is very low throughout;
- ESP is non-sodic throughout;
- Ca:Mg ratio is very high in topsoil decreasing to high in subsoils;
- R1 dispersion levels are low throughout; and
- extractable phosphorus present is low.

Representative site

Site 31 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-29, with a soil profile morphology summary presented in Table 4-30. The soil chemistry results for this SMU are presented in Table 4-31. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-29: Land Summary SMU R3

Item	Description
Representative site	31
Representative site photograph	
Location GDA94 ZONE 55	638792 mE 7543714 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Semi-disturbed
Landform element /pattern	Flat plain
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Well drained
Erosion	Nil erosion
Slope (%)	<1.0%/1.0%
Surface coarse fragments	Nil coarse fragments
Surface condition	Firm
ASC order (s)	Red Kandosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 53 mm/100 cm **Identified Physical and/or Chemical Limitation**: None identified **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 53 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: loamy sands to sandy clay loams • Sodicity / ESP: non-sodic • Ca:Mg: Very high in topsoil decreasing to high in subsoils • R1 Dispersion: low levels throughout • K-factor: 0.018, low (Foster et al., 1981) • Landform: flat plains • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil and subsoils.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.10 -1.00 mbgl **Recommended subsoil use**: support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species, on level plains. Buried supporting subsoils for topsoil placement. Subsoils may be stripped in two stages, 0.10-0.40 mbgl may be placed on level plains to 3% sloped areas. Subsoil 0.40-1.00 mbgl may be placed on sloped areas, greater than 3%.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	9

Table 4-30: Soil Profile Morphology Summary SMU R3

Site 31								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A11 0.00-0.12 Abrupt	Loamy sand / Loamy sand	Massive, loose	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, Rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
B21 0.12-0.45 Abrupt	Sandy loam / Sandy loam	Massive, loose	Nil	5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, Well	Few	0.30 / 6.0	
B22 0.45-1.00 EOBH	Sandy clay loam / Sandy loam to loam	Massive, minor weak structure, loose	Nil	2.5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, Well	Nil	0.60 / 6.0 0.90 / 6.0	

Table 4-31: Soil Chemistry Results for Representative Site 31

Analysis (Unit)	31-0.00-0.10	31-0.20-0.30	31-0.50-0.60	31-0.70-0.80	31-0.90-1.00
Soil pH	6.51	6.56	6.48	6.42	6.47
Soil EC (dS/m)	0.022	0.013	0.017	0.016	0.009
Soil Cl (mg/kg)	5.5	11	16	5.0	5.5
Exch. Ca (meq/100g)	2.3	1.99	1.94	1.98	1.86
Exch. Mg (meq/100g)	0.93	0.73	0.92	1.24	1.38
Exch. K (meq/100g)	0.45	0.36	0.27	0.22	0.18
Exch. Na (meq/100g)	<0.065	<0.065	<0.065	<0.065	<0.065
CEC (meq/100g)	3.7	3.11	3.19	3.48	3.44
ESP (%Na/CEC)	0.9	1.2	1.4	1.0	0.8
Ca/Mg (ratio)	2.5	2.7	2.1	1.6	1.3
Zinc (mg/kg)	1.1	-	-	-	-
Mn (mg/kg)	45	-	-	-	-
Iron (mg/kg)	23	-	-	-	-
Copper (mg/kg)	0.46	-	-	-	-
Boron (mg/kg)	0.19	-	-	-	-
Silicon (mg/kg)	44	-	-	-	-
Org Matter (%)	2.1	-	-	-	-
Tot Org C (%)	1.2	-	-	-	-
Total N (%)	0.07	-	-	-	-
P (Colwell) (mg/kg)	5.9	-	-	-	-
Nitrate (mg/kg)	8.0	-	-	-	-
Total S (%)	67	-	-	-	-
Sulfate-S (mg/kg)	3.6	-	-	-	-
ADMC (%)	1	3	4	4	5
Gravel >2mm (%)	0	1	3	3	3
CS >50µm (%)	76	76	74	65	69
CS>20µm (%)	82	83	77	70	74
2-50µm-Silt (%)	19	14	9	18	12
2-20µm-Silt (%)	13	7	6	13	7
Clay <2µm (%)	5	11	17	17	19
Disp Ratio (R1)	0.42	0.43	0.42	0.44	0.45

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.9 S1: Brown Sodosol – Brown texture contrast loamy soils on gently undulating plains

Overview

The SMU is associated with texture contrast at depth with dispersive subsoils on gently undulating plains. This SMU is situated along the northern, eastern and western portions of the study area.

S1 soils are soft surfaced loamy sands on dispersive sandy clay loams extending 1.0 m below the surface. The soil has PAWC and erosive limitations and is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast soils of loamy sands to sandy clay loams;
- pH (laboratory analysis) ranges from acidic in topsoil to alkaline in subsoils;
- very low electrical conductivity in topsoil, increasing to low in subsoils;
- CEC is very low in topsoil to low in subsoils;
- ESP is non-sodic to sodic in subsoils from 0.60 mbgl;
- Ca:Mg ratio is very high in topsoil decreasing to moderate in subsoils;
- R1 dispersion levels are low in topsoil increasing to moderate in subsoils; and
- extractable phosphorus present is very low.

Representative site

Site 1 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-32, with a soil profile morphology summary presented in Table 4-33. The soil chemistry results for this SMU are presented in Table 4-34. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-32: Land Summary SMU S1

Item	Description
Representative site	1
Representative site photograph	
Location GDA94 ZONE 55	638334 mE 7545005 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Poplar Box
Disturbance	Semi-disturbed
Landform element /pattern	Gently undulating plain, simple slope
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Imperfectly drained
Erosion	Nil erosion
Slope (%)	2.0%/2.0%
Surface coarse fragments	Coarse fragments <1% <5 mm
Surface condition	Soft
ASC order (s)	Brown Sodosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 73 mm/100 cm **Identified Physical and/or Chemical Limitation**: Marginal dispersive attributes below 0.60 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 73 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: loamy sands to sandy clays • Sodicity / ESP: non-sodic to sodic in subsoils from 0.60 mbgl • Ca:Mg: very high in topsoil decreasing to moderate in subsoils • R1 Dispersion: low levels in topsoil increasing to moderate in subsoils • K-factor: 0.020, moderate (Foster et al., 1981) • Landform: gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 3 • Erosion Hazard – Subsoils (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low to moderate in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.30-1.00 mbgl **Recommended subsoil use**: Buried supporting subsoils from 0.30- 0.60 mbgl for topsoil placement. Buried supporting subsoils from 0.60- 1.00 mbgl for topsoil placement on level plains.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	904

Table 4-33: Soil Profile Morphology Summary SMU S1

Site 1								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A11 0.00-0.21 Abrupt	Loamy Sand / Loamy Sand	Loose, apedal	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.35-0.45 0.60-0.70 0.90-1.00
A12 0.21-0.33 Abrupt	Loamy Sand / Loamy Sand	Loose, apedal	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, Rapid	Common	0.30 / 6.0	
A13 0.33-0.54 Abrupt	Loamy Sand / Loamy Sand	Massive 30% <20 mm peds	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, Well	Few	0.40 / 6.5	
B2 0.54-1.00 EOBH	Sandy clay loam / Light clay (sandy)	Weak to moderate, firm, angular <20 mm peds	<2% manganese nodules	10YR5/6 Yellowish brown Mottle <10% 10YR6/8 Brownish yellow Nil bleaching	Dry, moderate to imperfect	Fine	0.60 / 7.0	

Table 4-34: Soil Chemistry Results for Representative Site 1

Analysis (Unit)	1-0.0-0.10	1-0.20-0.30	1-0.35-0.45	1-0.60-0.70	1-0.90-1.00
Soil pH	6.53	6.12	7.08	7.11	7.98
Soil EC (dS/m)	0.011	0.010	0.073	0.078	0.091
Soil Cl (mg/kg)	12	34	35	146	182
Exch. Ca (meq/100 g)	2.1	1.25	0.97	4.25	4.60
Exch. Mg (meq/100 g)	0.58	0.54	0.59	3.84	4.46
Exch. K (meq/100 g)	0.19	0.27	0.25	0.35	0.26
Exch. Na (meq/100 g)	<0.065	<0.065	<0.065	1.03	1.41
CEC (meq/100 g)	2.9	2.08	1.87	9.48	10.73
ESP (%Na/CEC)	0.8	1.1	3.2	10.9	13.1
Ca/Mg (ratio)	3.7	2.3	1.6	1.1	1.0
Zinc (mg/kg)	0.56	-	-	-	-
Mn (mg/kg)	15	-	-	-	-
Iron (mg/kg)	25	-	-	-	-
Copper (mg/kg)	0.19	-	-	-	-
Boron (mg/kg)	0.21	-	-	-	-
Silicon (mg/kg)	17	-	-	-	-
Org Matter (%)	1.5	-	-	-	-
Tot Org C (%)	0.86	-	-	-	-
Total N (%)	0.05	-	-	-	-
P (Colwell) (mg/kg)	3.6	-	-	-	-
Nitrate (mg/kg)	0.90	-	-	-	-
Total S (%)	<50	-	-	-	-
Sulfate-S (mg/kg)	<1	-	-	-	-
ADMC (%)	1	2	8	8	8
Gravel >2 mm (%)	1	1	3	9	4
CS >50 µm (%)	85	92	80	50	50
CS >20 µm (%)	87	92	82	61	58
2-50 µm-Silt (%)	13	3	11	15	16
2-20 µm-Silt (%)	11	3	9	4	7
Clay <2 µm (%)	2	5	9	35	35
Disp. Ratio (R1)	0.36	0.48	0.35	0.48	0.68

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.10 S3: Brown Chromosol – Texture contrast loams on clays on flat to gently undulating plains

Overview

The SMU is associated with texture contrast soils with elevated (extreme electrical conductivity levels) located at the sandy loam surface with clay soils at depth on flat to gently undulating plains. This SMU is situated in the south-eastern portion of the study area.

The soil has limitations due to the surface salt concentrations and is suitable for light grazing of native pastures in accessible areas.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast soils of sandy loams to light clays;
- pH (laboratory analysis) is neutral;
- extreme electrical conductivity in topsoil, decreasing to very low in subsoils. It is noted that this elevated level of electrical conductivity is unlikely to be consistent for the soil mapping unit and is considered an anomaly;
- CEC is low throughout;
- ESP is non-sodic throughout;
- Ca:Mg ratio is very high in topsoil decreasing to high in subsoils;
- R1 dispersion levels are low; and
- extractable phosphorus present is very high.

Representative site

Site 10 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-35, with a soil profile morphology summary presented in Table 4-36. The soil chemistry results for this SMU are presented in Table 4-37. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-35: Land Summary SMU S3

Item	Description
Representative site	10
Representative site photograph	
Location GDA94 ZONE 55	636268 mE 7540681 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Narrow-leaved Ironbark
Disturbance	Semi-disturbed
Landform element /pattern	Crest, wide flat plain
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately drained
Erosion	Nil erosion
Slope (%)	1.0%/1.0%
Surface coarse fragments	Coarse fragments 2% <5 mm
Surface condition	Firm
ASC order (s)	Brown Chromosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 100 mm/100 cm **Identified Physical and/or Chemical Limitation**: None identified **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 100 mm **Land Suitability (Cropping) Class**: 4 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: sandy loams to light clays • Sodicity / ESP: non-sodic throughout • Ca:Mg: very high in topsoil decreasing to high in subsoils • R1 Dispersion: low levels • K-factor: 0.028, moderate (Foster et al., 1981) • Landform: crest, wide plain • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil and subsoils.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species. **Recommended subsoil strip depth**: 0.10 -1.00mbgl **Recommended subsoil use**: buried supporting subsoils for topsoil placement.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	162

Table 4-36: Soil Profile Morphology Summary SMU S3

Site 10								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.11 Abrupt	Sandy loam / Silty loam	Massive, apedal	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.10 0.20-0.30 0.48-0.58 0.70-0.80 0.90-1.00
B21 0.11-0.58 Abrupt	Clay loam / Light clay	Massive, apedal	<2% coarse fragments <5 mm	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5	
B22 0.58-0.85 Abrupt	Light clay / Medium heavy clay	Massive, apedal	2% coarse fragments <5 mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 7.0	
B23 0.85-1.00 EOBH	Light clay / Medium heavy to medium clay	Massive, apedal	2% coarse fragments 10 mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 7.0	

Table 4-37: Soil Chemistry Results for Representative Site 10

Analysis (Unit)	10-0.00-0.10	10-0.20-0.30	10-0.48-0.58	10-0.70-0.80	10-0.90-1.00
Soil pH	6.69	6.77	6.73	6.99	7.40
Soil EC (dS/m)	1.027	0.052	0.044	0.045	0.049
Soil Cl (mg/kg)	472	32	20	31	85
Exch. Ca (meq/100 g)	7.4	3.37	3.90	4.27	5.19
Exch. Mg (meq/100 g)	3.6	2.29	3.13	3.59	4.07
Exch. K (meq/100 g)	3.4	1.44	0.56	0.25	0.03
Exch. Na (meq/100 g)	<0.065	0.15	0.25	0.46	0.53
CEC (meq/100 g)	14	7.25	7.83	8.57	9.83
ESP (%Na/CEC)	0.1	2.1	3.2	5.3	5.4
Ca/Mg (ratio)	2.1	1.5	1.2	1.2	1.3
Zinc (mg/kg)	3.2	-	-	-	-
Mn (mg/kg)	75	-	-	-	-
Iron (mg/kg)	83	-	-	-	-
Copper (mg/kg)	0.67	-	-	-	-
Boron (mg/kg)	1.1	-	-	-	-
Silicon (mg/kg)	126	-	-	-	-
Org Matter (%)	8.1	-	-	-	-
Tot Org C (%)	4.6	-	-	-	-
Total N (%)	0.37	-	-	-	-
P (Colwell) (mg/kg)	99	-	-	-	-
Nitrate (mg/kg)	480	-	-	-	-
Total S (%)	350	-	-	-	-
Sulfate-S (mg/kg)	36	-	-	-	-
ADMC (%)	3	7	9	9	8
Gravel >2 mm (%)	2	15	19	27	13
CS >50 µm (%)	44	37	24	27	24
CS >20 µm (%)	49	44	28	32	31
2-50 µm-Silt (%)	42	20	17	17	23
2-20 µm-Silt (%)	37	13	14	12	16
Clay <2 µm (%)	14	43	59	56	53
Disp. Ratio (R1)	0.39	0.37	0.32	0.34	0.47

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.11 S4: Brown Tenosol – Deep sandy earths on flat plains

Overview

The SMU is associated with uniform loamy sands with sodic subsoils on flat plains. This SMU is situated in the northern and south-eastern portions of the study area.

S4 soils are soft surfaced, low fertility free draining sands. This SMU is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- uniform loamy sands;
- pH (laboratory analysis) is acidic in topsoil to neutral in subsoils;
- electrical conductivity is very low throughout;
- CEC is very low throughout;
- ESP is non-sodic in topsoil to sodic in subsoils from 0.7 mbgl;
- Ca:Mg ratio is very high throughout;
- R1 dispersion levels are low throughout; and
- extractable phosphorus present is very low.

Representative site

Site 68 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-38, with a soil profile morphology summary presented in Table 4-39. The soil chemistry results for this SMU are presented in Table 4-40. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-38: Land Summary SMU S4

Item	Description
Representative site	68
Representative site photograph	
Location GDA94 ZONE 55	628352 mE 7551956 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Poplar Box
Disturbance	Nil
Landform element /pattern	Flat plain
Micro relief	Nil
Permeability	Highly permeable
Drainage	Rapid
Erosion	Nil erosion
Slope (%)	<1.0%/<1.0%
Surface coarse fragments	Nil
Surface condition	Soft
ASC order (s)	Brown Tenosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 40 mm/100 cm **Identified Physical and/or Chemical Limitation**: None identified **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 40 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: loamy sands • Sodicity / ESP: non-sodic in topsoil to sodic in subsoils from 0.70 mbgl • Ca:Mg: very high throughout • R1 Dispersion: low levels throughout • K-factor: 0.010, low (Foster et al., 1981) • Landform: flat plain • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil, increasing slightly with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.60 mbgl **Recommended topsoil use**: support topsoils of suitable SMUs for the establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.60 – 1.00 mbgl **Recommended subsoil use**: Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species, on level plains. Buried supporting subsoils for topsoil placement.
ASS/PASS field assessment	Low field indication of PASS. No field indicators of AASS.
Total area (ha)	180

Table 4-39: Soil Profile Morphology Summary SMU S4

Site 68								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A11 0.00-0.15 Abrupt	Loamy sand / Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
A12 0.15-0.70 Abrupt	Loamy sand / Loamy sand	Massive, loose	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Few	0.30 / 6.0 0.60 / 7.0	
A13 0.70-1.00 EOBH	Loamy sand / Loamy sand	Massive, loose	Nil	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Nil	0.90 / 8.0	

Table 4-40: Soil Chemistry Results for Representative Site 68

Analysis (Unit)	68-0.00-0.10	68-0.20-0.30	68-0.50-0.60	68-0.70-0.80	68-0.90-1.00
Soil pH	6.39	6.60	7.43	7.54	7.44
Soil EC (dS/m)	0.011	0.017	0.019	0.009	0.011
Soil Cl (mg/kg)	3.8	8.0	3.8	4.8	7.0
Exch. Ca (meq/100 g)	2.1	2.07	1.11	0.81	0.83
Exch. Mg (meq/100 g)	0.48	0.44	0.24	0.20	0.18
Exch. K (meq/100 g)	0.28	0.25	0.06	0.03	0.05
Exch. Na (meq/100 g)	<0.065	<0.065	0.07	0.08	0.08
CEC (meq/100 g)	2.9	2.80	1.48	1.12	1.14
ESP (%Na/CEC)	0.6	1.6	4.7	7.3	6.9
Ca/Mg (ratio)	4.4	4.7	4.6	4.1	4.6
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	15	-	-	-	-
Iron (mg/kg)	38	-	-	-	-
Copper (mg/kg)	0.25	-	-	-	-
Boron (mg/kg)	0.20	-	-	-	-
Silicon (mg/kg)	19	-	-	-	-
Org Matter (%)	1.2	-	-	-	-
Tot Org C (%)	0.69	-	-	-	-
Total N (%)	0.04	-	-	-	-
P (Colwell) (mg/kg)	3.9	-	-	-	-
Nitrate (mg/kg)	2.3	-	-	-	-
Total S (%)	<50	-	-	-	-
Sulfate-S (mg/kg)	<1	-	-	-	-
ADMC (%)	1	0.9	0.6	0.6	0.7
Gravel >2 mm (%)	0	0.8	0.3	0.4	1.5
CS >50 µm (%)	83	86	88	89	88
CS >20 µm (%)	85	91	91	90	91
2-50 µm-Silt (%)	17	13	10	10	11
2-20 µm-Silt (%)	15	9	7	9	8
Clay <2 µm (%)	0	1	2	1	1
Disp. Ratio (R1)	0.26	0.37	0.41	0.41	0.41

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.12 T1-B: Brown Dermosol – Texture contrast brown clay soils on gently undulating plains

Overview

This SMU is situated in the south-western portion of the study area. This SMU is associated with weak texture contrast clay soils on gently undulating plains.

T1-B is suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast clay loams on clay soils;
- pH (laboratory analysis) is neutral in topsoil, varying from alkaline to strongly alkaline in subsoils;
- electrical conductivity is very low in topsoil and low in subsoils;
- CEC is moderate in topsoil and varies from moderate to high in subsoils;
- ESP is non-sodic throughout;
- Ca:Mg ratio is very high throughout;
- R1 dispersion levels are low throughout; and
- extractable phosphorus present is high.

Representative site

Site 42 was selected as a representative site of this SMU for chemical analysis.

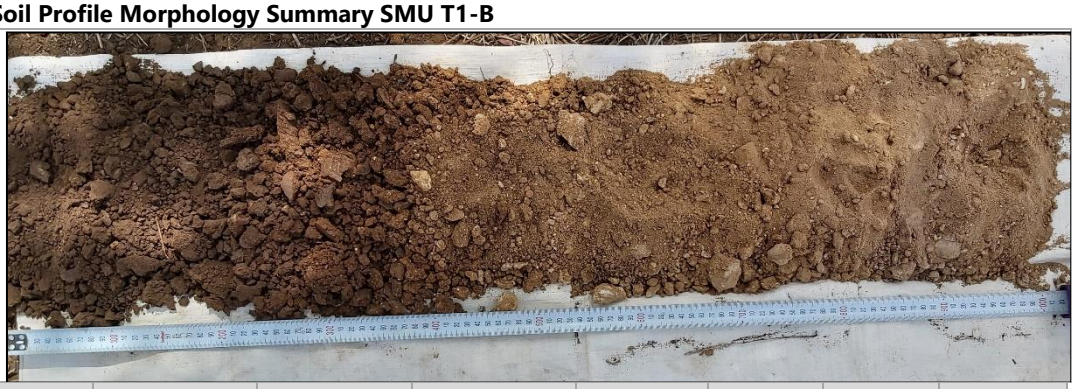
A site description is presented in Table 4-41, with a soil profile morphology summary presented in Table 4-42. The soil chemistry results for this SMU are presented in Table 4-43. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-41: Land Summary SMU T1-B

Item	Description
Representative site	42
Representative site photograph	
Location GDA94 ZONE 55	630026 mE 7543369 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Brigalow regrowth
Disturbance	Semi-disturbed
Landform element /pattern	Gently undulating plain, upper slope
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately drained
Erosion	Nil erosion
Slope (%)	1.0%/2.0%
Surface coarse fragments	Nil
Surface condition	Soft to firm
ASC order (s)	Brown Dermosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 75 mm/100 cm **Identified Physical and/or Chemical Limitation**: Marginal, pH at 9.03, in sample depth 0.80-0.90 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 75 mm **Land Suitability (Cropping) Class**: 4 **Land Suitability (Grazing) Class**: 3

Item	Description
	Agricultural Land Class: C2
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: texture contrast clay loams on clay soils • Sodicity / ESP: non-sodic throughout • Ca:Mg: very high throughout • R1 Dispersion: low levels throughout • K-factor: 0.020, moderate (Foster et al., 1981) • Landform: gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 3 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil, slightly increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.30-1.00 mbgl **Recommended subsoil use**: support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	73

Table 4-42: Soil Profile Morphology Summary SMU T1-B

Site 42								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A11 0.00-0.09 Abrupt	Clay loam / Clay loam	Massive to weak, loose	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	0.00-0.09 0.10-0.20 0.25-0.35 0.50-0.60 0.80-0.90
A12 0.09-0.24 Gradual	Clay loam / Clay loam	Weak, firm, sub-angular peds <10 mm	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.20 / 8.0	
B21 0.24-0.37 Abrupt	Light clay / Light clay	Moderate, firm, sub-angular peds <10 mm	<2% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.28 / 7.5	
B31 0.37-0.70 Abrupt	Clay loam / Light clay to clay loam	Massive to weak, weak subangular peds <10 mm <2%	<2% calcium carbonate	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.50 / 8.0	

B32 0.70-1.00 EOBH	Loam / Loam	Massive, loose	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 8.0	

Table 4-43: Soil Chemistry Results for Representative Site 42

Analysis (Unit)	42-0.00-0.09	42-0.10-0.20	42-0.25-0.35	42-0.50-0.60	42-0.80-0.90
Soil pH	7.32	7.97	8.49	8.93	9.20
Soil EC (dS/m)	0.062	0.054	0.117	0.115	0.093
Soil Cl (mg/kg)	9.8	28	46	88	36
Exch. Ca (meq/100 g)	12.57	17.72	22.63	13.84	11.97
Exch. Mg (meq/100 g)	2.57	3.11	4.11	3.99	3.70
Exch. K (meq/100 g)	1.24	0.68	0.21	0.08	0.00
Exch. Na (meq/100 g)	0.11	0.18	0.21	0.26	0.28
CEC (meq/100 g)	16.5	21.69	27.16	18.17	15.96
ESP (%Na/CEC)	0.7	0.8	0.8	1.4	1.8
Ca/Mg (ratio)	4.9	5.7	5.5	3.5	3.2
Zinc (mg/kg)	0.71	-	-	-	-
Mn (mg/kg)	26	-	-	-	-
Iron (mg/kg)	16	-	-	-	-
Copper (mg/kg)	0.44	-	-	-	-
Boron (mg/kg)	0.51	-	-	-	-
Silicon (mg/kg)	61	-	-	-	-
Org Matter (%)	5.7	-	-	-	-
Tot Org C (%)	3.3	-	-	-	-
Total N (%)	0.25	-	-	-	-
P (Colwell) (mg/kg)	18	-	-	-	-
Nitrate (mg/kg)	6.7	-	-	-	-
Total S (%)	232	-	-	-	-
Sulfate-S (mg/kg)	3.5	-	-	-	-
ADMC (%)	5	10.3	10.7	6.7	5.7
Gravel >2 mm (%)	0	0.7	0.6	13.2	4.4
CS >50 µm (%)	54	46	49	58	62
CS >20 µm (%)	58	49	50	65	67
2-50 µm-Silt (%)	23	21	12	19	22
2-20 µm-Silt (%)	18	17	10	12	18
Clay <2 µm (%)	24	33	39	23	16
Disp. Ratio (R1)	0.44	0.40	0.37	0.50	0.46

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.13 T1-R: Red Dermosol – Texture contrast brown to red clay soils on wide crests

Overview

The SMU is associated with weak texture contrast clay soils on wide crests. This SMU is situated in the north-western portion of the study area and is minor variant associated with SMU T1-B.

This SMU is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast clay loams on clay soils;
- pH (laboratory analysis) is neutral in topsoil to strongly alkaline in subsoils;
- electrical conductivity is very low in topsoil, varying from very low to low in subsoils (assessed on dominant SMU, T1-B laboratory clay texture percentages);
- CEC is low in topsoil, varying from low to moderate in subsoils;
- ESP is non-sodic throughout;
- Ca:Mg ratio is very high throughout;
- R1 dispersion levels are low (assessed on dominant SMU, T1-B); and
- extractable phosphorus present is low.

Representative site

Site 36 was selected as a representative site of this SMU for chemical analysis.

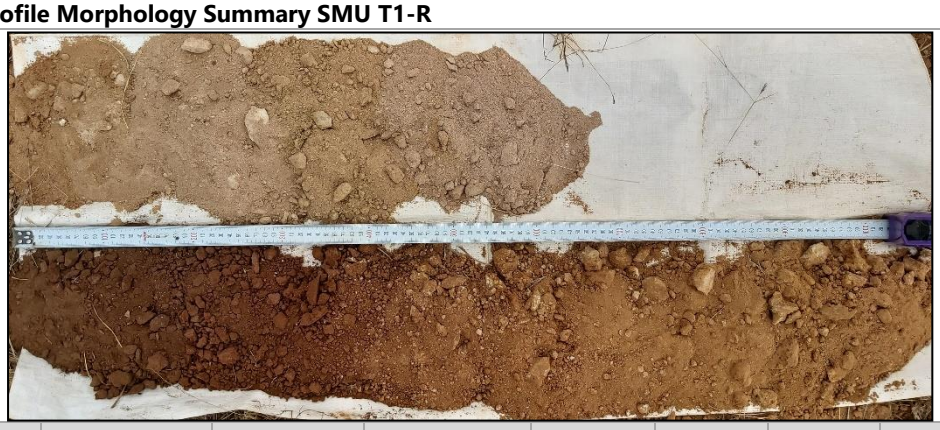
A site description is presented in Table 4-44, with a soil profile morphology summary presented in Table 4-45. The soil chemistry results for this SMU are presented in Table 4-46. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-44: Land Summary SMU T1-R

Item	Description
Representative site	36
Representative site photograph	
Location GDA94 ZONE 55	624098 mE 7551284 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Semi-disturbed
Landform element /pattern	Wide crest
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately drained
Erosion	Nil erosion
Slope (%)	<1.0%/<1.0%
Surface coarse fragments	Nil
Surface condition	Firm
ASC order (s)	Red Dermosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 75 mm/100 cm **Identified Physical and/or Chemical Limitation**: Marginal, pH at 8.98, in sample depth 0.90-1.00 mbgl **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 75 mm **Land Suitability (Cropping) Class**: 4 **Land Suitability (Grazing) Class**: 3

Item	Description
	Agricultural Land Class: C2
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: texture contrast clay loams on clay soils • Sodicity / ESP: non-sodic throughout • Ca:Mg: very high throughout • R1 dispersion: low levels • K-factor: 0.020, moderate (Foster et al., 1981) • Landform: wide crest • Water Erosion – Topsoil (Regional Frameworks): 3 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil, slightly increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.30 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.30-1.00 mbgl **Recommended subsoil use**: support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	60

Table 4-45: Soil Profile Morphology Summary SMU T1-R

Site 36								
Horizon Depth (m), Boundary	**Field / Lab[1] Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A11 0.00-0.08 Abrupt	Clay Loam / Clay loam	Massive, loose	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Common	0.05 / 6.5	0.00-0.08 0.10-0.20 0.20-0.30 0.50-0.60 0.90-1.00 1.40-1.50
A12 0.08-0.20 Abrupt	Clay loam / Clay loam	Weak, weak, sub-rounded 5-20 mm	<1% <2 mm coarse fragments	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well	Few	0.15 / 6.5	
B21 0.20-0.34 Abrupt	Light clay / Light clay	Moderate, weak, sub-rounded 5-20 mm	<1% <2 mm coarse fragments	5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, well	Few	0.30 / 7.0	

B22 0.34-0.75 Abrupt	Silty clay loam / Light clay to clay loam	Weak, weak, sub-angular <20 mm	<5% <2 mm coarse fragments	5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well to moderate	Nil	0.60 / 8.0	
B23 0.75-1.05 Abrupt	Silty clay loam / Loam	Weak, weak, sub-angular <20 mm	<2% <2 mm coarse fragments	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, well to moderate	Nil	0.90 / 8.0	
B3 1.05-1.60 EOBH	Loam	Massive, loose	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Nil	1.20 / 8.5	

1. Laboratory textures based on SMU T1-B.

Table 4-46: Soil Chemistry Results for Representative Site 36

Analysis (Unit)	36-0.00-0.08	36-0.10-0.20	36-0.20-0.30	36-0.50-0.60	36-0.90-1.00	36-1.40-1.50
Soil pH	7.30	7.36	8.19	8.75	8.98	9.23
Soil EC (dS/m)	0.030	0.051	0.096	0.098	0.096	0.070
Soil Cl (mg/kg)	5.8	15	12	15	28	7.1
Exch. Ca (meq/100 g)	7.40	11.28	16.28	13.62	13.84	13.02
Exch. Mg (meq/100 g)	1.88	1.59	2.13	2.08	3.12	3.11
Exch. K (meq/100 g)	0.68	0.34	0.28	0.12	0.08	0.02
Exch. Na (meq/100 g)	0.08	0.16	0.16	0.16	0.23	0.26
CEC (meq/100 g)	10.0	13.37	18.84	15.98	17.27	16.41
ESP (%Na/CEC)	0.8	1.2	0.8	1.0	1.3	1.6
Ca/Mg (ratio)	3.9	7.1	7.7	6.5	4.4	4.2
Zinc (mg/kg)	0.61	-	-	-	-	-
Mn (mg/kg)	24	-	-	-	-	-
Iron (mg/kg)	9.4	-	-	-	-	-
Copper (mg/kg)	0.51	-	-	-	-	-
Boron (mg/kg)	0.42	-	-	-	-	-
Silicon (mg/kg)	73	-	-	-	-	-
Org Matter (%)	3.1	-	-	-	-	-
Tot Org C (%)	1.8	-	-	-	-	-
Total N (%)	0.10	-	-	-	-	-
P (Colwell) (mg/kg)	6.2	-	-	-	-	-
Nitrate (mg/kg)	1.7	-	-	-	-	-
Total S (%)	111	-	-	-	-	-
Sulfate-S (mg/kg)	5.3	-	-	-	-	-

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.14 T2: Red Kandosol – Texture contrast massive structure clay soils on gently undulating plains

Overview

The SMU is associated with weak texture contrast loam soils on clays with massive structure on gently undulating plains. This SMU is situated in the western and south-western portion of the study area.

T2 is suitable for a narrow range of crops sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- texture contrast silty loams on clay soils;
- pH (laboratory analysis) is acidic in topsoil increasing to strongly alkaline in subsoils;
- electrical conductivity is very low in topsoil and varies from very low to low in subsoils;
- CEC is moderate in topsoil and varies from low to moderate in subsoils;
- ESP is non-sodic throughout;
- Ca:Mg ratio is very high in topsoil and varies from high to very high in subsoils;
- R1 dispersion levels are low in topsoil increasing to moderately dispersive in subsoils; and
- extractable phosphorus present is high.

Representative site

Site 75 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-47, with a soil profile morphology summary presented in Table 4-48. The soil chemistry results for this SMU are presented in Table 4-49. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-47: Land Summary SMU T2

Item	Description
Representative site	75
Representative site photograph	
Location GDA94 ZONE 55	627314 mE 7544935 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Semi-disturbed
Landform element /pattern	Gently undulating plain, mid-slope
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately drained
Erosion	Nil erosion
Slope (%)	2.0%/2.0%
Surface coarse fragments	Nil
Surface condition	Firm
ASC order (s)	Red Kandosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 106 mm/100 cm **Identified Physical and/or Chemical Limitation**: None identified **Estimated effective rooting depth**: 1.00 mbgl **Estimated soil water storage**: 106 mm **Land Suitability (Cropping) Class**: 3 **Land Suitability (Grazing) Class**: 3 **Agricultural Land Class**: B

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: texture contrast silty loams on clay soils; • Sodicity / ESP: non-sodic throughout • Ca:Mg: very high in topsoil and varies from high to very high in subsoils • R1 Dispersion: low levels in topsoil increasing moderately dispersive in subsoils • K-factor: 0.024, moderate (Foster et al., 1981) • Landform: gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 3 • Erosion Hazard – Subsoils (Regional Frameworks): 1 Erosion potential through dispersion is assessed as low in topsoil, slightly increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.10-1.00 mbgl **Recommended subsoil use**: support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.
ASS/PASS field assessment	Low field indication of PASS. No field indicators of AASS.
Total area (ha)	398

Table 4-48: Soil Profile Morphology Summary SMU T2

Site 75								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.10 Abrupt	Sandy clay loam / Silty loam	Massive to weak, form, peds <5 mm	<1% coarse fragments 5 mm	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00 1.40-1.50
A2 0.10-0.30 Abrupt	Clay loam / Silty clay loam	Massive to weak, form, peds <5 mm	<1% coarse fragments 5 mm	5YR4/3 Reddish brown Nil mottles / bleaching	Dry, well–moderate	Few	0.25 / 6.0	
B21 0.30-0.88 Abrupt	Medium clay / Medium to light medium clay	Massive to weak, form, peds <2% <20 mm	Nil	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Few	0.60 / 6.5	
B22 0.88-1.10 Abrupt	Medium clay / Medium heavy clay	Massive to weak, form, peds <10 mm	<1% coarse fragments <5 mm	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 6.5	
B23 1.10-1.50 EOBH	Clay loam / Clay loam	Massive to weak, form, peds <5 mm	<1% coarse fragments <5 mm	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Nil	1.20 / 7.0	

Table 4-49: Soil Chemistry Results for Representative Site 75

Analysis (Unit)	75-0.00-0.10	75-0.20-0.30	75-0.50-0.60	75-0.70-0.80	75-0.90-1.00	75-1.40-1.50
Soil pH	6.50	6.53	7.11	8.08	8.48	8.84
Soil EC (dS/m)	0.043	0.012	0.034	0.053	0.133	0.105
Soil Cl (mg/kg)	17	6.4	5.9	14	14	10
Exch. Ca (meq/100 g)	9.7	6.65	12.42	11.25	16.59	18.65
Exch. Mg (meq/100 g)	3.9	3.53	6.52	5.58	3.56	3.58
Exch. K (meq/100 g)	1.4	0.75	0.39	0.19	0.22	0.06
Exch. Na (meq/100 g)	0.07	0.09	0.42	0.59	0.31	0.38
CEC (meq/100 g)	15.1	11.02	19.75	17.61	20.69	22.67
ESP (%Na/CEC)	0.5	0.9	2.1	3.3	1.5	1.7
Ca/Mg (ratio)	2.5	1.9	1.9	2.0	4.7	5.2
Zinc (mg/kg)	2.3	-	-	-	-	-
Mn (mg/kg)	75	-	-	-	-	-
Iron (mg/kg)	55	-	-	-	-	-
Copper (mg/kg)	1.5	-	-	-	-	-
Boron (mg/kg)	0.46	-	-	-	-	-
Silicon (mg/kg)	91	-	-	-	-	-
Org Matter (%)	7.0	-	-	-	-	-
Tot Org C (%)	4.0	-	-	-	-	-
Total N (%)	0.25	-	-	-	-	-
P (Colwell) (mg/kg)	17	-	-	-	-	-
Nitrate (mg/kg)	4.0	-	-	-	-	-
Total S (%)	233	-	-	-	-	-
Sulfate-S (mg/kg)	5.6	-	-	-	-	-
ADMC (%)	3	8.4	12.9	12.2	13.4	9.3
Gravel >2 mm (%)	1	6.5	0.4	4.0	16.8	18.9
CS >50 µm (%)	53	42	39	38	20	65
CS >20 µm (%)	56	49	42	45	22	69
2-50 µm-Silt (%)	32	31	15	18	20	10
2-20 µm-Silt (%)	29	24	12	11	18	6
Clay <2 µm (%)	15	27	46	44	60	25
Disp. Ratio (R1)	0.49	0.39	0.46	0.58	0.40	0.60

A '-' indicates laboratory analysis was not conducted for this sample.

4.1.15 T3: Brown Chromosol – Gradational alkaline silty clay soils on flat plains

Overview

The SMU is associated with gradational (weak) texture contrast silty loam on clay loam soils on gently undulating plains. This SMU is situated in the south-west, central and south-east of the study area in four UMAs.

T3 has sodic and salinity attributes in the subsoils and is suitable for grazing native pastures, with or without the introduction of pasture species.

Soil characteristics and chemistry

The major characteristics from the laboratory data indicate that this SMU has:

- gradational texture contrast silty loams on clay soils;
- pH (laboratory analysis) is neutral in topsoil and increases to strongly alkaline in subsoils;
- electrical conductivity is very low in topsoil and varies from low to very high in subsoils;
- CEC is low throughout;
- ESP is non-sodic in topsoil and increases to extremely sodic in subsoils from 0.20 mbgl;
- Ca:Mg ratio is moderate in topsoil and decreases to low in subsoils;
- R1 dispersion levels are low in topsoil and increases to moderate in subsoils; and
- extractable phosphorus present is low.

Representative site

Site 6 was selected as a representative site of this SMU for chemical analysis.

A site description is presented in Table 4-50, with a soil profile morphology summary presented in Table 4-51. The soil chemistry results for this SMU are presented in Table 4-52. The site profile and laboratory analysis are presented in Appendix A and C.

Table 4-50: Land Summary SMU T3

Item	Description
Representative site	6
Representative site photograph	
Location GDA94 ZONE 55	637823 mE 7540836 mN
Current land use	Grazing
Site survey type	Detailed, 50 mm hand auger
Vegetation	Exotic grassland
Disturbance	Completely disturbed
Landform element /pattern	Gently undulating plain, flat plain
Micro relief	Nil
Permeability	Slowly permeable
Drainage	Moderately drained
Erosion	Nil erosion
Slope (%)	1.0%/1.0%
Surface coarse fragments	Nil
Surface condition	Firm, hard setting
ASC order (s)	Brown Chromosol
Land suitability summary	**Plant Available Water Capacity (RPI 08/14 Soil Texture Table)**: 62 mm/100 cm **Identified Physical and/or Chemical Limitation**: ESP at 21%, in sample depth 0.20-0.30 mbgl **Estimated effective rooting depth**: 0.20 mbgl **Estimated soil water storage**: 12 mm **Land Suitability (Cropping) Class**: 5 **Land Suitability (Grazing) Class**: 4 **Agricultural Land Class**: C2

Item	Description
Erosion potential	The assessment included reviewing the laboratory data and landform factors; • Texture: gradational texture contrast silty loams on clay soils; • Sodicity / ESP: non-sodic in topsoil and increases to extremely sodic in subsoils from 0.20 mbgl • Ca:Mg: moderate in topsoil and decreases to low in subsoils • R1 dispersion: low levels in topsoil and increases to moderate in subsoils • K-factor: 0.029, moderate (Foster et al., 1981) • Landform: gently undulating plains • Water Erosion – Topsoil (Regional Frameworks): 2 • Erosion Hazard – Subsoils (Regional Frameworks): 3 Erosion potential through dispersion is assessed as low in topsoil, increasing with subsoils. Appropriate management of bare earths should be considered when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	**Recommended topsoil strip depth**: 0.00-0.10 mbgl **Recommended topsoil use**: support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management. **Recommended subsoil strip depth**: 0.00 mbgl **Recommended subsoil use**: no rehabilitation stripping recommendations for subsoils. Potential reuse as capping for waste rock due to dispersive attributes to a depth of 1.00 mbgl.
ASS/PASS field assessment	Very low field indication of PASS. No field indicators of AASS.
Total area (ha)	255

Table 4-51: Soil Profile Morphology Summary SMU T3

Site 6								
Horizon Depth (m), Boundary	**Field / Lab Texture**	**Structure Strength**	**Inclusions Segregations**	**Colour, Mottle, Bleaching**	**Moisture Drainage**	**Roots**	**Depth (m) / Field pH**	**Samples (m)**
A1 0.00-0.20 Abrupt	Silty loam / Silty loam	Massive, firm	<1% <5 mm coarse fragments	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.10 0.20-0.30 0.50-0.57 0.65-0.75 0.90-1.00
B21 0.20-0.57 Abrupt	Silty clay loam / Silty clay loam to clay loam	Weak, firm, subangular <10 mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.0	
B22 0.57-0.76 Abrupt	Silty clay loam / Clay loam	Weak to moderate, firm, subangular <20 mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 8.0	
B23 0.76-100 EOBH	Silty clay loam / Clay loam	Moderate, firm, subangular <10 mm	Nil	10YR5/4 Yellowish brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 8.0	

Table 4-52: Soil Chemistry Results for Representative Site 6

Analysis (Unit)	6-0.00-0.10	6-0.20-0.30	6-0.50-0.57	6-0.65-0.75	6-0.90-1.00
Soil pH	6.63	7.82	8.96	9.29	9.26
Soil EC (dS/m)	0.022	0.137	0.409	0.731	0.861
Soil Cl (mg/kg)	11	173	605	995	1188
Exch. Ca (meq/100 g)	2.1	2.02	2.19	1.69	1.46
Exch. Mg (meq/100 g)	2.5	4.71	6.04	5.17	4.79
Exch. K (meq/100 g)	0.43	0.05	0.07	0.03	0.04
Exch. Na (meq/100 g)	0.28	1.80	3.05	3.23	3.06
CEC (meq/100 g)	5.4	8.58	11.34	10.12	9.35
ESP (%Na/CEC)	5.2	21.0	26.9	31.9	32.7
Ca/Mg (ratio)	0.83	0.4	0.4	0.3	0.3
Zinc (mg/kg)	<0.5	-	-	-	-
Mn (mg/kg)	29	-	-	-	-
Iron (mg/kg)	38	-	-	-	-
Copper (mg/kg)	1.1	-	-	-	-
Boron (mg/kg)	0.57	-	-	-	-
Silicon (mg/kg)	37	-	-	-	-
Org Matter (%)	1.5	-	-	-	-
Tot Org C (%)	0.86	-	-	-	-
Total N (%)	0.06	-	-	-	-
P (Colwell) (mg/kg)	8.5	-	-	-	-
Nitrate (mg/kg)	0.99	-	-	-	-
Total S (%)	<50	-	-	-	-
Sulfate-S (mg/kg)	2.1	-	-	-	-
ADMC (%)	2	6	7	8	9
Gravel >2 mm (%)	1	6	1	4	5
CS >50 µm (%)	55	41	44	40	39
CS >20 µm (%)	61	46	48	48	47
2-50 µm-Silt (%)	29	29	22	25	25
2-20 µm-Silt (%)	23	24	18	16	17
Clay <2 µm (%)	17	30	34	36	36
Disp. Ratio (R1)	0.48	0.64	0.67	0.69	0.72

A '-' indicates laboratory analysis was not conducted for this sample.

5 LAND SUITABILITY AND AGRICULTURAL LAND ASSESSMENT

5.1 Land Suitability Classes

5.1.1 Background

Determination of the land suitability of the study area has been conducted based on GALE (DSITI and DNRM, 2015) and Regional Frameworks (DSITI and DNRM, 2013), where guidance is not specifically provided in the GALE or Regional Frameworks, reference and assessment were also made in reference to the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).

GALE (DSITI and DNRM, 2015) and the Regional Frameworks (DSITI and DNRM, 2013) give specific information for appropriate land uses and their associated limitations. The Regional Frameworks were reviewed in conjunction with GALE to assist with determining land suitability in the study area. Review of the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) assisted in determining specific classifications for beef cattle grazing land suitability classes.

GALE defines five land suitability classes for use in Queensland (Table 5-1). These land suitability classes decrease progressively from Class 1 to Class 5 and are used to describe an area of land in terms of suitability for a land use, allowing for optimal, sustainable production, while minimising degradation to the land resource in the short, medium or long-term. GALE and Regional Frameworks give specific information for appropriate land uses and their associated limitations.

Table 5-1: Land Suitability Classes

Class	Suitability	Limitations	Definition
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Land with limitations that either constrain production or require more than the simple management practices of class 1 land to maintain economic production.
3	Suitable	Moderate	Land with limitations that either further constrain production or require more than those management practices of class 2 land to maintain economic production.
4	Unsuitable	Severe	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology.
5	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

Source: Definitions from GALE (DSITI and DNRM, 2015).

As detailed in Table 5-1, land determined as Class 1 to 3 is considered suitable for a land use, as the long-term benefits obtained from that land use typically outweigh the inputs required to initiate and maintain production. It should be noted that with the use of soil improvement techniques (for example, the application of fertiliser), Class 3 land can be as productive as Class 1 or 2 land.

Class 4 land is considered temporarily unsuitable for the specified land use due to the severity of one or several limitations. However, this land may be improved to a more suitable class with the implementation of considerable soil improvement measures.

Class 5 land is considered entirely unsuitable for the specified land use as the limitation(s) are so severe that the inputs required to initiate and maintain the specified land use are not sustainable.

5.1.2 Limitation assessment criteria

The Regional Frameworks (DSITI and DNRM, 2013) provides the attributes, limitations and suitability subclass values for land suitability limitations assessment.

In reviewing the Regional Frameworks (DSITI and DNRM, 2013) suitability subclasses and attributes, the following assessments were undertaken:

- an assessment based on the cropping examples outlined in the suitability framework for the Inland Fitzroy and Southern Burdekin area for cropping based on thirteen subclasses (crops selected from the Regional Frameworks), refer to Section 5.1.3.
- an assessment for beef cattle grazing based on relevant information within the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991), as the Regional Frameworks (DSITI and DNRM, 2013) for the Inland Fitzroy does not include defined rules for grazing land, refer to Section 5.1.4.

The following land attributes have been considered based on the suitability of the Inland Fitzroy and Southern Burdekin area, include:

- Water erosion (E);
- Erosion hazard, subsoil erodibility (Es);
- Soil water availability (M);
- Narrow moisture range (Pm);
- Surface Condition (Ps);
- Rockiness (R);
- Microrelief (Tm); and
- Wetness (W).

Field, laboratory and available public data collected was used as diagnostic attributes to assess the severity of these land attributes and the land suitability class of each soil unit.

Generally, soils in the study area have been determined based on their observed individual polygon areas, referred to as an UMA and not across the entire SMU. This allowed minor sub-dominant diagnostic attributes in the SMU, such as a degree of rockiness, slope or microrelief to be determined on a per polygon basis.

Due to the nature and homogeneity of the soils encountered, the number of minor polygons identified through the free survey method, review of satellite imagery, SMUs and representative site attributes determined are applied to all UMAs.

Assessment review of water erosion

Water erosion was assessed using k-factor Nomograph (Foster et al., 1981) or ESP and R1 dispersion as required.

Assessment review of limitations PAWC and ERD

PAWC and Effective Rooting Depth (ERD) are important attributes relating to soil water availability. PAWC is an estimate of the water content in the soil available for plants, the difference between field capacity and permanent wilting point.

ERD is assessed by physical and chemical limitations. This includes presence of mottles, hard rock, hard pan, gravel layers, very low or very pH, high chloride, low Ca/Mg ratio and/or high ESP.

PAWC was calculated using *RPI Act Statutory Guideline 08/14* (Queensland Government, 2017) using the soil texture lookup table. These were then assessed against the ERD.

ERD has been assessed based on the suitable assessment criteria for the Western Cropping Zone outlined in the *RPI Act Statutory Guideline 08/14* (Queensland Government, 2017). This is summarised in Table 5-2.

Table 5-2: Effective Rooting Depth Physical and Chemical Limitations

ERD Limitation	Assessment Level
Soil depth	Equal to or greater than 600mm
Soil wetness	Has favourable drainage
pH	For rigid soils, the soil at 300mm and 600mm soil depth must be within the range of pH1:5 5.1 to pH1:5 8.9 inclusive For non-rigid soils, the soil at 300mm and 600mm soil depth must be greater than pH1:5 5.0
Salinity	Chloride content is less than 800mg/kg at 600mm soil depth
Sodic conditions	ESP greater than 15%
Low exchangeable calcium and magnesium ratios	Equal to or less than 0.1

5.1.3 Cropping land suitability assessment

The land uses assessed included all thirteen crops nominated from the Regional Frameworks including barley (dryland), chickpea (dryland), cotton (furrow irrigated), maize (dryland), millet (dryland), mungbean (dryland), oat (dryland), safflower (dryland), sorghum (dryland), soybean (dryland), sunflower (dryland), triticale (dryland) and wheat (dryland).

The suitability assessment of each SMU for the various land management options as outlined in the preceding sections, has been summarised in Tables D-1 to D-15 and presented in Appendix D.

Table 5-3 summarises the assessed land suitability classes for each SMU. The overall class is assessed on reviewing the land suitability subclasses across all land uses, not the highest subclass number indicated. This assists in assessing the ALC class.

Table 5-3: Land Suitability Classes, Regional Frameworks Assessment Summary

SMU	Suitability subclasses for different land use summary													
	Barley	Chickpea	Cotton	Maize	Millet	Mungbean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat	Overall Class
C1-BL	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C1-BR	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C3-BL	3	3	4	3	3	3	3	3	3	3	3	3	3	3
C3-BR	5	5	4	4	5	4	5	4	4	4	4	5	5	5
C4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
C5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
K1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
R3	5	5	4	5	5	5	5	5	5	5	5	5	5	5
S1	5	5	4	5	5	5	5	5	5	5	5	5	5	5
S3	5	5	3	4	5	4	5	4	4	4	4	5	5	4
S4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
T1-B	5	5	3	4	5	4	5	4	4	4	4	5	5	4
T1-R	5	5	3	4	5	4	5	4	4	4	4	5	5	4
T2	3	3	4	3	3	3	3	3	3	3	3	3	3	3
T3	5	5	5	5	5	5	5	5	5	5	5	5	5	5

SMUs C3-BL, C4, and T2 present moderate limitations for land uses. SMUs C3-BL and T2 however present severe limitations and are unsuitable for irrigated cotton.

The remaining SMUs (including all UMAs in the nominated SMUs) are unsuitable for the land uses proposed for the region with severe or extreme limitations, except for SMUs T1-R, T1-B, and S3 which present moderate limitations for irrigated cotton.

5.1.4 Grazing land suitability assessment

The following land attributes have been assessed based on the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) suitability for beef cattle grazing, including:

- water availability;
- nutrient deficiency;
- soil physical factors;
- salinity;
- rockiness;
- microrelief;
- wetness;
- water erosion;
- flooding; and
- vegetation.

Field, laboratory, and available public data collected was used as diagnostic attributes to assess the severity of these land attributes and the land suitability class of each soil unit.

Review of the SMUs against the suitability for beef cattle grazing in the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) was undertaken in Table 5-4. This assessment will assist in specifically assessing the limitations for cattle beef grazing.

Table 5-4: SMU, Suitability for Beef Cattle Grazing Summary (Shields and Williams, 1991])

SMU	Water Availability	Nutrient Def	Soil Physical Factors	Salinity	Rockiness	Microrelief	Wetness	Water Erosion	Flooding	Vegetation	Beef Cattle Grazing Class
C1-BL	4	1	2	2	1	2	2	2	1	3	4
C1-BR	4	1	2	2	1	2	2	2	1	3	4
C3-BL	3	2	3	1	1	1	1	2	1	1	3
C3-BR	3	3	1	2	1	1	1	2	1	2	3
C4	2	3	2	1	1	2	2	2	1	3	3
C5	1	3	3	1	1	1	2	2	2	2	3
K1	4	4	3	1	2	1	1	4	1	2	4
R3	4	2	3	1	1	1	1	2	1	1	4
S1	4	3	3	1	1	1	1	4	1	1	4
S3	2	2	3	2	1	1	1	2	1	1	3
S4	4	2	3	1	1	1	1	2	1	1	4
T1-B	3	1	3	1	1	1	1	2	1	1	3
T1-R	3	2	3	1	1	1	1	1	1	1	3

SMU	Water Availability	Nutrient Def	Soil Physical Factors	Salinity	Rockiness	Microrelief	Wetness	Water Erosion	Flooding	Vegetation	Beef Cattle Grazing Class
T2	2	2	3	1	1	1	1	2	1	1	3
T3	4	2	3	2	1	1	1	2	1	1	4

SMUs C3-BL, C3-BR, C4, C5, S3, T1-B, T1-R, and T2 were assessed as Class 3 with moderate limitations. These related to water availability, nutrient deficiency and physical factors.

SMUs C1-BL, C1-BR, K1, R3, S1, S4 and T3 were assessed as Class 4 with severe limitations relating to water availability, nutrient deficiency and water erosion.

5.2 Agricultural Land Classes

5.2.1 Background

ALC are based on a simple hierarchical scheme that is applicable across Queensland. It allows the interpreted land evaluation data to indicate the location and extent of agricultural land that can be used for a wide range of land uses with minimal land degradation.

This evaluation scheme has evolved through various guidelines and state planning policies and is currently referenced in regional shire council planning schemes. ALC assessment guidelines are presented below in Table 5-5.

Table 5-5: Agricultural Land Class Descriptions

Agricultural Land Class[1]	Land Suitability (Cropping)[2]	Land Suitability (Grazing)[2]	Description[1]
A	-	-	Crop land - Land that is suitable for a wide range[3] of current and potential crops with nil to moderate limitations to production.
A1	1-3	1-3	Suitable for a wide range of current and potential broadacre and horticultural[4] crops.
A2	1-3	1-3	Suitable for a wide range of current and potential horticultural crops only.
B	3-4	1-3	Limited crop land - Land that is suitable for a narrow range[5] of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops.
C	-	-	Pasture land - Land that is suitable only for improved or native pastures due to limitations that preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	4-5	1-2	Suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.
C2	4-5	3-4	Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
C3	4-5	4-5	Suitable for light grazing of native pastures in accessible areas and includes steep land more suited to forestry or catchment protection.
D	5	5	Non-agricultural land[6] - Land not suitable for agricultural use, including land alienated from agricultural use.

Agricultural Land Class[1]	Land Suitability (Cropping)[2]	Land Suitability (Grazing)[2]	Description[1]
A/C A/D B/C C/D	-	-	Land that is a complex of class A, B, C or D land where it is not possible to delineate the land class at the map scale. The dominant class is the first code in the sequence and is assumed to be >50% of the area, but <70%[7].

1. Sourced from GALE (DSITI and DNRM, 2015).
2. Land suitability classes are a guide to assess ALC. Reference to Section 5.1 and Table 11, GALE (DSITI and DNRM, 2015) have also been referred to as guidance.
3. A wide range of crops is four or more crop types of local commercial significance.
4. Horticulture includes intensively grown small crops (e.g. vegetables) as well as tree crops (e.g. grown for nuts, seeds or fruit). Silviculture (plantation forestry) is not included.
5. A narrow range of crops is three or fewer crop types (broadacre or horticulture) of local commercial significance. Silviculture (plantation forestry) may be included. Crops with similar agronomic requirements e.g. maize and grain sorghum, peaches and nectarines are not generally regarded as different crop types. Different management regimes (including irrigation strategies) for the same crop do not increase the number of crops.
6. Non-agricultural land includes land that cannot be placed in any of the other land classes and includes land such as urban areas and stream channels.
7. In cases where two or more land classes are equally dominant and none are greater than 50%, judgement is used to identify the most appropriate agricultural land class/es for the unit.

5.2.2 Agricultural land class assessment

The land suitability class of each SMU has been determined using the Regional Frameworks (DSITI and DNRM, 2013) land suitability sub classes land uses (Table 5-3) and *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991) beef cattle grazing land suitability frameworks (Table 5-4) against the ALC assessment (Table 5-5). The results of this assessment are presented in Table 5-6.

Table 5-6: Land Suitability Classes, Regional Frameworks Assessment Summary

SMU	Land Suitability (Cropping)	Land Suitability (Grazing)	ALC
C1-BL	5	4	C2
C1-BR	5	4	C2
C3-BL	3	3	A1
C3-BR	5	3	C2
C4	3	3	A1
C5	4	3	C2
K1	5	4	C2
R3	5	4	C2
S1	5	4	C2
S3	4	3	C2
S4	5	4	C2
T1-B	4	3	C2

SMU	Land Suitability (Cropping)	Land Suitability (Grazing)	ALC
T1-R	4	3	C2
T2	3	3	B
T3	5	4	C2

SMUs with extreme limitations for cropping and grazing were not classified as Class D. These SMUs are still considered to have some value for light grazing and it is viewed by GTE that Class D land would be either have soils that are unable to support native or introduced plant or grass species or be located on landforms such as very steep to precipitous areas.

The regional frameworks, beef cattle grazing classes and ALC assessment are presented on Figures 4, 5 and 6. ALC summary with areas is presented in Table 5-7.

Table 5-7: Study Area Agricultural Land Class Areas

Agricultural Land Class Assessment		
Agricultural Land Class	**SMU**	**Area (ha)**
A1	C3-BL, C4	4,300
A2	-	-
B	T2	398
C1	-	-
C2	C1-BL, C1-BR, C3-BR, C5, K1, R3, S1, S3, S4, T1-B, T1-R, T3	8,878
C3	-	-
D	-	-
Disturbed Areas		25

6 REGIONAL PLANNING INTERESTS ASSESSMENT

The RPI Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The RPI Act protects each of the following areas of regional interest:

- SCAs (strategic cropping areas);
- PAAs (priority agricultural areas);
- PLAs (priority living areas); and
- SEAs (strategic environmental areas).

The study area was assessed against SCA and PAA requirements.

6.1 Assessment of Strategic Cropping Areas

The RPI Act repealed the *Strategic Cropping Land Act 2011*. The repealed policies were migrated into the new legislation through the declaration of the SCA as an area of regional interest. SCA consists of areas identified as strategic cropping land (SCL).

Identification of SCL was undertaken for the study area. Desktop review of the study area was compared to the SCL Trigger Map. SCL was not identified in the Project area and was located to the west, within 10 m away at its closest point (within the Norwich Park Branch Railway corridor). No further assessment is required.

6.2 Assessment of Priority Agricultural Areas

PAAs are areas of regionally significant agricultural production that are identified in a regional plan. Identifying PAAs ensures that resource activities that seek to operate in these areas do not unreasonably constrain, restrict or prevent on-going agricultural operation.

Identification of PAAs was undertaken for the study area. Desktop review of the study area compared to Queensland Government Development Assessment Mapping System confirmed that no PAA was located within the study area, and the nearest areas were situated approximately 100 km to the south.

7 ACID SULFATE SOILS ASSESSMENT

As stated in Section 3.6, a review of the ASRIS including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken.

It was identified that most of the study area is shown as extremely low probability with very low confidence. Areas to the north-west and south-west identify low probability with very low confidence.

Field observations of SMUs were undertaken during the soils and land suitability assessment. These observations have been reviewed against the *State Planning Policy 2/02, Planning and Managing Development involving Acid Sulfate Soils* (Queensland Government, 2002) *Appendix 2: Soil and Water Field Indicators*.

7.1 Assessment of Actual and Potential Acid Sulfate Soils

Assessment of SMUs for AASS and PASS included the following indicators;

- field pH;
    - AASS, when field pH_F ≤4, when field pH_F >4 but <5 may indicate some existing acidity;
    - PASS, when field pH_F >4 and commonly neutral;
- presence of corroded shell (AASS) or shell (PASS);
- jarositic horizons or substantial iron oxide mottling in surface (AASS);
- a sulfurous smell, e.g. hydrogen sulphide or 'rotten egg' gas; and
- dead, dying, stunted vegetation scalded or bare low-lying areas (AASS).

Field pH was initially conducted using a pH indictor kit and meter. Laboratory pH analysis was also reviewed. All other indicators were visually inspected within the soil profile and field as part of the soils and land suitability survey.

A summary of the SMU assessment is shown in Table 7-1.

Table 7-1: Assessment of Field Indicators for AASS/PASS

SMU	AASS / PASS Assessment	Overall Assessment
C1-BL	pH ranges from neutral in topsoil to acidic in subsoils in mound positions and acidic in topsoil to alkaline in subsoils in depression positions, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Low field indication of PASS No field indicators of AASS.
C1-BR	pH ranges from neutral in topsoil, to strongly alkaline to acidic in subsoils in mound positions and acidic in topsoil to strongly acidic in subsoils in depression positions, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Low field indication of PASS No field indicators of AASS.
C3-BL	pH is alkaline in topsoil to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	No field indication of AASS/PASS.
C3-BR	pH is neutral in topsoil to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
C4	pH is neutral in topsoil to alkaline in subsoils in mound positions and alkaline in topsoil varying from alkaline to strongly alkaline in subsoils in depression positions, no observations of corroded shell, jarosite horizons, iron oxide mottling (although light brown mottling observed, it is not considered to be iron oxide), sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
C5	pH is alkaline in topsoil to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
K1	pH is acidic, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Low field indication of PASS. No field indicators of AASS.
R3	pH is acidic throughout, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
S1	pH ranges from acidic in topsoil to alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
S3	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
S4	pH is acidic in topsoil to neutral in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Low field indication of PASS. No field indicators of AASS.
T1-B	pH is neutral in topsoil, varying from alkaline to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell. Soil profile is moderately moist but not observed as water logged.	Very low field indication of PASS. No field indicators of AASS.
T1-R	pH is neutral in topsoil to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell. Soil profile is moderately moist but not observed as water logged.	Very low field indication of PASS. No field indicators of AASS.
T2	pH is acidic in topsoil increasing to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Low field indication of PASS. No field indicators of AASS.
T3	pH is neutral in topsoil and increases to strongly alkaline in subsoils, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.

Seven of the 15 SMUs, C1-BL, C1-BR, K1, R3, S1, S4 and T2 reported acidic pH in soils and all other SMUs indicated neutral to alkaline pH. The remaining indicators (corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils) were not observed at any SMUs. Light brown mottling was observed in SMU C4 representative site 35 at 1.25 mbgl, however this is not considered to indicate iron oxide mottling.

The SMUs with acidic pH were assessed as having a low to very low field indication of PASS and no field indication of AASS. SMUs with neutral or neutral to alkaline pH were assessed as having a very low field indication of PASS and no field indication of AASS. SMU C3-BL (with an alkaline to strongly alkaline pH) had no field indications of AASS and/or PASS.

These results (i.e. low to no field indicators) are consistent with the desktop review against the *Atlas of Australian Acid Sulfate Soils* mapping which showed the study area as extremely low to low probability of PASS/AASS. Acid sulfate soils were not observed during the survey and it is highly unlikely that the study area would include AASS and/or PASS. In the unlikely event conditions of the soil during the Project's life present attributes of PASS or AASS, an ASS environmental management plan should be prepared and implemented.

8 SOIL MANAGEMENT MEASURES

The following management measures are related to the construction and operational activities of the Project.

8.1 Topsoil and subsoil stripping

Areas to be disturbed because of mining activities and infrastructure would require stripping of the topsoil and subsoil, where suitable for rehabilitation (Table 8-1), for reuse in the rehabilitation of these areas. All SMUs in the study area have been assessed to determine their suitability for stripping and reuse for rehabilitation purposes.

Soil stripping, stockpiling and placement would follow a detailed topsoil management plan which would consider the areas to be disturbed, disturbance type, the volumes of soils required for eventual rehabilitation, the management of stockpiling soils, area of placement and volumes of topsoil material to be stripped.

8.2 Specific soil mapping unit stripping recommendations

The sections below give specific recommendations for the removal and management of each of the SMUs identified based on the limitations identified (including ERD limitations in Table 5-2).

These stripping depths are based on single stage stripping only as this has been the preferred method for maximum useable volumes of suitable rehabilitation resource.

The SMUs and recommended rehabilitation uses are provided in Table 8-1.

Table 8-1: Recommended Soil Rehabilitation Use and Stripping Depths

SMU	Topsoil Limitation and Recommended Rehabilitation Use	Recommended Topsoil Stripping Depth (mbgl)	Subsoil Limitation and Recommended Rehabilitation Use	Recommended Subsoil Stripping Depth (mbgl)
C1-BL	*Limitation:* Topsoil is identified as a thin horizon on undulating surface of microrelief clay soils. Stripping operations may be limited to the amount of material removed from the mound positions with supervision. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains.	0.00-0.10 Mound positions depth recommended 0.00-0.30 Depression positions depth recommended	*Limitation:* Subsoil has dispersion and salinity limitations. *Recommended Rehabilitation Use:* Subsoil is not suitable for rehabilitation use. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.	0.00

SMU	Topsoil Limitation and Recommended Rehabilitation Use	Recommended Topsoil Stripping Depth (mbgl)	Subsoil Limitation and Recommended Rehabilitation Use	Recommended Subsoil Stripping Depth (mbgl)
C1-BR	*Limitation:* Topsoil is identified as a thin horizon on undulating surface of microrelief clay soils. Stripping operations may be limited to the amount of material removed from the mound positions with supervision. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains.	0.00-0.10 Mound positions recommended 0.00-0.30 Depression positions depth recommended	*Limitation:* Subsoil has dispersion and salinity limitations. *Recommended Rehabilitation Use:* Subsoil is not suitable for rehabilitation use. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.	0.00
C3-BL	*Limitation:* Nil limitations were observed for rehabilitation use in the surface horizon (A1) and second horizon (B21). *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species.	0.00-0.30	*Limitation:* Subsoil below 0.30 mbgl has dispersive limitations. *Recommended Rehabilitation Use:* Subsoil is not suitable for rehabilitation use. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.	0.00
C3-BR	*Limitation:* Nil limitations were observed for rehabilitation use in the surface horizon (A1) and second horizon (B21). *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species	0.00-0.30	*Limitation:* Subsoil below 0.30 mbgl has dispersive limitations. *Recommended Rehabilitation Use:* Subsoil is not suitable for rehabilitation use. Potential reuse as capping for waste rock due to limitations to a depth of 1.00 mbgl.	0.00
C4	*Limitation:* Topsoil is on an undulating surface of microrelief clay soils. Stripping operations may be limited to the amount of material removed from the mound positions with supervision. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species.	0.00-0.30 Mound positions recommended 0.00-0.30 Depression positions recommended	*Limitation:* Subsoil below 1.10 mbgl has dispersive and salinity limitations *Recommended Rehabilitation Use:* Buried supporting subsoils for topsoil placement. Potential reuse as capping for waste rock due to limitations from 0.80 to 1.00 mbgl.	0.30-1.10 Mound positions recommended 0.30-1.10 Depression positions recommended
C5	*Limitation:* Nil limitations were observed for rehabilitation use in the surface horizon. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species.	0.00-0.10	*Limitation:* Subsoil below 0.80m has marginal dispersive limitations. *Recommended Rehabilitation Use:* Buried supporting subsoils for topsoil placement. Potential reuse as capping for waste rock due to limitations from 0.80 to 1.00 mbgl.	0.10-0.80

SMU	Topsoil Limitation and Recommended Rehabilitation Use	Recommended Topsoil Stripping Depth (mbgl)	Subsoil Limitation and Recommended Rehabilitation Use	Recommended Subsoil Stripping Depth (mbgl)
K1	*Limitation:* Very shallow sandy loam topsoil. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains.	0.00-0.10	*Limitation:* Nil subsoil encountered.	0.00
R3	*Limitation:* Topsoil is identified as loamy sand, which may be unfavourable for landforms with a slope greater than 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.10	*Limitation:* Minor limitation with the shallow subsoils texture of sandy loam, more suited to level plains and supporting topsoil placement. *Recommended Rehabilitation Use:* Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species, on level plains. Buried supporting subsoils for topsoil placement. Subsoils may be stripped in two stages, 0.10-0.40 mbgl may be placed on level plains to 3% sloped areas. Subsoil 0.40-1.00 mbgl may be placed on sloped areas, greater than 3%.	0.10-1.00
S1	*Limitation:* Topsoil is identified as loamy sand, which may be unfavourable for landforms with a slope greater than 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.30	*Limitation:* Subsoil has dispersive limitations from 0.60 mbgl. *Recommended Rehabilitation Use:* Buried supporting subsoils from 0.30-0.60 mbgl for topsoil placement. Buried supporting subsoils from 0.60-1.00 mbgl for topsoil placement on level plains.	0.30-0.60 0.60-1.00
S3	*Limitation:* Electrical conductivity is reported above 0.8dS/m, however this is considered not to be indicative of the SMU. It is recommended that stockpiled SMU S3 be analysed once stripping commences. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species.	0.00-0.10	*Limitation:* Subsoil below 0.10 mbgl does not present the limitations as the topsoil. *Recommended Rehabilitation Use:* Buried supporting subsoils for topsoil placement.	0.10-1.00

SMU	Topsoil Limitation and Recommended Rehabilitation Use	Recommended Topsoil Stripping Depth (mbgl)	Subsoil Limitation and Recommended Rehabilitation Use	Recommended Subsoil Stripping Depth (mbgl)
S4	*Limitation:* Topsoil is identified as loamy sand, which may be unfavourable for landforms with a slope greater than 3%. *Recommended Rehabilitation Use:* Support topsoils of suitable SMUs for the establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including but limited to, erosion and sediment controls, reduced time of bare soils, vegetation establishment.	0.00-0.60	*Limitation:* Subsoil below 0.60m may exhibit marginal dispersive limitations. *Recommended Rehabilitation Use:* Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species, on level plains. Buried supporting subsoils for topsoil placement.	0.60-1.00
T1-B	*Limitation:* Topsoil structure is massive and loose and may be suitable for sloped areas below 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.30	*Limitation:* Subsoil below 0.30 mbgl does not present the same limitations as the topsoil. *Recommended Rehabilitation Use:* Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.	0.30-1.00
T1-R	*Limitation:* Topsoil structure is massive and loose and may be suitable for sloped areas below 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.30	*Limitation:* Subsoil below 0.30 mbgl does not present the same limitations as the topsoil. *Recommended Rehabilitation Use:* Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.	0.30-1.00

SMU	Topsoil Limitation and Recommended Rehabilitation Use	Recommended Topsoil Stripping Depth (mbgl)	Subsoil Limitation and Recommended Rehabilitation Use	Recommended Subsoil Stripping Depth (mbgl)
T2	*Limitation:* Topsoil structure is massive and loose and may be suitable for sloped areas below 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.10	*Limitation:* Subsoil structure is massive and loose and may be suitable for sloped areas below 3%. *Recommended Rehabilitation Use:* Support topsoils with fertiliser and soil conditioning for the establishment of native vegetation and grasses, or other appropriate species. Buried supporting subsoils for topsoil placement.	0.10-1.00
T3	*Limitation:* Topsoil structure is massive and firm and may be suitable for sloped areas below 3%. *Recommended Rehabilitation Use:* Support establishment of native vegetation and grasses, or other appropriate species, on level plains or sloped landforms with appropriate management, including implementation of erosion and sediment controls, reduced time of bare soils, and vegetation establishment.	0.00-0.10	*Limitation:* Subsoil has dispersive limitations. *Recommended Rehabilitation Use:* Subsoil is not suitable for rehabilitation use.	0.00

8.2.1 Soil amelioration and management

The rehabilitation reuse of the soils may be assisted with the following treatments and amelioration recommendations.

- SMUs such as C3-BL with alkaline pH and SMUs T1-R, C3-BR, T1-B, C4 and C5 with marginal alkaline levels may have reduced nitrogen availability for plant growth during revegetation. The use of nitrogen specific fertilisers during rehabilitation (as required during the targeted management of native vegetation or pasture development), will bolster nitrogen levels and would be suitable for alkaline soils.

  The addition of any nutrient should be managed to ensure runoff or excessive use is minimised.

- Gypsum ameliorants may be used to reduce any dispersive attributes for subsoils. This may be applied specifically for subsoils with SMUs C3-BL, C3-BR, C4, S1 and T3.

- SMUs R3, S1, S4, T1-B, T1-R, T2 and T3 have minimal limitations with the exception that topsoil consists of massive structure and/or loamy sands which may be unfavourable in sloped areas of rehabilitation due to soil structure. It is recommended that it be considered to support other suitable SMU topsoil volumes. If additional rehabilitation volumes of topsoil are required, SMUs S1 and S4 may be used separately, however, they are recommended on level plains.
- Reduce time bare soils are exposed by planting native grasses or other appropriate species and encouraging organic matter horizon, preferably during dry season.
- Contour ripping of soils during the rehabilitation process will reduce erosion and hard setting of surfaces prior to vegetation establishment.

8.2.2 Summary of recommended soil stripping depths and volumes available

Table 8-2 presents the recommended stripping depths for each SMU and total estimated available topsoil and subsoil reserves from areas likely to be disturbed. Topsoil stripping depths are presented on Figure 7. The estimates in Table 8-2 have been prepared based on the maximum Project surface development areas.

Table 8-2: Recommended Rehabilitation Stripping Depths and Approximate Volumes Available

SMU	Recommended Topsoil Stripping Depth in Soil Profile (mbgl)	Recommended Subsoil Stripping Depth in Soil Profile (mbgl)	Area of SMU Likely to be Disturbed (ha)	Approximate Topsoil Volume Available (cubic metres [m^3])	Approximate Subsoil Volume Available (m^3)
C1-BL (Mound)	0.00 – 0.10	0.00	132	66,000[1]	0
C1-BL (Depression)	0.00 – 0.30	0.00	132	198,000[1]	0
C1-BR (Mound)	0.00 – 0.10	0.00	1,476	738,000[1]	0
C1-BR (Depression)	0.00 – 0.30	0.00	1,476	2,214,000[1]	0
C3-BL	0.00 – 0.30	0.00	2,042	6,126,000	0
C3-BR	0.00 – 0.30	0.00	2,774	8,322,000	0
C4 (Mound & Depression)	0.00 – 0.30	0.30-1.10	150	450,000[2]	1,200,000[2]
C5	0.00 – 0.10	0.10 – 0.80	90	90,000	630,000
K1	0.00 – 0.10	0.00	16	16,000	0
R3	0.00 – 0.10	0.10 – 1.00	0	0	0
S1	0.00 – 0.30	0.30 – 1.00	161	483,000	1,127,000
S3	0.00 - 0.10	0.10 – 1.00	24	24,000	216,000
S4	0.00 - 0.60	0.60-1.00	87	522,000	348,000
T1-R	0.00 - 0.30	0.30 - 1.00	8	24,000	56,000

SMU	Recommended Topsoil Stripping Depth in Soil Profile (mbgl)	Recommended Subsoil Stripping Depth in Soil Profile (mbgl)	Area of SMU Likely to be Disturbed (ha)	Approximate Topsoil Volume Available (cubic metres [m^3])	Approximate Subsoil Volume Available (m^3)
T1-B	0.00 - 0.30	0.30 - 1.00	0	0	0
T2	0.00 - 0.10	0.10 - 1.00	21	21,000	189,000
T3	0.00 - 0.10	0.00	149	149,000	0
TOTAL			**7,130**	**19,443,000**	**3,766,000**

1. Volumes are based on half of the SMU area, i.e. mound position. Note, these volumes represent the maximum volume of available topsoil, as loss of soil resource during stripping activities associated with microrelief areas may occur due to the undulating nature of the soils.
2. Linear gilgai microrelief areas was observed to be shallow with minimum difference between mound and depression. Therefore, the loss of soil resource during stripping activities will be minimal.

8.2.3 Recommended topsoil application depths for rehabilitation

It is recommended that the placement depth of topsoil to rehabilitate the Project final landform to pasture or native woodland be 0.20 m to 0.30 m.

Based on the available topsoil (Table 8-2), a nominal minimum re-application depth of approximately 0.20 m could be applied to rehabilitate the Project landform. Accordingly, there would be sufficient soil available to meet the recommended placement depth (i.e. 0.20 m to 0.3 m).

Notwithstanding the above, to supplement topsoil resources (if required), a layer of suitable subsoils (Table 8-1) could be placed up to 0.05 m deep (or a similar minimal practicable application depth) and capped with approximately 0.15-0.20 m of topsoil. In addition, subsoils that are suitable for rehabilitation (e.g. 0.10-1.00 m of T2, Table 8-1), could be mixed with suitable topsoils to create slightly reduced quality topsoil that would still be suitable for rehabilitation. Approximately 0.20 m to 0.30 m of this combined topsoil/subsoil should be placed on the Project final landform.

9 LAND USE IMPACTS AND FINAL LAND USE

9.1 Rehabilitation of the Project Area

Areas which would be disturbed by the Project (e.g. mining activities and associated infrastructure) would require rehabilitation. As the primary source of disturbance for the Project would be from the open cut operation, surface rehabilitation would form a significant portion of the study area. Current mine planning indicates that changes in pre-mining land use and suitability would involve approximately 7,130 ha of the study area.

Key activities that would require significant rehabilitation works because of direct surface disturbance include (Figure 2):

- open-cut mining and out-of-pit waste rock emplacement areas;
- mine infrastructure area, including a CHPP, ROM pads, workshops, offices, raw and product handling systems, coal processing plant, rail spur and loop and train load-out facility;
- mine access road and internal roads;
- water supply and management infrastructure, including a raw water supply pipeline, sediment dams and storage dams, pumps, pipelines and other water management equipment and structures (including up-catchment diversions, drainage channel realignments and levees); and
- ancillary infrastructure including electricity supply, consumable storage areas, explosives storage facilities, crib facilities, bathhouse, warehouse, workshop and re-fuelling facilities.

The remainder of the study area (approximately 6,471 ha) would either not be disturbed or would have altered local topography from local impacts such as access roads or other minor infrastructure.

9.2 Post-mining Land Use Suitability

Post-mining land use suitability is influenced by various factors including physical, biological and chemical changes of soil, depth of soil and slope gradient and length in the final landform design. Open cut mining activities are expected to change the nature of the final landform and suitability for land use activities.

Overall rehabilitation concepts envisaged specific to the Project components are summarised in Table 9-1.

Table 9-1: Disturbance Types, Rehabilitation Recommendations and Post-mining Land Use

Potential Disturbance Type	Proposed Rehabilitation Strategy Recommendations	Proposed Post-mining Land Suitability Class
Open cut mining Out-of-pit waste rock emplacement areas	Final landform design would be developed in consideration of suitable soil attributes, depths and slopes. Open cut mining areas would be partially backfilled with suitable waste rock and capped with subsoil and topsoil rehabilitation reserves. Open cut mining areas would be backfilled up to the pre-mining surface level or higher with batters to be graded to 18%/10 degrees (°) slope on highwall and battered down. No areas would exceed 20% slope. The overall goal wherever possible is for landforms to be regraded where at least 70% of the land surface is <10% slope. Areas throughout the landform (e.g. ramp or pit batters), where the proportion of land with <10% slope will be less than 70%; would have reduced grazing land suitability potential. Implementation of practical drainage designs would ensure that any area affected by settling would be sufficiently drained to ensure that pre-existing productive uses can be returned. This may include targeted earthworks programs in areas of excessive cracking or to produce a desirable surface topography. Rehabilitated areas would be topsoiled and seeded with native grasses or other appropriate species. Monitoring would assess remediation success for an appropriate period. The Environmental Management Plan, or equivalent, would detail methods, success criteria and management of all rehabilitation areas. Coal rejects would be managed in accordance with the recommendations in the Geochemistry Assessment (Terrenus Earth Sciences, 2020). An ongoing, post-mining management plan would be documented.	**>70% of the land is <10% slope of land surface** Class 3 - Grazing Class 5 - Cropping **>30% of the land has slope in the range 10-15% with <10% of the land exceeding 15% slope** Class 4 - Grazing Class 5 - Cropping
Residual voids	Low-wall slopes would be seeded with native grasses or other appropriate species, except low-walls adjacent to the residual void highwall (slopes greater than 18%), as this low-wall area would not be considered suitable to support cropping or grazing due to the steepness of the slope. Areas would be fenced off on highwall sides to prevent access by livestock. If water ponds from surrounding surface and groundwater, initial environmental monitoring will assess the risk to cattle and native wildlife. If deemed unsuitable for consumption by fauna, the area would be fully fenced off. A management plan for the residual voids would be developed and would include, but not limited to, the following: long term geotechnical stability and hydrogeology of the void pit lake, water quality assessment of the void, ongoing management and maintenance of drainage structures, fences, signs and pumping/moving of water as required.	**Residual Void Low-walls with <18% slope** Class 5 - Cropping/Grazing **Residual Void Low-walls with >18% slope, Highwalls and Pit Lake** N/A[1]
General infrastructure including potentially contaminated areas (e.g. coal preparation plant, workshops and vehicle servicing and wash down stations)	Infrastructure would be assessed on an individual basis for possible removal or whether it can be retained for future landowners. Infrastructure would be removed, and areas prepared and re-seeded if necessary. Location of all such areas would be recorded in a Progressive Rehabilitation and Closure Plan (PRC Plan). Potentially contaminated areas would undergo Stage 1 and 2 contaminated land assessments. A Remediation Plan for potentially contaminated areas would be prepared. Remediation works to remove contaminated material or rip, cap and topsoil inert areas. Areas would be seeded with native grasses or other appropriate species. Aim is to assess and remediate any residual contamination in a manner described for potentially low risk contaminated areas. Monitoring would assess remediation success for an appropriate period. The Environmental Management Plan, or equivalent, would detail methods, success criteria and management of all rehabilitation areas.	Same classes as pre-mining

Potential Disturbance Type	Proposed Rehabilitation Strategy Recommendations	Proposed Post-mining Land Suitability Class
Coal material (ROM pad and product coal stockpile) Laydown areas	Coal material and stockpile base would be removed. Areas would be capped and topsoiled, ripped and seeded with pasture grasses. It is anticipated that these areas would return to grazing lands consistent with pre-mining suitability.	Same classes as pre-mining
Water management structures	Water management structures would be individually assessed as they may provide future benefit to agricultural activities prior to being decommissioned. If no value in retaining the water management structures is assessed, the water management structures would be dewatered, capped and rehabilitated using topsoil and pasture grasses.	Same classes as pre-mining
Linear infrastructure (raw water pipeline, rail spur and loop, ETL and mine access road)	Infrastructure would be assessed, and either decommissioned and removed, and the area would be rehabilitated to previous landforms or retained for future use, as part of the post-mining land use.	Same classes as pre-mining

1. No agricultural use is proposed for the low-walls adjacent to the highwalls of the residual voids (slopes >18%), the highwalls and pit lakes of the residual voids, as such no post-mining land suitability class has been assigned to these areas.

Table 9-2 summarises the expected changes in agricultural land suitability area following mining if the recommendations in Table 9-1 are implemented. Figures 8 and 9 present the distribution of post-mining land suitability classes.

Table 9-2: Post-mining Land Suitability Changes

Land Suitability - Cropping			Land Suitability - Grazing		
Class	**Pre-mining (ha)**	**Post-mining# (ha)**	**Class**	**Pre-mining (ha)**	**Post-mining# (ha)**
1	0	0	**1**	0	0
2	0	0	**2**	0	0
3	4,698	3,369	**3**	8,353	4,613
4	436	271	**4**	5,223	3,912
5	8,442	9,360	**5**	0	0
-	-	-	**3 / 4***	0	4,474
Disturbed Areas	25	25	Disturbed Areas	25	25
N/A	-	576	N/A	-	576
Total	**13,601**	**13,601**	**-**	**13,601**	**13,601**

Specific areas are subject to change as part of the PRC Plan process.

* Open cut mining and out-of-pit waste rock emplacement areas, refer Table 9-1 for description.

9.3 General Rehabilitation Strategy

All disturbances would be recorded in a PRC Plan and updated as per the *Guideline – Progressive rehabilitation and closure plans (PRC plans)* (DES 2019) The rehabilitation objective is to return all disturbed areas to their pre-disturbance land suitability potential or to the level described in an Environmental Management Plan, or equivalent (e.g. a PRC Plan), for the Project.

Stable landforms would be established following mining, using soils capable of supporting vegetation communities adapted to the local environment. Topsoil and subsoils would be assessed for quality and, where suitable, would be retrieved and managed according to a Topsoil Management Plan during the life of the Project.

The stability of the post-mine landform would be achieved by applying sound rehabilitation practices based on industry knowledge and science. Disturbed land would be rehabilitated to a condition that is self-sustaining or to a condition where the maintenance requirements are consistent with the pre-mining land use.

Rehabilitation strategies for the study area would include all areas of disturbance and would be reviewed on a regular basis to consider any changes to mine operations, changes in legislative requirements and/or results of ongoing studies and monitoring.

The rehabilitation strategies have been developed after consideration of the *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (DME, 1995) and *EIS information guideline – Rehabilitation* (EHP, 2016).

In particular, the following guidelines shall be considered:

- Progressive Rehabilitation - which describes the advantages of and opportunities and strategies for progressive rehabilitation;
- Assessment and Management of Acid Drainage - which addresses the identification, evaluation and management of solid waste materials with potential to generate acid drainage and/or heavy metal toxicity;
- Erosion Control - which addresses the prediction, control and measurement of soil erosion on mining lease areas;
- Growth Media Management - which outlines the selection, handling, storage, treatment and replacement of soils and other media to be used for establishing and growing vegetation on land following mining;
- Mine Site Decommissioning - which addresses the closure and decommissioning of areas, works and facilities used for mining;
- Site Water Management - which discusses the management of water at the Project to reduce the amount of contaminated water that may need to be handled;
- Water Discharge Management - which addresses the management of water discharged from the Project to ensure compliance with statutory requirements and protection of downstream uses;

- progressive rehabilitation of disturbed areas, using rehabilitation procedures appropriate to the type of disturbance;
- a rehabilitation monitoring program to assess the success of rehabilitation;
- a corrective action program to address areas of failed rehabilitation; and
- preparation of final rehabilitation report prior to surrender of the mining leases.

10 CONCLUSION

The following conclusions have been made for the soils and land suitability assessment for the study area:

- Fifteen SMUs are present in the study area.
- The study area includes areas of flat to gently undulating plains dominated by uniform and gradational clays with microrelief (C1-BL, C1-BR and C4), uniform and gradational clays (C3-BL, C3-BR and C5), texture contrast soils on gently undulating plains (R3, S1, T1-R, T1-B, T2 and T3), texture contrast soils on wide crests (S3), uniform sands on plains (S4) and shallow sandy earths (K1).
- Land use suitability assessment of the fifteen SMUs was determined against the Regional Frameworks (DSITI and DNRM, 2013), GALE (DSITI and DNRM, 2015) and *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).
    - SMUs C3-BL, C4, and T2 present moderate limitations for cropping land uses. Limitations include PAWC, erosion hazards, surface conditions and moisture range.

      SMUs C3-BL and C4 were assessed as ALC rating A1 and suitable for a wide range of current and potential broadacre and horticultural crops.

      SMU T2 was assessed as ALC rating B and is suitable for a narrow range of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops.
    - The remaining SMUs were assessed as unsuitable for cropping land uses and suitable for beef cattle grazing land use.

      SMUs C1-BL, C1-BR, C3-BR, C5, K1, R3, S1, S3, S4, T1-B, T1-R and T3 were assessed as ALC rating C2 and are suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
    - Disturbed areas consist of 25 ha.
- Topsoil for rehabilitation use (e.g. able to support the establishment of native vegetation and grasses, or other appropriate species) is available from all SMUs, with S3 recommended to be analysed once stripping commences prior to use for rehabilitation due to the potential for high salinity in the topsoil. SMUs recommended for level plains or sloped backfill batters above 3% include C3-BL, C3-BR, C4, C5 and S3. SMUs recommended for level plains or slopes equal to or less than 3% include C1-BL, C1-BR, K1, R3, S1, S4, T1-B, T1-R, T2 and T3, with R3, S1, S4, T1-B, T1-R, T2 and T3 available for use on slopes above 3% with appropriate management such as the application of gypsum ameliorants, surface preparation including ripping of topsoils, erosion and sediment controls, reduced exposure time of bare soils and vegetation establishment of rehabilitated areas

- Subsoil suitable for supporting the establishment of natural vegetation growth with additional soil fertility conditioning and the potential to increase topsoil reserves is limited due to dispersive and salinity attributes for most SMUs. SMUs C4, C5, R3, S1, S3, S4, T1-B, T1-R and T2 may provide suitable subsoils for rehabilitation use. All remaining SMUs are not suitable for rehabilitation use and more suited as potential capping of waste rock.
- No areas of regional interest, including any SCAs or PAAs, are located within the Project area.
- Acid sulfate soils were not observed during the survey and it is highly unlikely that the study area would include AASS and/or PASS. In the unlikely event conditions of the soil during the Project's life present attributes of PASS or AASS, an ASS environmental management plan should be prepared and implemented.
- The proposed post-mining final land use for most of the study area may include beef cattle grazing activities and cropping activities. It has been assumed that part of the residual void areas (e.g. steep sections of the low-wall [>18% slope], the highwalls and pit lake) would be unsuitable for beef cattle grazing or cropping activities. It is expected that undisturbed areas of the study area would remain the same classes identified pre-mine.

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12 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

Acid sulfate soils. Acid sulfate soil is the common name for soils that contain metal sulfides. In an undisturbed and waterlogged state, these soils may pose no or low risk. However, when disturbed or exposed to oxygen, acid sulfate soils undergo a chemical reaction known as oxidation. Oxidation produces sulfuric acid which has led to these soils being called acid sulfate soils.

Apedal. Describes a soil in which none of the soil material occurs in the form of peds or soil aggregates in the moist state.

ASC. Australian soil class.

ASPAC. Australasian Soil and Plant Analysis Council.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger. CEC is often used as a measure of soil fertility and nutrient retention capacity.

Chromosol. Soils with a clear or abrupt textural B horizon and in which the major part1 of the upper 0.2 m of the B2 horizon (or a major part of the entire B2 horizon if it is less than 0.2 m thick) is not strongly acid.

Clay. A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.

Complete disturbance. Extensively cleared pasture land.

Dermosol. Soils with structured B2 horizons and lacking strong texture contrast between A and B horizons.

Dispersion. A process by which species in solution mix with a second solution, thus reducing in concentration. In the case of sodic soils, it will predispose the soil material to lose structure and disseminate into the solution.

Dispersion Ratio (R1). The measurement of soil dispersion when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour

Effective Soil Depth (ERD). The depths of which vegetation roots may readily penetrate the soil profile, have access to water and nutrients and not be restricted by physical (e.g. hard pans) or chemical barriers (e.g. elevated chloride ≥800 mg/kg).

EIS. Environmental Impact Statement.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. The EC of soils will vary depending on the texture and amount of moisture held by the soil particles. Electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.

Erosion. The displacement of soil, rock or dissolved material by wind or water flow from one location on the earth and then travels to another location.

Exchangeable Sodium Percentage (ESP). The amount of sodium as a proportion of all cations in a soil is termed the Exchangeable Sodium Percentage. It is calculated by dividing the exchangeable sodium by the CEC (cation exchange capacity), multiplied by 100. ESP values greater than 6% are considered sodic, with values greater than 15% considered very sodic. ESP = (Exchangeable sodium (meq/100g)/Cation exchange capacity (meq/100g)) x 100.

Extensive disturbance. Extensive clearing of an area for use of pastures.

Field pH. The measurement of the pH in the field by utilising Manutec Pty Ltd, Soil pH Test Kit. This kit consists of pH dye indicator, Barium Sulphate and reference colour chart.

Gradational. The lower boundary between soil layers (horizons) has a gradual transition to the next layer. The solum (soil horizon) becomes gradually more clayey with depth.

Gradient. The rate of inclination of a slope. The degree of deviation from the horizontal.

Horizon. An individual soil layer, based on texture and colour, which differs from those above and below.

Kandosol. Soils which lack strong texture contrast, have massive or only weakly structured B horizons, and are not calcareous throughout.

Layer. See Horizon.

Loam. A medium textured soil of approximate composition 10-25% clay, 25-50% silt and >50% sand.

Massive. Refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.

Meter pH. The measurement of the pH in the field by utilising a TPS Aqua-CP/A meter.

Mottles. Areas of contrasting colour in the overall soil colour which are caused by anerobic conditions because of poor aeration. Usually an indicator of poor drainage and retention of water.

NATA. National Association of Testing Authority.

Ped. An individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.

Pedality. Describes a soil in which some or all the soil material occurs in the form of peds in the moist state.

pH. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

pH 1:5 water. A measure of the acidity / alkalinity of the soil. In this method, soil is shaken in water. Neutral = pH 7.

Potential Acid Sulfate Soils (PASS). Soils or sediments that contain sulfides and have the potential to oxidise and become severely acidic.

Profile. The solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Representative Site. A location deemed very representative of the soil mapping unit for which detailed characterisation is to be done.

Semi-disturbance. Limited clearing of an area, an example is selected logging.

Sodic. Also commonly referred to as a non-saline alkali soil. It is a soil that contains sufficient exchangeable sodium and does not contain appreciable quantities of soluble salts. A term given to soil with a level of exchangeable sodium cations greater than 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations.

Soil Mapping Unit (SMU). Soils grouped into a single management unit based on similar morphology, position on the landscape, substrate and chemistry.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

Tenosol. Soils with generally only weak pedologic organisation apart from the A horizons.

Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

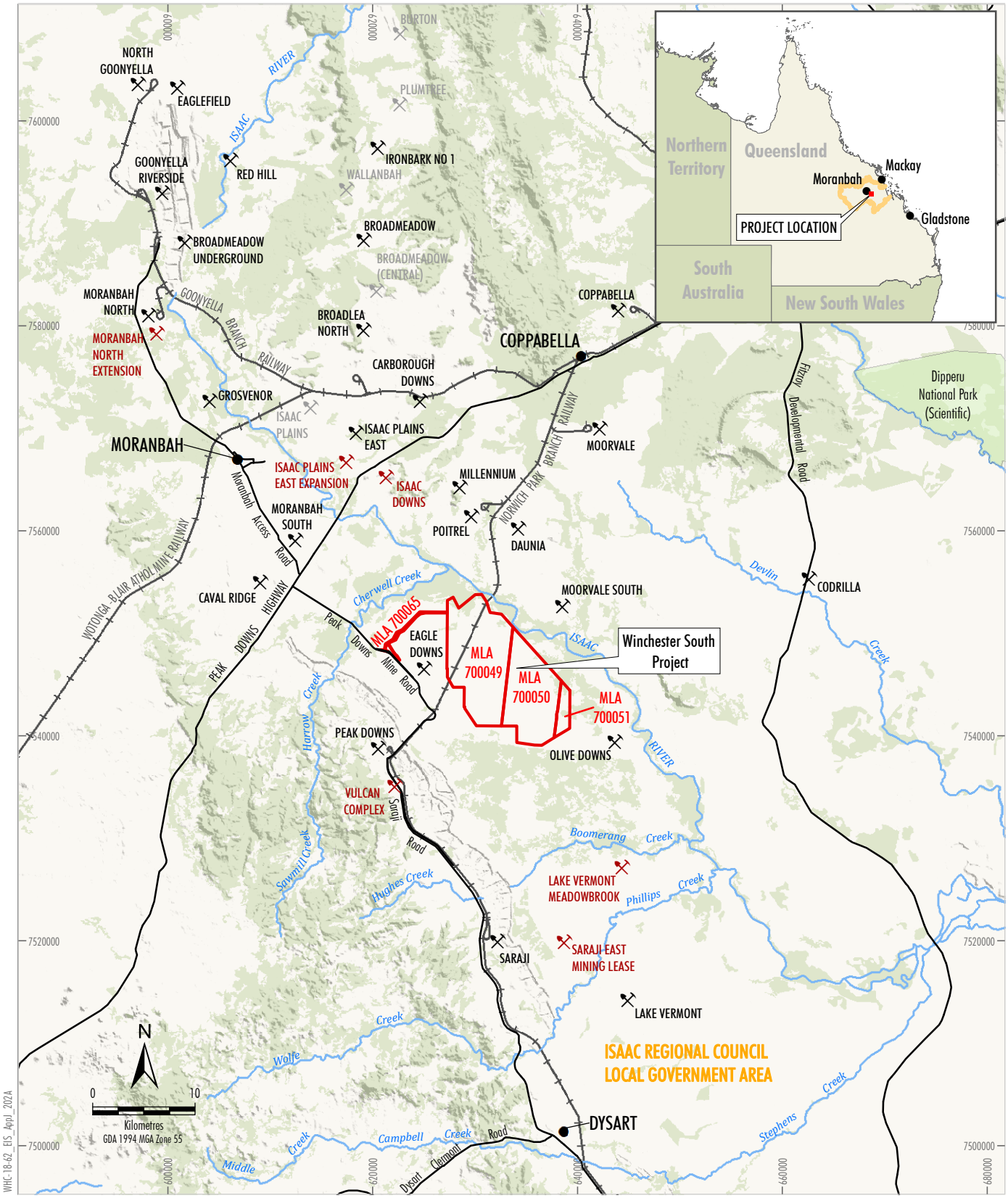
Topsoil. Part of the soil profile, typically the A1 horizon, containing material, which is usually darker, more fertile and better structured than the underlying layers.

Unique Mapping Area (UMA). Individual polygon areas of a SMU. If applicable, allows minor sub-dominant diagnostic attributes in the SMU, such as a degree of rockiness, slope or microrelief to be determined on a per polygon basis.

Variant (Soil). a soil with one or more attributes outside the usual range for a defined soil profile class, but because of its restricted distribution (or because the varying properties are not considered to have particular management.

Vertosol. Soils that have a clay field texture of 35% or more clay throughout the solum except for thin, surface crusty horizons 0.03m or less thick, have open cracks at some time in most years that are at least 5mm wide and extend upward to the surface or to the base of any plough layer, self-mulching horizon, or thin, surface crusty horizon and at some depth in the solum have slicken sides and/or lenticular peds.

13 FIGURES



WHC-18-62_EIS_App1_202A

LEGEND
- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Local Government Area Boundary
- Railway
- Road

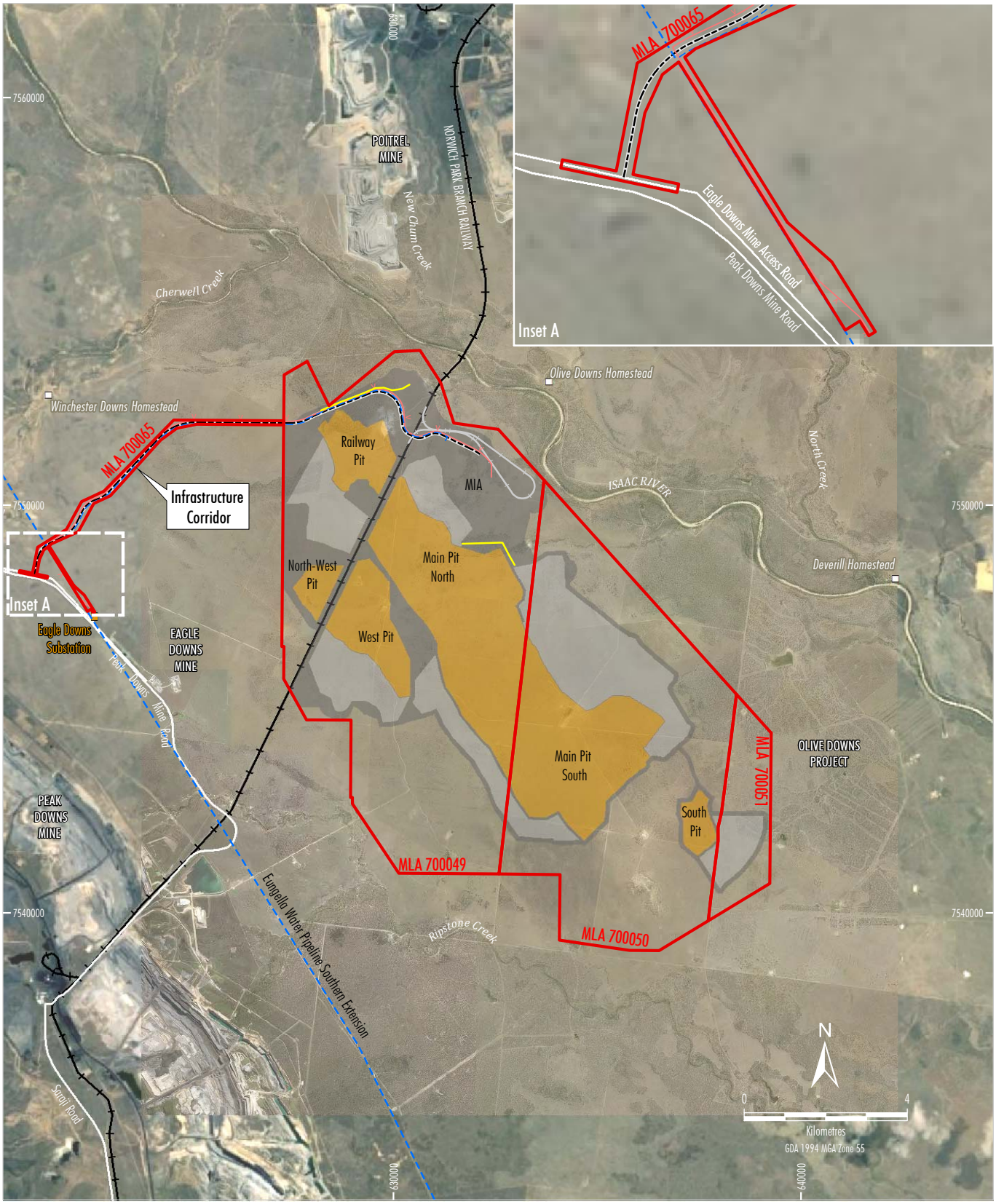
Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project Location

Figure 1



WHC-18-62_EIS_Appl_201A

LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project Layout

Figure 2

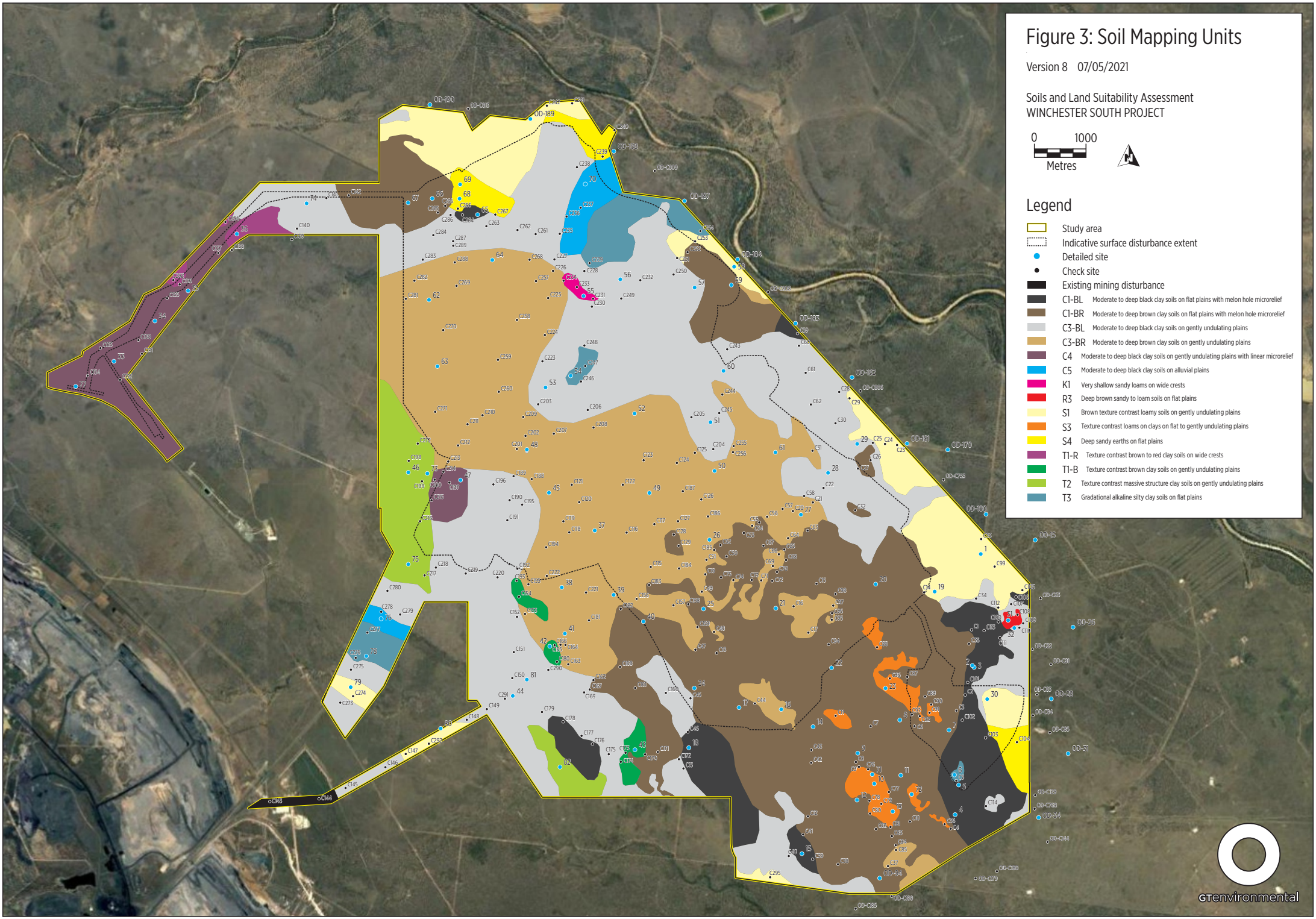


Figure 3: Soil Mapping Units
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0 1000
Metres
Legend
Study area
Indicative surface disturbance extent
Detailed site
Check site
Existing mining disturbance
C1-BL Moderate to deep black clay soils on flat plains with melon hole microrelief
C1-BR Moderate to deep brown clay soils on flat plains with melon hole microrelief
C3-BL Moderate to deep black clay soils on gently undulating plains
C3-BR Moderate to deep brown clay soils on gently undulating plains
C4 Moderate to deep black clay soils on gently undulating plains with linear microrelief
C5 Moderate to deep black clay soils on alluvial plains
K1 Very shallow sandy loams on wide crests
R3 Deep brown sandy to loam soils on flat plains
S1 Brown texture contrast loamy soils on gently undulating plains
S3 Texture contrast loams on clays on flat to gently undulating plains
S4 Deep sandy earths on flat plains
T1-R Texture contrast brown to red clay soils on wide crests
T1-B Texture contrast brown clay soils on gently undulating plains
T2 Texture contrast massive structure clay soils on gently undulating plains
T3 Gradational alkaline silty clay soils on flat plains
GTenvironmental

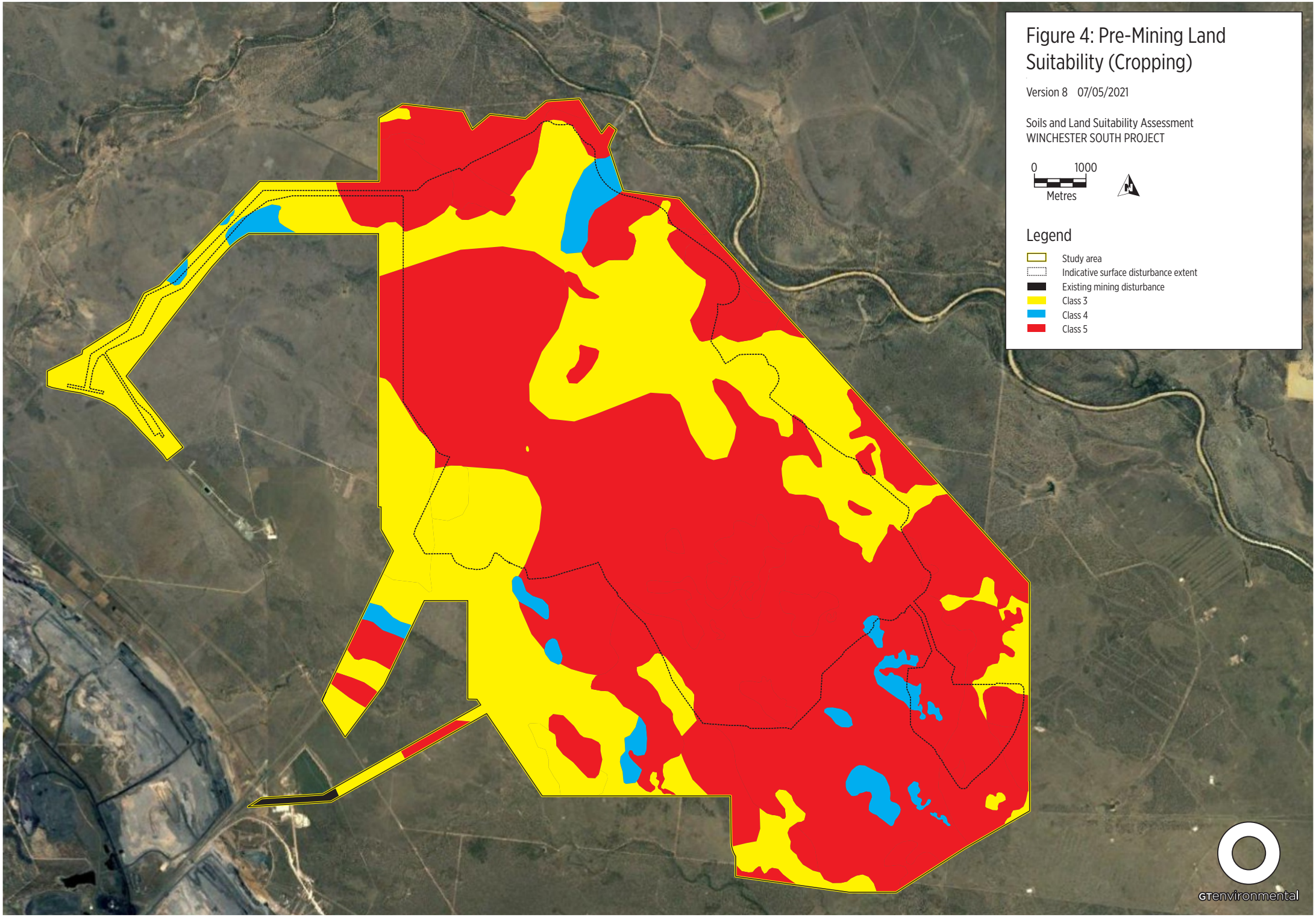


Figure 4: Pre-Mining Land Suitability (Cropping)
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
Class 3
Class 4
Class 5
GTenvironmental

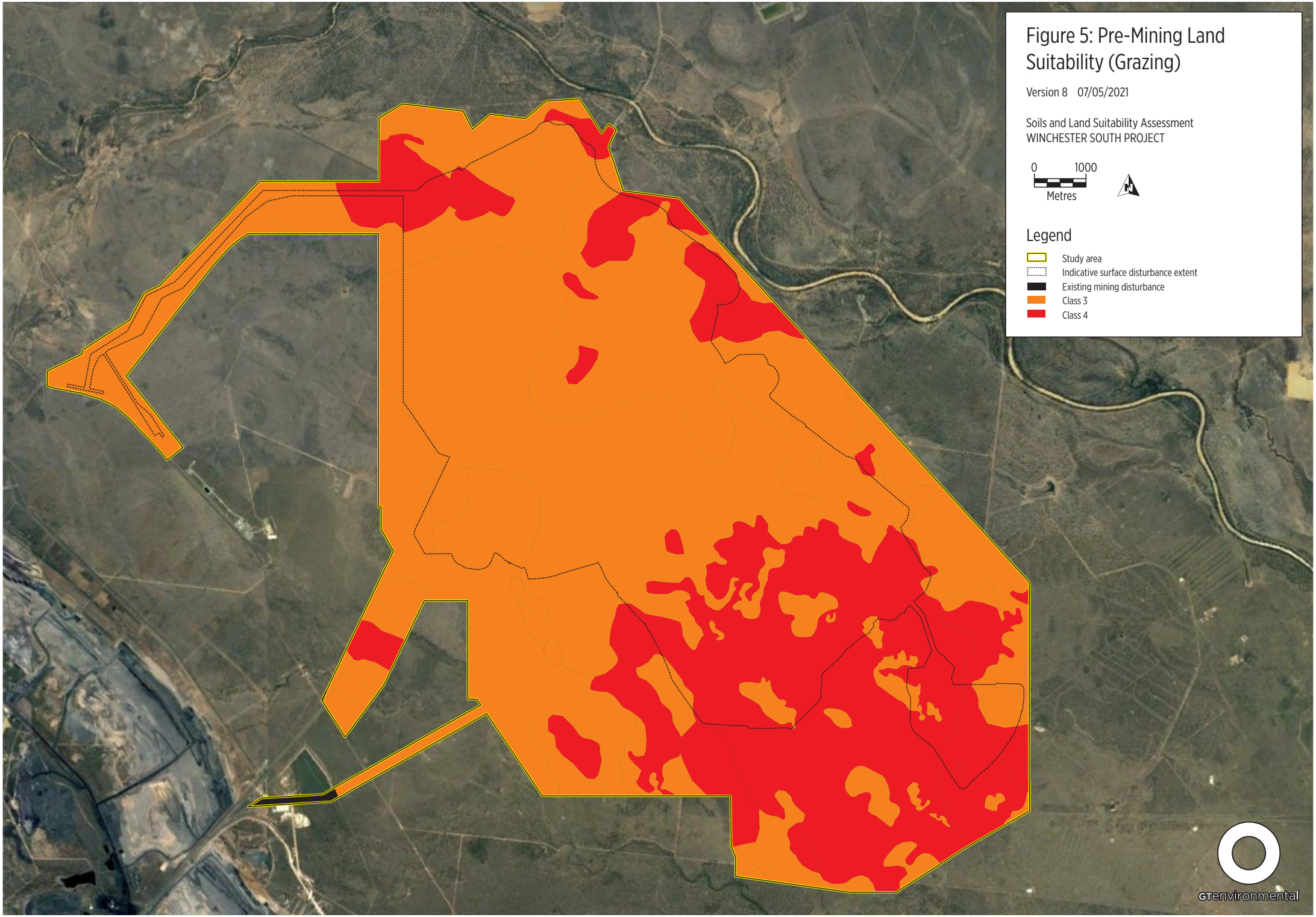


Figure 5: Pre-Mining Land Suitability (Grazing)
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
Class 3
Class 4
GTenvironmental

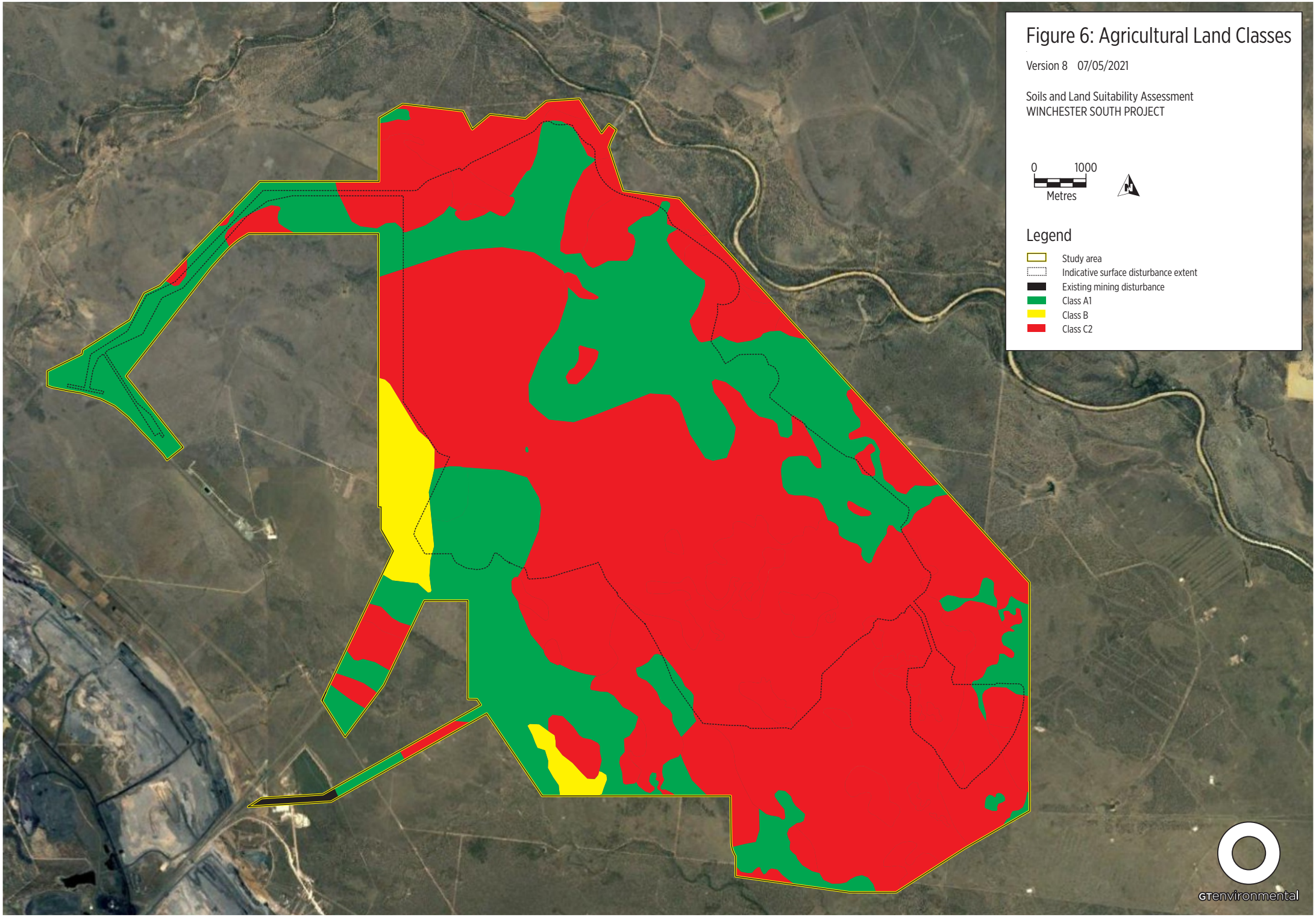


Figure 6: Agricultural Land Classes
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
Class A1
Class B
Class C2
GTenvironmental

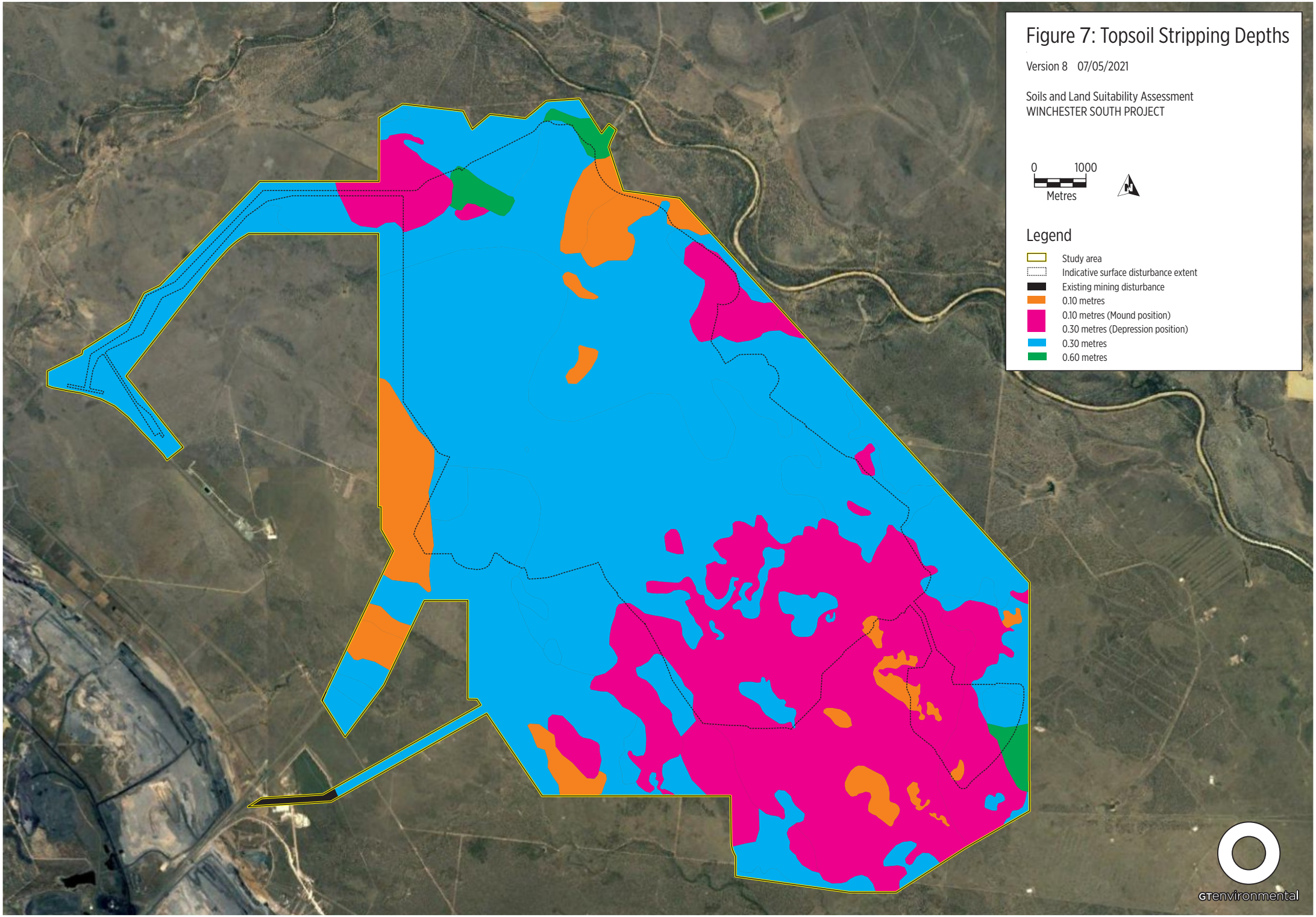


Figure 7: Topsoil Stripping Depths
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
0.10 metres
0.10 metres (Mound position)
0.30 metres (Depression position)
0.30 metres
0.60 metres
GTenvironmental

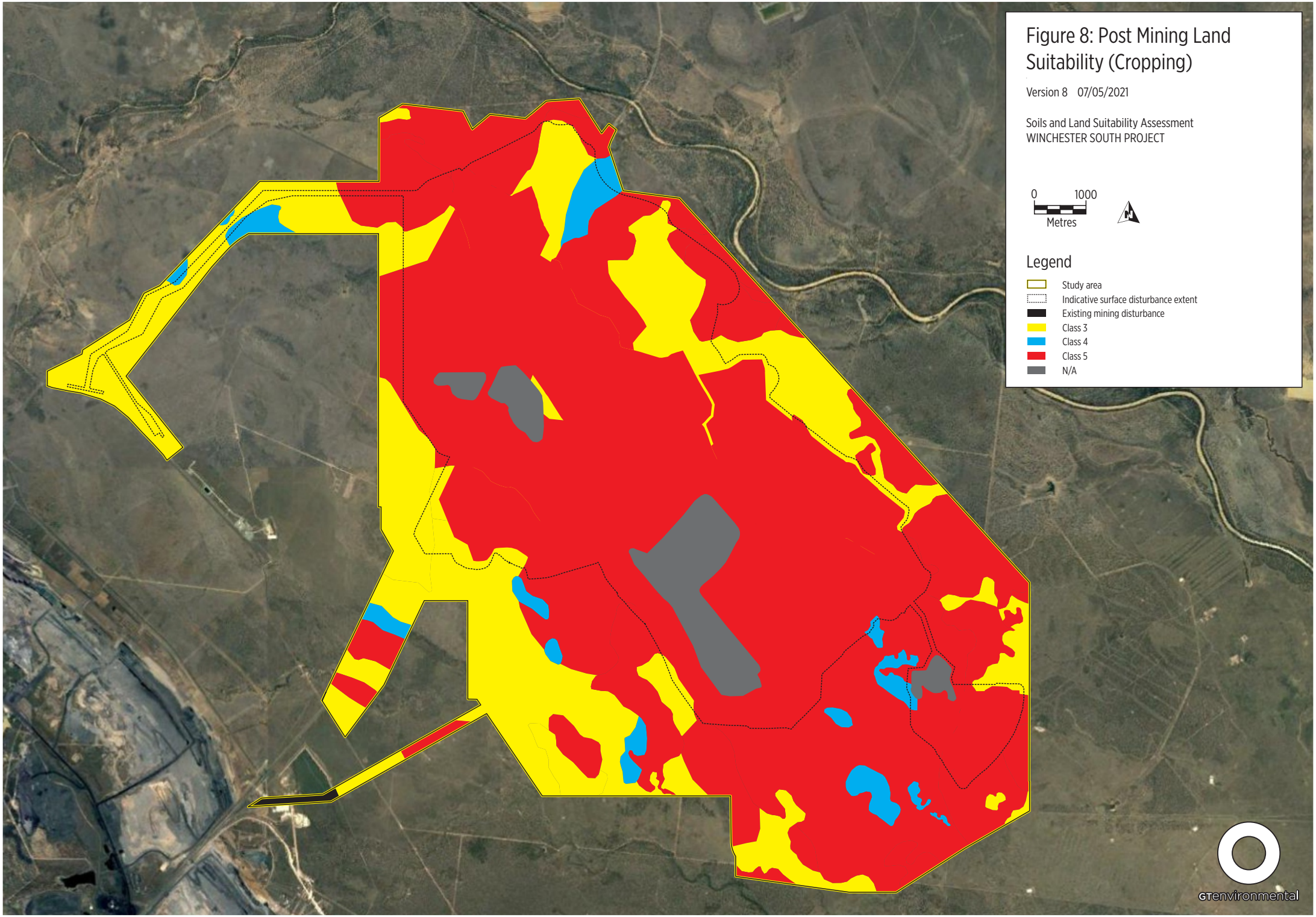


Figure 8: Post Mining Land Suitability (Cropping)
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
Class 3
Class 4
Class 5
N/A
GTenvironmental

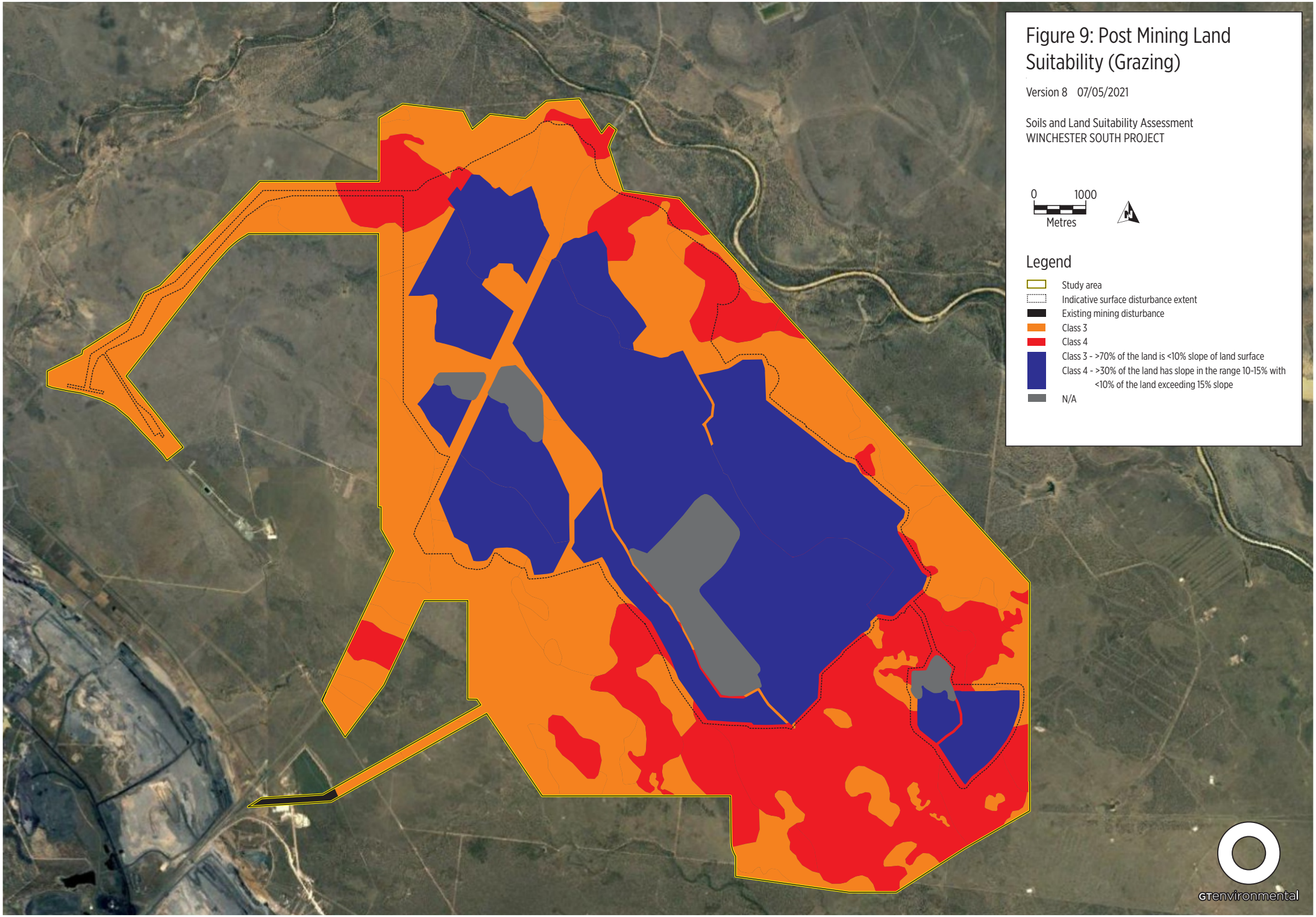


Figure 9: Post Mining Land Suitability (Grazing)
Version 8 07/05/2021
Soils and Land Suitability Assessment
WINCHESTER SOUTH PROJECT
0
1000
Metres
N
Legend
Study area
Indicative surface disturbance extent
Existing mining disturbance
Class 3
Class 4
Class 3 - >70% of the land is <10% slope of land surface
Class 4 - >30% of the land has slope in the range 10-15% with <10% of the land exceeding 15% slope
N/A
GTenvironmental

14 APPENDICES

Appendix A Detailed site descriptions

Appendix B Check site descriptions

Appendix C Laboratory certificates

Appendix D Regional Frameworks Land Suitability Limitations Review

SITE 1

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	638334 7545005	Brown Sodosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, Simple Slope 2%/2%	Poplar Box	Nil microrelief, Semi disturbance Nil erosion	Soft, <1% coarse fragments <5mm	A11 0.00-0.21 Abrupt	Loamy Sand	Loose, apedal	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.35-0.45 0.60-0.70 0.90-1.00	Nil
				A12 0.21-0.33 Abrupt	Loamy Sand	Loose, apedal	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, Rapid	Common	0.30 / 6.0		
				A13 0.33-0.54 Abrupt	Loamy Sand	Massive 30% <20mm peds	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, Well	Few	0.40 / 6.5		
				B2 0.54-1.00 End of borehole (EOBH)	Sandy clay loam	Weak to moderate, firm, angular <20mm peds	<2% manganese nodules	10YR5/6 Yellowish brown Mottle <10% 10YR6/8 Brownish yellow Nil bleaching	Dry, moderate to imperfect	Fine	0.60 / 7.0		

SITE 2 - Mound

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	638156 7542869	Black Vertosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Dawson Gum and Brigalow regrowth	Melon hole 40% coverage, 3-10m wide, 0.3-0.6m deep Semi disturbance	Firm, cracking Nil coarse fragments	A1 0.00-0.12 Abrupt	Medium clay	Moderate, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.05 / 5.5-6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Borehole conducted on the mound
				B21 0.12-0.50 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0		
				B22 0.50-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular <40mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90m / 5.5		

SITE 2 - Depression

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	638156 7542869	Black Vertosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Melon hole 40% coverage, 3-10m wide, 0.3-0.6m deep Semi disturbance Nil erosion	Firm, cracking Nil coarse fragments	A1 0.00-0.13 Abrupt	Medium clay	Weak, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Borehole conducted in depression
				B21 0.13-0.61 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0		
				B22 0.61-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular 10-30mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5		

SITE 3

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL (Sub-dominant C1-BR)	638169 7542852	Black Vertosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Gilgai (normal to melon hole) Semi disturbed Nil erosion	Soft to firm Nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, strong, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.0	Nil	Nil
				B21 0.10-0.68 Abrupt	Medium clay	Weak to moderate, very firm, subangular 10-20mm	<1% <20mm coarse fragments (coarse fragments)	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.0		
				B22 0.68-1.00 EOBH	Medium clay	Weak to moderate, very firm, subangular 10-20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 5.5		

SITE 4

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	637812 7540071	Black Vertosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Melon hole 40% coverage, 3-10m wide, 0.3-0.6m deep Minor to semi disturbance Nil erosion	Firm, cracking Nil coarse fragments	A1 0.00-0.11 Abrupt	Medium clay	Moderate, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	Nil	Nil
				B21 0.11-0.48 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0		
				B22 0.48-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular <40mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5		

SITE 5

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	637884 7540622	Black Vertosol	Detailed Hand Auger 50mm	20/9/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Melon hole 40% coverage, 3-10m wide, 0.3-0.6m deep Minor to semi disturbance Nil erosion	Firm, cracking Nil coarse fragments	A1 0.00-0.13 Abrupt	Medium clay	Weak, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	Nil	Nil
				B21 0.13-0.61 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0		
				B22 0.61-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular 10-30mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5		

SITE 6

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T3	637823 7540836	Brown Chromosol	Detailed Hand Auger 50mm	20/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, flat plain 1%/1%	Exotic grassland	Nil microrelief Completely disturbance Nil erosion	Firm, hard setting Nil coarse fragments	A1 0.00-0.21 Abrupt	Silty loam	Massive, firm	<1% <5mm coarse fragments	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.10 0.20-0.30 0.50-0.57 0.65-0.75 0.90-1.00	Nil
				B21 0.20-0.57 Abrupt	Silty clay loam	Weak, firm, subangular <10mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.0		
				B22 0.57-0.76 Abrupt	Silty clay loam	Weak to moderate, firm, subangular <20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 8.0		
				B23 0.76-1.00 EOBH	Silty clay loam	Moderate, firm, subangular <10mm	Nil	10YR5/4 Yellowish brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 8.0		

SITE 7

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	637705 7541681	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow regrowth	Melon hole 30% coverage, 3-6m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, hard setting Nil coarse fragments	A1 0.00-0.20 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.20-0.65 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.0 0.60 / 8.0		
				B22 0.65-1.00 EOBH	Medium heavy clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 8.0		

SITE 8

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	636764 7541885	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/1%	Brigalow regrowth	Melon hole 30% coverage, 3-6m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, hard setting Nil coarse fragments	A1 0.00-0.22 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.22-0.62 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.0 0.60 / 8.0		
				B22 0.62-1.00 EOBH	Medium heavy clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 8.0		

SITE 9 - Mound

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	635942 7541225	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Dawson Gum and Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking, Nil coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, subangular <10mm	<2% manganese nodules	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.09 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.09-0.60 Abrupt	Light medium clay	Weak, firm, subangular <10mm	<1% manganese nodules	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.60-1.00 EOBH	Light medium heavy clay	Weak, firm, subangular 10-20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 9 - Depression

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	635942 7541225	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking Nil coarse fragments	A1 0.00-0.12 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 4.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.38 Abrupt	Light medium clay	Moderate, weak, subangular <10mm	<1% manganese nodules	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5 0.60 / 5.5		
				B22 0.38-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 5.5		

SITE 10

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S3	636268 7540681	Brown Chromosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Crest, flat plain 1%/1%	Narrow-leaved Ironbark	Nil microrelief Semi disturbance Nil erosion	Firm, <2% coarse fragments <5mm	A1 0.00-0.11 Abrupt	Sandy loam	Massive, apedal	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.10 0.20-0.30 0.48-0.58 0.70-0.80 0.90-1.00	Nil
				B21 0.11-0.58 Abrupt	Clay loam	Massive, apedal	<2% coarse fragments <5mm	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5		
				B22 0.58-0.85 Abrupt	Light clay	Massive, apedal	2% coarse fragments <5mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 7.0		
				B23 0.85-1.00 EOBH	Light clay	Massive, apedal	2% coarse fragments 10mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 7.0		

SITE 11

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	636792 7540808	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow regrowth	Melon hole 30% coverage, 3-6m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, hard setting Nil coarse fragments	A1 0.00-0.20 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.20-0.62 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.62-1.00 EOBH	Medium heavy clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 8.0		

SITE 12

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	635884 7540395	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking, Nil coarse fragments	A1 0.00-0.14 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 4.5	Nil	Nil
				B21 0.14-0.40 Abrupt	Light medium clay	Moderate, weak, subangular <10mm	<1% manganese nodules	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5 0.60 / 5.5		
				B22 0.40-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.0		

SITE 13

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S3	636629 7540160	Brown Chromosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain 1%/1%	Narrow Leaf Ironbark	Nil microrelief Semi disturbance Nil erosion	Firm, <2% coarse fragments <5mm	A1 0.00-0.11 Abrupt	Sandy loam	Massive, apedal	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.11-0.50 Abrupt	Clay loam	Massive, apedal	<2% coarse fragments <5mm	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5		
				B22 0.50-0.85 Abrupt	Light clay	Weak, apedal	2% coarse fragments <5mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 7.0		
				B22 0.85-1.00 EOBH	Light clay	Weak, apedal	2% coarse fragments 10mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 7.0		

SITE 14

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	635097 7541741	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking Nil coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, subangular <10mm	<2% manganese nodules	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.09-0.60 Abrupt	Light medium clay	Weak, firm, subangular <10mm	<1% manganese nodules	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.60-1.00 EOBH	Light medium heavy clay	Weak, firm, subangular 10-20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 15

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	634851 7539279	Black Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Melon hole 40% coverage, 3-10m wide, 0.3-0.6m deep	Firm, cracking Nil coarse fragments	A1 0.00-0.12 Abrupt	Medium clay	Moderate, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	Nil	Nil
				B21 0.12-0.55 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 5.5-6.0		
				B22 0.55-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular <40mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5		

SITE 16

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	634514 7542109	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope 1%	Mixed regrowth	Nil microrelief Semi disturbance Nil erosion	Cracking Nil coarse fragments	A1 0.00-0.15 Abrupt	Light clay	Moderate, firm, subangular <10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Site placed in small polygon with no microrelief, surrounding areas feature melon holes
				B21 0.15-0.80 Abrupt	Medium clay	Moderate, firm, subangular <10mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.80-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 7.0		

SITE 17

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	633642 7542147	Brown Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <1%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking, crust, Nil coarse fragments	A1 0.00-0.15 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.0	Nil	Nil
				B21 0.15-0.45 Abrupt	Medium clay	Moderate, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.0 0.60 / 6.0		
				B22 0.45-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.0		

SITE 18

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	632695 7541423	Black Vertosol	Detailed Hand Auger 50mm	21/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow	Melon hole 40-50% coverage, 3-10m wide, 0.3-0.6m deep	Firm, cracking with crust Nil coarse fragments	A1 0.00-0.15 Abrupt	Medium clay	Moderate, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5	Nil	Nil
				B21 0.15-0.55 Abrupt	Medium clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.0		
				B22 0.55-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular <40mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 6.0 0.90 / 5.5		

SITE 19

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	637468 7544348	Brown Sodosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain / flat plain 1%	Mixed vegetation with Poplar Box	Nil microrelief Semi disturbance Nil erosion	Hard setting, nil coarse fragments	A11 0.00-0.10 Abrupt	Loamy sand	Apedal, massive	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.10 / 6.0	Nil	Second attempt to reach 1m, first attempt no recovery at 0.70m
				A21 0.10-0.33 Abrupt	Clayey sand	Massive, weak, with parts firm subangular peds	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.25 / 7.0		
				A22 0.33-0.70 Abrupt	Clayey sand	Weak, firm, subangular peds	Nil	10YR3/6 Dark yellowish brown Nil mottles / bleaching	Dry, rapid/well drained	Few	0.60 / 7.0		
				B21 0.70-1.00 EOBH	Sandy clay loam	Moderate, very firm, subangular 10-20mm	<1% mg nodules <2mm	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, well drained	Few	0.90 / 7.5		

SITE 20

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	636315 7544448	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain 1%/<1%	Brigalow regrowth	Melon hole 30% coverage, 3-6m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, cracking Nil coarse fragments	A1 0.00-0.15 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.15-0.60 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.55 / 6.5		
				B22 0.60-1.00 EOBH	Medium heavy clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 7.5		

SITE 21

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	634457 7544037	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope 1%	Brigalow regrowth	Melon hole 40-50% coverage, 2-5m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking, Nil coarse fragments	A1 0.00-0.15 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5	Nil	Nil
				B21 0.15-0.38 Abrupt	Light medium clay	Moderate, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.38-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 22

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	635436 7542867	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat Plain 1%	Sparse Brigalow regrowth	Melon hole 40% coverage, 3-5 m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, cracking, self-mulching Nil coarse fragments	A1 0.00-0.14 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.0	Nil	Nil
				B21 0.14-0.62 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.62-1.00 EOBH	Medium heavy clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 7.0		

SITE 23

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S3	636484 7542483	Brown Chromosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Flat plain <1%	Mixed regrowth with Poplar Box	Nil microrelief Semi disturbance Nil erosion	Firm to hard setting, <1% coarse fragments including Mg nodules	A1 0.00-0.10 Abrupt	Sandy loam	Weak, loose	2% coarse fragments 1-3mm	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60	No auger recovery at 0.60m, three attempts
				B21 0.10-0.60+	Clay loam	Massive, weak	2% coarse fragments 1-3mm	7.5YR4/4 Brown Nil mottles / bleaching	Dry, rapidly drained	Nil	0.30 / 5.5 0.60 / 5.5		

SITE 24

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	632797 7542537	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat Plain 1%	Brigalow regrowth	Melon hole 40% coverage, 3-5 m wide, 0.2-0.4m deep Minor to semi disturbance Nil erosion	Firm, cracking self-mulching Nil coarse fragments	A1 0.00-0.18 Abrupt	Light clay	Moderate, firm, subangular 10-30mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.0	Nil	Nil
				B21 0.18-0.62 Abrupt	Medium clay	Moderate, strong, subangular 20-40mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.62-1.00 EOBH	Medium clay	Moderate, strong, subangular 30-50mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 25

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	633001 7544031	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking Nil coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, subangular <10mm	<2% manganese nodules	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.09-0.66 Abrupt	Light medium clay	Weak, firm, subangular <10mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.66-1.00 EOBH	Light medium heavy clay	Weak, firm, subangular 10-20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 7.0		

SITE 26

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	633122 7545375	Brown Vertosol	Detailed Hand Auger 50mm	22/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope 1-2%	Grasses, nearby white/grey gums	Nil microrelief Semi disturbance Nil erosion	Firm, cracking nil coarse fragments	A1 0.00-0.18 Abrupt	Light clay	Weak, very firm peds <10mm	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.10 / 6.0	Nil	Nil
				B21 0.18-0.68 Gradual	Light clay	Weak to moderate, firm, peds <20mm	<1% <2mm manganese nodules	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 6.5 0.60 / 6.5		
				B22 0.68-1.00 EOBH	Light medium clay	Moderate, very firm, peds 10-20mm	<1% <2mm manganese nodules	10YR5/6 Yellowish brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.5		

SITE 27

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	634901 7545803	Brown Vertosol	Detailed Hand Auger 50mm	23/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 2-3%	Grasses, nearby white/grey gums	1% normal gilgai in the area 0.2-0.3m deep Semi disturbance Nil erosion	Firm, cracking nil coarse fragments	A1 0.00-0.12 Abrupt	Light clay	Weak, firm	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.10 / 8.0	0.00-0.10 0.20-0.30 0.45-0.55 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.33 Abrupt	Medium clay	Weak, firm	<2% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.25 / 7.0		
				B22 0.33-0.55 Clear	Medium clay	Moderate, strong, subangular blocky	<2% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 7.0		
				B23 0.66-1.00 EOBH	Medium clay	Moderate, firm, subangular blocky	<1% manganese nodules	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.5		

SITE 28

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	635396 7546618	Black Vertosol	Detailed Hand Auger 50mm	23/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope 1-2%	Grasses	Nil microrelief Extensive disturbance Nil erosion	Soft nil coarse fragments	A1 0.00-0.14 Abrupt	Light medium clay	Moderate, weak, sub-rounded	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Common	0.10 / 7.5	Nil	Nil
				B21 0.14-0.33 Abrupt	Light medium clay	Moderate, firm, subangular 10-20mm peds	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.25 / 8.0		
				B22 0.33-0.78 Clear	Medium clay	Moderate, firm, subangular 10-20mm peds	<1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.55 / 8.0		
				B23 0.78-1.00 EOBH	Medium clay	Moderate, firm, subangular 20-40mm peds	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 8.0		

SITE 29

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	635955 7547117	Black Vertosol	Detailed Hand Auger 50mm	23/09/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope 1-2%	Grasses	Nil microrelief Extensive disturbance Nil erosion	Firm, cracking nil coarse fragments	A1 0.00-0.15 Abrupt	Light medium clay	Moderate, weak, sub-rounded	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Common	0.10 / 7.5	Nil	Nil
				B21 0.15-0.45 Abrupt	Light medium clay	Moderate, firm, subangular 10-20mm peds	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.25 / 7.0		
				B22 0.45-1.00 EOBH	Medium clay	Moderate, firm, subangular 20-40mm peds	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.5 0.90 / 7.5		

SITE 30

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	638425 7542286	Brown Sodosol	Detailed Hand Auger 50mm	07/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1-2%	Poplar Box	Nil microrelief Nil disturbance Nil erosion	Hard setting, 1% coarse fragments <2mm	A11 0.00-0.12 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.10 / 6.0	Nil	Nil
				A12 0.12-0.40 Abrupt	Loamy sand	Massive, loose	Nil	10YR5/3 Brown Nil mottles / bleaching	Dry, rapidly drained	Few	0.30 / 6.5		
				A13 0.40-0.60 Abrupt	Loamy sand	Massive, loose	<5% coarse fragments <1mm	10YR5/3 Brown Nil mottles / bleaching	Dry, rapidly drained	Nil	0.55 / 6.5		
				B2 0.60-1.00 EOBH	Sandy clay loam	Weak to moderate, firm, subangular	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 7.0		

SITE 31

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
R3	638792 7543714	Red Kandosol	Detailed Hand Auger 50mm	07/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain <1% / 1%	Exotic grassland	Nil microrelief Semi disturbance Nil erosion	Firm, Nil coarse fragments	A11 0.00-0.12 Abrupt	Loamy sand	Massive, loose	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, Rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.45 Abrupt	Sandy loam	Massive, loose	Nil	5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, Well	Few	0.30 / 6.0		
				B22 0.45-1.00 EOBH	Sandy clay loam	Massive, minor weak structure, loose	Nil	2.5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, Well	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 32 - Mound

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	638966 7543632	Black Vertosol	Detailed Hand Auger 50mm	07/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, flat plain 1%	Brigalow	Gilgai 50% coverage depth 0.24-0.29m disturbance Nil erosion	Hard setting, trampled, cracking and crust observed in area, nil coarse fragments	A1 0.00-0.12 Abrupt	Light medium clay	Weak, firm, angular <5mm peds	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, well drained	Common	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.75-0.85 0.90-1.00	Nil
				B21 0.12-0.75 Abrupt	Medium clay	Weak, firm, angular <10mm peds	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.75-1.00 EOBH	Medium clay	Weak, firm, angular <10mm peds	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 7.5		

SITE 32 - Depression

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	638966 7543632	**Black Vertosol**	Detailed Hand Auger 50mm	07/10/2019

Depression

Surface and depression depth

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, flat plain 1%	Brigalow	Gilgai 50% coverage depth 0.29m Average for area 0.42-0.29m disturbance Nil erosion	Hard setting, trampled, cracking, nil coarse fragments	A1 0.00-0.09 Abrupt	Light medium clay	Weak, firm, angular <5mm peds	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, well drained	Common	0.10 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.72-0.80 0.90-1.00	Nil
				B21 0.09-0.72 Abrupt	Medium clay	Moderate, firm, angular <10mm peds	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.72-1.00 EOBH	Medium clay	Moderate, firm, angular <10mm peds	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 7.5		

SITE 33

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	621684 7548890	Black Vertosol	Detailed Hand Auger 50mm	09/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope, 3%/3%	Sparse mixed vegetation	Minor linear gilgai observed in surrounding areas Semi disturbance Nil erosion	Soft, self-mulching, nil coarse fragments	A1 0.00-0.15 Abrupt	Light clay	Weak, weak, sub-rounded peds	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.10 / 8.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.95-1.05 1.22-1.32	Nil
				B21 0.15-0.43 Gradual	Light clay	Moderate, form, sub-rounded peds	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 8.5		
				B22 0.43-0.70 Abrupt	Light medium clay	Moderate, form, sub-angular peds	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 8.0		
				B23 0.70-0.95 Abrupt	Medium clay	Moderate, form, sub-angular peds	2-5% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately-imperfectly drained	Very few	0.90 / 8.0		

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
				BC 0.95-1.10 Clear	Silty loam	Massive, loose	10% rocks 5-20mm 10% coarse fragments 2-6mm	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, imperfectly drained	Nil	1.00 / 8.0		
				C 1.10-1.32	Silty loam	Massive, loose	50% coarse fragments 2-6mm	10YR5/3 Brown Nil mottles / bleaching	Dry, imperfectly drained	Nil	1.20 / 8.0		
				1.32 EOBH	No recovery	-	-	-	-	-	-		

SITE 34

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	622486 7549684	Black Vertosol	Detailed Hand Auger 50mm	09/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, midslope, simple slope, 2-3%	Buffel grass	Linear gilgai observed in surrounding areas, 0.15m deep Semi disturbance Nil erosion	Soft, cracking and crust nil coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, moderate, sub-rounded peds <20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.60-0.70 0.90-1.00 1.10-1.20 1.30-1.40	Nil
				B21 0.11-0.46 Abrupt	Light medium clay	Moderate, firm, sub-angular peds <20mm	<1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Common	0.30 / 6.0		
				B22 0.46-0.74 Abrupt	Light medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 6.0		
				B23 0.74-1.05 Gradual	Light medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.0		
				BC 1.05-1.20 Abrupt	Silty loam	Massive, loose	<20% coarse fragments 5-20mm <10% coarse fragments <5mm	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Nil	1.10 / 6.0		

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
				C 1.20-1.50 EOBH	Sandy loam	Massive, loose	20-30% coarse fragments <20mm <5% <5% black coarse fragments	10YR5/6 Yellowish brown Nil mottles / bleaching	Dry, rapidly drained	Nil	1.40 / 6.0		

SITE 35 - Mound

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	623121 7550243	Black Vertosol	Detailed Hand Auger 50mm	09/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope, simple slope, 2-3%	Native grassland	Linear gilgai 0.2m deep, 40% coverage Extensive disturbance Nil erosion	Soft, cracking nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, moderate, sub-rounded peds <20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50	Nil
				B21 0.10-0.42 Abrupt	Light medium clay	Moderate, firm, sub-angular peds <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Common	0.30 / 6.5		
				B22 0.42-0.60 Clear	Medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 6.5		
				B23 0.60-1.25 Gradual	Medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	2.5YR3/2 Dusky red Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.5		
				B24 1.25-1.50 EOBH	Medium clay	Moderate, firm, sub-angular peds <20mm	Nil	7.5YR4.3 20% light brown mottle Nil bleaching	Dry, imperfectly drained	Nil	1.30 / 6.5		

SITE 35 – Depression

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	623121 7550243	Black Vertosol	Detailed Hand Auger 50mm	09/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope, simple slope, 2-3%	Buffel grass	Linear gilgai 0.2m deep, 40% coverage Semi disturbance Nil erosion	Soft, cracking nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, moderate, sub-rounded peds <20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50	Nil
				B21 0.10-0.50 Abrupt	Light medium clay	Moderate, firm, sub-angular peds <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Common	0.30 / 6.0		
				B22 0.50-0.65 Clear	Medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 6.5		
				B23 0.65-1.30 Gradual	Medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	2.5YR3/2 Dusky red Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 6.5		
				B24 1.30-1.50 EOBH	Medium clay	Moderate, firm, sub-angular peds <20mm	<2% calcium carbonate	7.5YR4.3 Brown 20% light brown mottle Nil bleaching	Dry, imperfectly drained	Nil	1.30 / 6.5		

SITE 36

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T1-R	624098 7551284	Red Dermosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Wide crest <1%/<1%	Exotic grassland	Nil microrelief Semi disturbed Nil erosion	Firm, Nil coarse fragments	A11 0.00-0.08 Abrupt	Clay Loam	Massive, loose	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Common	0.05 / 6.5	0.00-0.08 0.10-0.20 0.20-0.30 0.50-0.60 0.90-1.00 1.40-1.50	Nil
				A12 0.08-0.20 Abrupt	Clay loam	Weak, weak, sub-rounded 5-20mm	<1% <2mm coarse fragments	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well	Few	0.15 / 6.5		
				B21 0.20-0.34 Abrupt	Light clay	Moderate, weak, sub-rounded 5-20mm	<1% <2mm coarse fragments	5YR3/4 Dark reddish brown Nil mottles / bleaching	Dry, well	Few	0.30 / 7.0		
				B22 0.34-0.75 Abrupt	Silty clay loam	Weak, weak, sub-angular <20mm	<5% <2mm coarse fragments	5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well to moderate	Nil	0.60 / 8.0		
				B23 0.75-1.05 Abrupt	Silty clay loam	Weak, weak, sub-angular <20mm	<2% <2mm coarse fragments	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, well to moderate	Nil	0.90 / 8.0		

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
				B3 1.05-1.60 EOBH	Loam	Massive, loose	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Nil	1.20 / 8.5		

SITE 37

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	630899 7545564	Brown Vertosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope 2%	Exotic grassland	Nil microrelief Semi disturbed Nil erosion	Soft, cracking with crust Nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, subangular peds <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 8.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.10-0.63 Gradual	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	<2% calcium carbonate <1% <2mm coarse fragments	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 7.0 0.55 / 7.0		
				B22 0.63-1.00 EOBH	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	Nil	10YR5/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Very few	0.90 / 7.0		

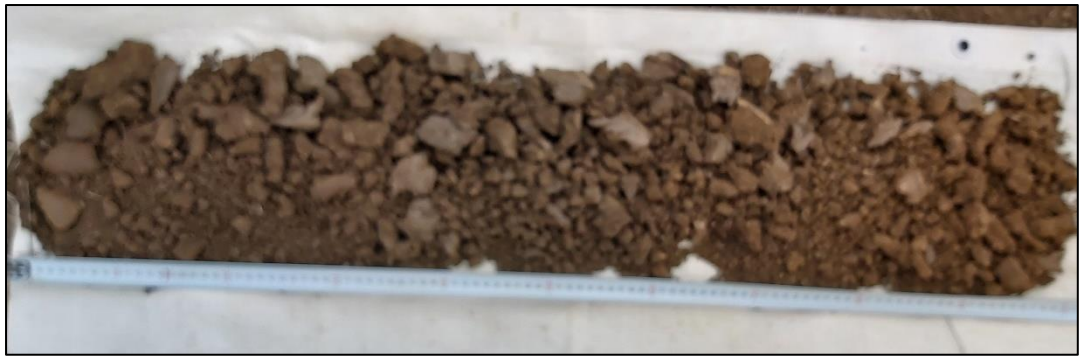
SITE 38

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	630256 7544461	Brown Vertosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile



Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope 2%	Spare regrowth, Brigalow in area	Nil microrelief Semi disturbed Nil erosion	Cracking with crust	A1 0.00-0.14 Abrupt	Light clay	Weak, firm, subangular peds <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 8.0	Nil	Nil
				B21 0.14-0.66 Gradual	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	<2% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 7.0 0.55 / 7.0		
				B22 0.66-1.00 EOBH	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	Nil	10YR5/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Very few	0.90 / 7.0		

SITE 39

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	631277 7544334	Brown Vertosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, upper slope <2%	Very sparse, Brigalow approx. 100m away	Nil microrelief Semi disturbed Nil erosion	Firm, cracking observed in area	A1 0.00-0.12 Abrupt	Light clay	Weak, firm, subangular peds <20mm	Nil	7.5YR2.5/2 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.10 / 7.0	Nil	Nil
				B21 0.12-0.25 Abrupt	Light medium clay	Moderate, firm, angular peds 20-40mm	Nil	7.5YR2.5/2 Very dark brown Nil mottles / bleaching	Dry, moderately well drained	Common	0.20 / 7.0		
				B22 0.25-0.63 Clear	Medium clay	Moderate, firm, angular peds 20-40mm	<1% calcium carbonate	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.50 / 8.0		
				B23 0.63-0.85 Abrupt	Medium clay	Moderate, firm, angular peds 20-40mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.80 / 8.0		
				B3 0.85-1.00 EOBH	Medium clay	Moderate, firm, angular peds <20mm	10% coarse fragments and weathered rock	10YR4/3 Brown Nil mottles / bleaching	Dry, imperfectly drained	Nil	0.95 / 8.0		

SITE 40

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	631851 7543813	Brown Vertosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Mid slope <2%/1%	Brigalow regrowth	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking with crust observed in area, Nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, subangular <10mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.10-0.60 Abrupt	Light medium clay	Weak, firm, subangular <10mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.60-1.00 EOBH	Light medium heavy clay	Weak, firm, subangular 10-20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 41

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	630330 7543582	Brown Vertosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1%	Brigalow regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, cracking, crust observed in area	A1 0.00-0.12 Abrupt	Light clay	Weak, firm, subangular peds <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.12-0.62 Gradual	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	<1% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 7.0 0.55 / 7.0		
				B22 0.62-1.00 EOBH	Light medium clay	Moderate, firm, angular peds 20-40mm, slickensides	Nil	10YR5/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Very few	0.90 / 7.0		

SITE 42

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T1-B	630026 7543369	Brown Dermosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope 1-2%	Brigalow regrowth	Nil microrelief Semi disturbed Nil erosion	Soft to firm, nil coarse fragments	A11 0.00-0.09 Abrupt	Clay loam	Massive to weak, loose	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	0.00-0.10 0.10-0.20 0.25-0.35 0.50-0.60 0.80-0.90	Nil
				A12 0.09-0.24 Gradual	Clay loam	Weak, firm, sub-angular peds <10mm	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.20 / 8.0		
				B21 0.24-0.37 Abrupt	Light clay	Moderate, firm, sub-angular peds <10mm	<2% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.28 / 7.5		
				B31 0.37-0.70 Abrupt	Clay loam	Massive to weak, weak subangular peds <10mm <2%	<2% calcium carbonate	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.50 / 8.0		
				B32 0.70-1.00 EOBH	Loam	Massive, loose	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 8.0		

SITE 43

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T1-B	631639 7541337	Brown Dermosol	Detailed Hand Auger 50mm	10/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1-2%	Mixed shrubs	Nil microrelief Semi disturbed Nil erosion	Hard setting, nil coarse fragments	A1 0.00-0.12 Abrupt	Sandy clay loam	Massive to weak, loose	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	0.00-0.10 0.20-0.30 0.50-0.60 0.68-0.78 0.90-1.00	Nil
				B21 0.12-0.38 Gradual	Light clay	Weak, firm, sub-angular peds <10mm	<2% calcium carbonate	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.20 / 7.5		
				B22 0.38-0.60 Abrupt	Medium clay	Moderate, firm, sub-angular peds <10mm	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.28 / 7.5		
				B31 0.60-0.78 Abrupt	Clayey sand	Massive to weak, weak subangular peds <10mm <2%	5% weathered material	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, well drained	Nil	0.70 / 8.0		
				B32 0.78-1.00 EOBH	Clayey sand (increased sand content)	Massive, loose	5% weathered material	7.5YR4/4 Brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 8.0		

SITE 44

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	629299 7542395	Black Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope 1-2%	Grass, sparse mixed vegetation	Nil microrelief extensively disturbed Nil erosion	Soft, self-mulching, <2% coarse fragments <5mm	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, subangular peds 10-20mm	<2% coarse fragments <5mm	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Coming	0.05 / 7.5	0.00-0.09 0.20-0.30 0.50-0.60 0.72-0.82 0.90-1.00 1.40-1.50	Nil
				B21 0.09-0.46 Abrupt	Light medium clay	Moderate, firm, subangular peds 10-20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.5		
				B22 0.46-0.72 Abrupt	Light medium clay	Moderate, firm, subangular peds 5-20mm	<2% coarse fragments <5mm	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Nil	0.60 / 8.0		
				BC 0.72-1.00 EOBH	Loamy sand	Massive, weak, <5% loose	<2% coarse fragments <5mm	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapidly drained	Nil	0.90 / 7.5		

SITE 45

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	630026 7546291	Brown Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, lower slope <2%	Sparse Brigalow regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, cracking	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, subangular peds <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.10-0.65 Gradual	Light medium clay	Moderate, firm, angular peds 20-40mm	<1% <2mm coarse fragments	10YR4/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 7.0 0.55 / 7.0		
				B22 0.65-1.00 EOBH	Light medium clay	Moderate, firm, angular peds 20-40mm	<1% calcium carbonate	10YR5/3 Brown Nil mottles / bleaching	Dry, moderately well drained	Very few	0.90 / 7.5		

SITE 46

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T2	627368 7546702	Red Kandosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1-2%	Sparse vegetation, gums	Nil microrelief Semi disturbed Nil erosion	Firm	A1 0.00-0.11 Abrupt	Sandy clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	No recovery at 0.91 m
				B21 0.11-0.31 Abrupt	Clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	5YR4/3 Reddish brown Nil mottles / bleaching	Dry, well drained	Few	0.25 / 6.0		
				B22 0.31-0.80 Clear	Medium clay	Massive to weak, form, peds <2% <20mm	Nil	2.5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well drained	Few	0.60 / 6.0		
				B23 0.80-0.91	Medium clay	Massive to weak, form, peds <5mm	Nil	5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well drained	Nil	0.85 / 6.0		

SITE 47

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	628379 7546548	Black Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Gently undulating plain, lower slope 1-2%,	Sparse mixed vegetation	Linear gilgai, <0.1m deep, 50% coverage Semi disturbed Nil erosion	Self-mulching, nil coarse fragments	A1 0.00-0.08 Abrupt	Light clay	Moderate, weak, peds 5-20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.08 0.20-0.30 0.50-0.60	Auger refusal at 0.80m
				B21 0.08-0.80	Medium clay	Moderate, strong, subangular peds 20-50mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 6.5 0.75 / 6.5		

SITE 48

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	629619 7547139	Black Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1-2%	Mixed	Nil microrelief Extensive disturbed Nil erosion	Soft, self-mulching	A1 0.00-0.10 Abrupt	Light clay	Weak, firm Sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Isolated area of C3-BL, surrounded by C3-BR
				B21 0.10-0.49 Abrupt	Light medium clay	Moderate, firm, subangular peds 20-40mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.30 / 6.5		
				B22 0.49-0.88 Abrupt	Light medium clay	Moderate, firm, subangular peds 20-40mm	<10% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 6.5		
				B23 0.88-1.00 EOBH	Light medium clay	Moderate, firm, subangular peds <10mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderately well drained	Nil	0.95 / 6.5		

SITE 49

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	631969 7546284	Brown Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope 2/2%	Sparse mixed regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, cracking, nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, weak, peds 5-10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.10-0.35 Abrupt	Light clay	Moderate, firm, peds 10-20mm	Nil	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.25 / 7.5		
				B22 0.35-0.77 Abrupt	Medium clay	Moderate, very firm, subangular peds 10-40mm	<1% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.5		
				B23 0.77-1.00 EOBH	Medium clay	Moderate, weak, peds 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.5		

SITE 50

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	633207 7546644	Brown Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope 2%	Sparse mixed regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, cracking nil coarse fragments	A1 0.00-0.12 Abrupt	Light clay	Moderate, weak, peds 5-10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.12-0.340 Abrupt	Light clay	Moderate, firm, peds 10-20mm	Nil	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.25 / 7.0		
				B22 0.40-0.75 Abrupt	Medium clay	Moderate, very firm, subangular peds 10-40mm	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.5		
				B23 0.75-1.00 EOBH	Medium clay	Moderate, weak, peds 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.5		

SITE 51

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	633162 7547605	Black Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, simple mid slope 1-2%	Native vegetation	Nil microrelief Semi / Extensive disturbed Nil erosion	Firm, cracking, white nodules <1%	A1 0.00-0.12 Abrupt	Light clay	Weak, very firm, sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.80 Abrupt	Light medium clay	Moderate, very firm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well to moderately drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.80-1.00 EOBH	Light medium clay	Moderate, very firm	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0		

SITE 52

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	631697 7547799	Brown Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope 1-2%	Sparse mixed regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, cracking nil coarse fragments	A1 0.00-0.08 Abrupt	Light clay	Moderate, weak, peds 5-10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.08-0.37 Abrupt	Light clay	Moderate, firm, peds 10-20mm	<1% calcium carbonate	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.25 / 6.5		
				B22 0.37-0.70 Abrupt	Medium clay	Moderate, very firm, subangular peds 10-40mm	<1% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.0		
				B23 0.70-1.00 EOBH	Medium clay	Moderate, weak, peds 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.0		

SITE 53

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	629989 7548288	Black Vertosol	Detailed Hand Auger 50mm	11/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, simple mid slope 1-2%	Grass	Nil microrelief Extensively disturbed Nil erosion	Firm, cracking	A1 0.00-0.12 Abrupt	Light clay	Weak, very firm, sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.12-0.78 Abrupt	Light medium clay	Moderate, very firm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.78-1.00 EOBH	Light medium clay	Moderate, very firm	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0		

SITE 54

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T3	630478 7548527	Brown Chromosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope 2%	Mixed woodlands, Poplar Box	Nil microrelief Semi disturbed Nil erosion	Firm, cracking, nil coarse fragments	A1 0.00-0.12 Abrupt	Loam	Massive, loose	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.30 Gradual	Silty loam	Massive, weak	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, well drained	Few	0.25 / 6.5		
				B22 0.30-0.70 Gradual	Silty clay loam	Weak, weak, peds 5-30mm	<1% black nodules <1mm	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Few	0.60 / 6.5		
				B23 0.70-1.00 EOBH	Silty clay loam	Weak, weak, peds 5-30mm	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 7.0		

SITE 55

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
K1	630779 7550077	Very shallow Brown Tenosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

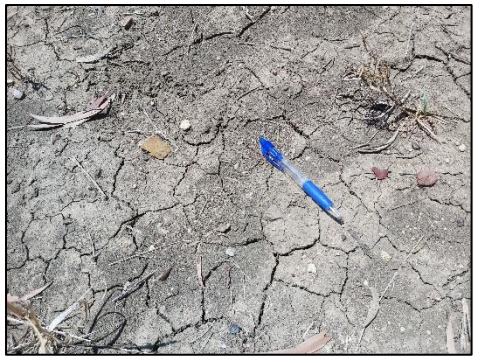
Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, wide crest upper slope, 1-2%	Exotic grassland	Nil microrelief Semi disturbed Nil erosion	Firm, 2% coarse fragments <10mm	A1 0.00-0.11 EOBH	Sandy loam	Massive, loose	40% <10mm coarse fragments 10% 10-20mm coarse fragments	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapidly drained	Common	0.05 / 6.5	0.00-0.10	Auger refusal at 0.11m, 5 attempts in the area

SITE 56

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	631455 7550363	Black Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface



Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, lower slope, open flat plain	Brigalow	Very minor gilgai <1% coverage Semi disturbed Nil erosion	Soft, crust with cracking observed 5% coarse fragments <20mm	A1 0.00-0.12 Abrupt	Light clay	Weak, firm, subangular peds <10mm	<1% coarse fragments <5mm	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.70 Abrupt	Light medium clay	Moderate, firm, subangular peds <20mm	<1% coarse fragments <5mm <2% coarse fragments <2mm	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 6.0 0.60 / 6.0		
				B22 0.70-1.00 EOBH	Light medium clay	Moderate, firm, subangular peds <20mm	<2% coarse fragments 2-5mm	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 6.0		

SITE 57

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	632877 7550194	Black Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, simple mid slope 1-2%	Softwood scrub mixed vegetation	Nil microrelief Semi disturbed Nil erosion	Firm, crust with cracking white nodules <1%	A1 0.00-0.10 Abrupt	Light clay	Weak, very firm, sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.10-0.68 Abrupt	Light medium clay	Moderate, very firm	<1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.68-1.00 EOBH	Light medium clay	Moderate, very firm	<2% calcium carbonate	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0		

SITE 58

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	633675 7550629	Brown Sodosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope 1-2%	Sparse mixed regrowth	Nil microrelief Semi disturbed Nil erosion	Soft, nil coarse fragments	A11 0.00-0.16 Abrupt	Loamy Sand	Massive, loose	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, Rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	
				A12 0.16-0.50 Abrupt	Clayey Sand	Massive, loose	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, Rapid	Few	0.30 / 6.0		
				B2 0.50-1.00 EOBH	Sandy clay Sand	Massive, loose, <10% <20mm weak peds	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, Well	Few	0.60 / 6.5 0.90 / 6.5		

SITE 59

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	633592 7550246	Brown Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain	Very sparse Brigalow Grasses	Melon hole gilgai microrelief Extensive disturbance Nil erosion	Curst with cracking observed, soft to firm	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, subangular <10mm	<2% manganese nodules	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.09-0.59 Abrupt	Light medium clay	Weak, firm, subangular <10mm	<1% manganese nodules	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.59-1.00 EOBH	Light medium heavy clay	Weak, firm, subangular 10-20mm	Nil	7.5YR4/3 Brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 6.5		

SITE 60

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	633443 7548576	Black Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid-slope 2-3 %	Mixed vegetation including Brigalow and shrubs	Nil microrelief Semi disturbed Nil erosion	Cracking with crust nil coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, very firm, sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.11-0.76 Abrupt	Light medium clay	Moderate, very firm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.76-1.00 EOBH	Light medium clay	Moderate, very firm	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0		

SITE 61

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	634364 7546987	Brown Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid-slope 2 / 2%	Sparse mixed regrowth	Nil microrelief Semi disturbed Nil erosion	Crust cracking nil coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, weak, peds 5-10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.09-0.27 Abrupt	Light clay	Moderate, firm, peds 10-20mm	Nil	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.25 / 7.5		
				B22 0.27-0.77 Abrupt	Medium clay	Moderate, very firm, subangular peds 10-40mm	<1% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.5		
				B23 0.77-1.00 EOBH	Medium clay	Moderate, weak, peds 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.5		

SITE 62

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	627773 7550039	Brown Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid-slope 2 / 2%	Grasses	Nil microrelief Semi disturbed Nil erosion	Cracking self-mulching, nil coarse fragments	A1 0.00-0.12 Abrupt	Light clay	Moderate, weak, peds 5-10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 7.0	Nil	Nil
				B21 0.12-0.25 Abrupt	Light clay	Moderate, firm, peds 10-20mm	<1% calcium carbonate	7.5YR2.5/3 Very dark brown Nil mottles / bleaching	Dry, well drained	Common	0.25 / 7.5		
				B22 0.25-0.71 Abrupt	Medium clay	Moderate, very firm, subangular peds 10-40mm	<1% calcium carbonate	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, moderately well drained	Few	0.60 / 7.5		
				B23 0.71-1.00 EOBH	Medium clay	Moderate, weak, peds 10-20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderately well drained	Nil	0.90 / 7.5		

SITE 63

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	627918 7548726	Brown Vertosol	Detailed Hand Auger 50mm	12/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Midslope <2%/1%	Brigalow regrowth	Nil microrelief Semi disturbed Nil erosion	Cracking, self-mulching Nil coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10m / 4.5	Nil	Nil
				B21 0.11-0.38 Abrupt	Light medium clay	Moderate, weak, subangular <10mm	<1% manganese nodules	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Common	0.30m / 5.5 0.60m / 5.5		
				B22 0.53-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90m / 5.5		

SITE 64

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BR	628992 7550731	Brown Vertosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, flat plain 1%/1%	Sparse Brigalow	Nil microrelief Semi disturbed Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, weak, subangular <10mm	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10m / 4.5		
				B21 0.11-0.58 Abrupt	Light medium clay	Moderate, weak, subangular <10mm	<1% manganese nodules	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Common	0.30m / 5.5 0.60m / 5.5		
				B22 0.58-1.00 EOBH	Medium clay	Moderate, firm, subangular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.90m / 5.5		

SITE 65

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BL	628719 7551638	**Black Vertosol**	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat Plain	Sparse Brigalow, grasses	Melon hole 50% coverage, 3-6m wide, 0.2-0.4m deep Semi disturbance Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.15 Abrupt	Medium clay	Weak, very firm, subangular <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 5.5-6.0	Nil	Nil
				B21 0.15-0.66 Abrupt	Medium heavy clay	Moderate, very firm, subangular <20mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Common	0.30 / 5.5-6.0		
				B22 0.66-1.00 EOBH	Medium heavy clay	Moderate, very firm, subangular 10-30mm	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.60 / 5.5-6.0 0.90 / 5.5		

SITE 66 - Mound

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	627840 7551946	Brown Vertosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Mid-slope <1-1 %	Brigalow regrowth, sparse grasses	Melon hole 40% coverage, 3-6m wide, 0.2-0.4m deep extensive disturbance Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.17 Abrupt	Light medium clay	Weak, very firm, subangular <10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.0	Backup samples	Nil
				B21 0.17-0.50 Abrupt	Light medium clay	Moderate, very firm, subangular <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Common	0.30 / 7.5		
				B22 0.50-0.66 Abrupt	Medium clay	Moderate, very firm, subangular <40mm	1% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.60 / 7.5		
				B23 0.66-1.00 EOBH	Medium clay	Moderate, very firm, subangular <40mm	1% calcium carbonate / manganese nodules	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.90 / 7.5		

SITE 66 - Depression

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	627840 7551946	Brown Vertosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Mid-slope <1-1 %	Brigalow regrowth, sparse grasses	Melon hole 40% coverage, 3-6m wide, 0.2-0.4m deep extensive disturbance Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.11 Abrupt	Light medium clay	Weak, very firm, subangular <10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.0	Backup samples	Nil
				B21 0.11-0.43 Abrupt	Medium clay	Moderate, very firm, subangular <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5		
				B22 0.43-1.00 EOBH	Medium clay	Moderate, very firm, subangular <40mm	1% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.60 / 7.5 0.90 / 7.5		

SITE 67

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C1-BR	627369 7551873	Brown Vertosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Mid-slope <1-1 %	Brigalow regrowth, sparse grasses	Melon hole 40% coverage, 3-6m wide, 0.2-0.4m deep extensive disturbance Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.13 Abrupt	Light medium clay	Weak, very firm, subangular <10mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.0	Nil	Nil
				B21 0.13-0.45 Abrupt	Medium clay	Moderate, very firm, subangular <20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5		
				B22 0.43-1.22 Abrupt	Medium clay	Moderate, very firm, subangular <40mm	1% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Very few	0.60 / 7.5 0.90 / 7.5		
				B22 1.22-1.50 EOBH	Medium clay	Moderate, very firm, subangular <40mm	2% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Nil	1.20 / 7.5		

SITE 68

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S4	628352 7551956	Brown Tenosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain <1% / <1%	Poplar Box	Nil microrelief Nil disturbance Nil erosion	Soft, nil coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				A12 0.15-0.70 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Few	0.30 / 6.0 0.60 / 7.0		
				A13 0.70-1.00 EOBH	Loamy sand	Massive, loose	Nil	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Nil	0.90 / 8.0		

SITE 69

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S2	628387 7552222		Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain	Poplar box	Nil microrelief Nil disturbance Nil erosion	Soft, sandy	A11 0.00-0.10 Abrupt	Loamy sand	Apedal, loose	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Nil	0.10 / 6.5	Nil	No recovery at 0.50 metres below ground level (mbgl)
				A12 0.10-0.50 EOBH	Loamy sand	Apedal, loose	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Nil	0.30 / 6.5		

SITE 70

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C5	630784 7552235	Black Vertosol	Detailed Hand Auger 50mm	13/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Alluvial plain, flat wide depression	Exotic grassland	Nil microrelief Extensive disturbance Nil erosion	Cracking with crust Nil coarse fragments	A1 0.00-0.12 Abrupt	Medium clay	Moderate, firm, subangular <20mm	1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00	Nil
				B21 0.12-0.88 Abrupt	Medium clay	Moderate, firm, subangular 20-40mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.88-1.00 EOBH	Medium clay	Moderate, very firm, subangular 20-40mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate to imperfect	Nil	0.90 / 7.5		

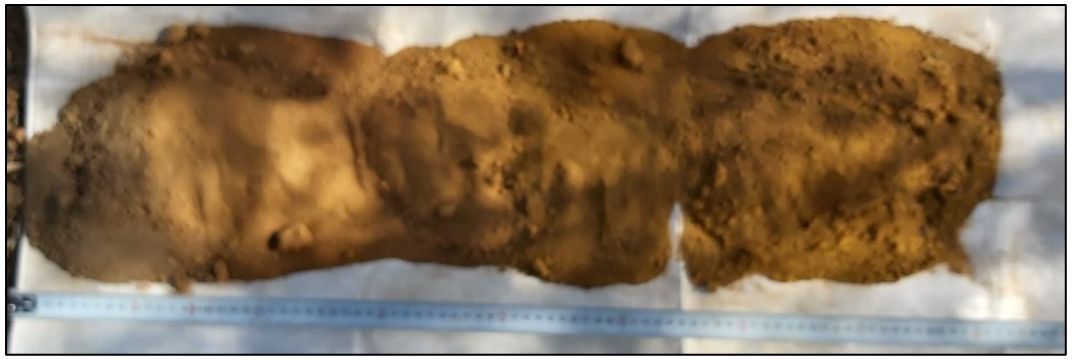
SITE 71

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S3	636235 7540822	Brown Chromosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile



Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain 1%/1%	Narrow Leaf Ironbark	Nil microrelief Semi disturbance Nil erosion	Firm, <2% coarse fragments <5mm	A1 0.00-0.11 Abrupt	Sandy loam	Massive, apedal	Nil	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 6.5	Nil	Nil
				B21 0.11-0.50 Abrupt	Clay loam	Massive, apedal	<2% coarse fragments <5mm	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, moderate	Few	0.30 / 6.5		
				B22 0.50-0.85 Abrupt	Light clay	Massive, apedal	2% coarse fragments <5mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 7.0		
				B22 0.85-1.00 EOBH	Light clay	Massive, apedal	2% coarse fragments 10mm	7.5YR5/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 7.0		

SITE 72

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S3	636966 7540450	Brown Chromosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid-slope <2%	Grasses	Nil microrelief Extensive disturbance Nil erosion	Hard Nil coarse fragments	A1 0.00-0.09 Abrupt	Clay loam	Massive, firm	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, Well	Common	0.10 / 6.0	Nil	No recovery at 0.8 mbgl
				B21 0.09-0.28 Abrupt	Silty loam	Massive, firm	<1% <5mm coarse fragments	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Few	0.20 / 6.0		
				B22 0.28-0.80 Abrupt	Silty clay loam	Massive, firm	1% manganese nodules	7.5YR4/6 Strong brown Nil mottles / bleaching	Dry, moderate	Nil	0.60 / 6.0		

SITE 73

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T2	627705 7546720	Red Kandosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid slope 1-2%	Sparse vegetation, gums	Nil microrelief Semi disturbed Nil erosion	Firm	A1 0.00-0.10 Abrupt	Sandy clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.10-0.33 Abrupt	Clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	5YR4/3 Reddish brown Nil mottles / bleaching	Dry, well drained	Few	0.25 / 6.0		
				B22 0.33-0.80 Clear	Medium clay	Massive to weak, form, peds <2% <20mm	Nil	2.5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well drained	Few	0.60 / 6.0		
				B23 0.80-1.00 EOBH	Medium clay	Massive to weak, form, peds <5mm	Nil	5YR4/4 Reddish brown Nil mottles / bleaching	Dry, well drained	Nil	0.85 / 6.0		

SITE 74

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	625433 7551868	Black Vertosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, mid-slope 2%	Grasses	Nil microrelief Extensive disturbance Nil erosion	Firm to soft cracking with crust Nil coarse fragments	A11 0.00-0.12 Abrupt	Light clay	Weak to moderate, sub-angular <20mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well	Common	-	Nil	Nil
				B21 0.12-0.80 Abrupt	Light medium clay	Weak to moderate, sub-angular <20mm	Nil	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, well to moderate	Common	-		
				B22 0.80-1.10 Abrupt	Light medium clay	Moderate, sub-angular <20mm	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, well to moderate	Nil	-		
				B23 1.10-1.50 EOBH	Medium clay	Moderate, sub-angular <20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, moderate	Nil	-		

SITE 75

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T2	627314 7544935	Red Kandosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing GUP mid-slope 2 / 2%	Mixed vegetation	Nil microrelief Semi disturbance Nil erosion	Firm, Nil coarse fragments	A1 0.00-0.10 Abrupt	Sandy clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00 1.40-1.50	Nil
				A2 0.10-0.30 Abrupt	Clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments 5mm	5YR4/3 Reddish brown Nil mottles / bleaching	Dry, well – moderate	Few	0.25 / 6.0		
				B21 0.30-0.88 Abrupt	Medium clay	Massive to weak, form, peds <2% <20mm	Nil	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Few	0.60 / 6.5		
				B22 0.88-1.10 Abrupt	Medium clay	Massive to weak, form, peds <10mm	<1% coarse fragments <5mm	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Nil	0.90 / 6.5		
				B23 1.10-1.50 EOBH	Clay loam	Massive to weak, form, peds <5mm	<1% coarse fragments <5mm	2.5YR4/6 Red Nil mottles / bleaching	Dry, moderate	Nil	1.20 / 7.0		

SITE 76

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C5	626770 7543936	Black Vertosol	Detailed Hand Auger 50mm	14/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Alluvial plain, flat wide depression	Mount Coolibah	Nil microrelief Extensive disturbance Nil erosion	Cracking, Nil coarse fragments	A1 0.00-0.10 Abrupt	Medium clay	Moderate, firm, subangular <20mm	1% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well to moderate	Common	0.10 / 7.5	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90	Nil
				B21 0.10-0.85 Abrupt	Medium clay	Moderate, firm, subangular 20-40mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate	Few	0.30 / 7.5 0.60 / 7.5		
				B22 0.85-0.94 EOBH	Medium clay	Moderate, very firm, subangular 20-40mm	2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, moderate to imperfect	Nil	0.90 / 7.5		

SITE 77

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C4	620919 7548417	Black Vertosol	Detailed Hand Auger 50mm	15/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing GUP Mid-slope 3%	Grasses	Nil microrelief Extensive disturbance Nil erosion	Self-mulching, cracking Nil coarse fragments	A11 0.00-0.10 Abrupt	Light clay	Moderate, firm, sub-angular 5-15mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well	Common	-	Nil	Refusal encountered at 1.20 mbgl
				B21 0.10-0.33 Abrupt	Light medium clay	Moderate, firm, sub-angular 10-20mm	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, moderate	Common	-		
				B22 0.33-1.05 Abrupt	Medium clay	Moderate, firm, sub-angular 10-40mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, moderate	Few	-		
				B23 1.05-1.20 EOBH	Medium clay	Moderate, firm, sub-angular 10-20mm	<2% coarse fragments	10YR3/2 Very dark greyish brown Mottles <2% 10YR4/2 Dark greyish brown Nil bleaching	Dry, moderate to imperfect	Nil	-		

SITE 78

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T3	626510 7543191	Brown Chromosol	Detailed Hand Auger 50mm	15/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing GUP mid-slope 2%	Poplar box with minor Brigalow	Nil microrelief Semi disturbance Nil erosion	Firm to hard setting <1% coarse fragments < 5mm	A11 0.00-0.09 Abrupt	Silty clay	Weak, firm, sub-angular <10mm	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Well	Common	0.05 / 7.5	Nil	Nil
				A12 0.09-0.23 Abrupt	Silty clay	Weak, firm, sub-angular <15mm	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Well	Common	0.15 / 7.5		
				B21 0.23-0.41 Abrupt	Silty clay loam	Moderate, firm, sub-angular 10-20mm	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Well to moderate	Common	0.30 / 7.5		
				B22 0.41-0.53 Abrupt	Silty clay loam	Moderate, firm, sub-angular 10-20mm	<1% calcium carbonate	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, Well to moderate	Few	0.45 / 8.0		
				B23 0.53-1.05 Abrupt	Light clay	Moderate, firm, sub-angular 10-20mm	<2% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, Moderate	Few	0.60 / 8.0		
				B3 1.05-1.50 EOBH	Silty loam	Massive, weak	Nil	5YR3/3 Dark reddish brown Nil mottles / bleaching	Dry, Moderate	Nil	1.20 / 7.0		

SITE 79

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	626206 7542633	Brown Sodosol	Detailed exposed soil profile	15/10/2019

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing GUP, lower slope near drainage line	Mixed Eucalyptus	Nil microrelief Semi disturbed Gully erosion	Hard Nil coarse fragments	A11 0.00-0.22 Abrupt	Clayey Sand	Weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, Well	Common	-	Nil	Exposed cutting profile
				A12 0.22-0.70 Abrupt	Clayey Sand	Weak	<1% coarse fragments <5mm	10YR3/3 Dark brown Nil mottles / bleaching	Dry, Well to moderate	Common	-		
				B2 0.70-1.00 EOBH	Sandy clay loam	Firm	<1% coarse fragments <5mm	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, Well to moderate	Few	-		

SITE 80

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
S1	627902 7541799	Brown Sodosol	Detailed Hand Auger 50mm	15/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing Flat plain	Tall woodlands including poplar box	Nil microrelief Nil disturbance Nil erosion	Hard setting Nil coarse fragments	A11 0.00-0.10 Abrupt	Clayey Sand	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, Well	Common	0.10 / 6.0	Nil	Nil
				A12 0.10-0.45 Abrupt	Clayey Sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, Well to moderate	Few	0.30 / 6.0		
				B21 0.45-0.90 Abrupt	Sandy clay loam	Moderate, firm 5-20mm	<1% coarse fragments <5mm	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, Well to moderate	Nil	0.60 / 7.5		
				B22 0.90-1.50 EOBH	Sandy clay loam	Weak, weak	Nil	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, Moderate	Nil	1.20 / 7.5		

SITE 81

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
C3-BL	629586 7542707	Black Vertosol	Detailed Hand Auger 50mm	15/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, simple mid slope 1-2%	Softwood scrub mixed vegetation	Nil microrelief Semi disturbed Nil erosion	Firm, cracking with crust, white nodules <1%	A1 0.00-0.11 Abrupt	Light clay	Weak, very firm, sub-rounded peds <10mm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Common	0.05 / 6.5	Nil	Nil
				B21 0.11-0.70 Abrupt	Light medium clay	Moderate, very firm	<2% calcium carbonate	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Few	0.30 / 7.0 0.60 / 7.0		
				B22 0.70-1.00 EOBH	Light medium clay	Moderate, very firm	Nil	10YR4/1 Dark grey Nil mottles / bleaching	Dry, moderately well drained	Few	0.90 / 7.0		

SITE 82

Soil Mapping Unit:	Location (GDA94 ZONE 55):	Australian Soil Class:	Site Survey Type:	Survey Date:
T2	630200 7541015	Red Kandosol	Detailed Hand Auger 50mm	15/10/2019

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Field Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle, Bleaching	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope 1-2%	Tall woodlands	Nil microrelief Semi disturbance Nil erosion	Firm, Nil coarse fragments	A1 0.00-0.10 Abrupt	Clayey sand	Massive, loose	<2% coarse fragments <1mm	7.5YR3/2 Dark brown Nil mottles / bleaching	Dry, rapid	Common	-	Nil	Nil
				B21 0.10-0.38 Abrupt	Sandy clay loam	Weak, weak, sub-angular <20mm	Nil	7.5YR3/4 Dark brown Nil mottles / bleaching	Dry, well	Common	-		
				B22 0.38-0.68 Abrupt	Medium clay	Weak, weak, sub-angular <20mm	Nil	7.5YR3/3 Dark brown Nil mottles / bleaching	Dry, well	Few	-		
				B22 0.68-1.00 EOBH	Medium clay	Weak, weak, sub-angular <20mm	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, well	Nil	-		

SITE OD-15

Soil Mapping Unit:	**CSIRO Land Systems (Gunn et al 1967):**	**Location (GDA ZONE 55):**	**Aust. Soil Class.** :	**Site Survey Type**:	**Survey Date:**
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	639357 mE 7545231 mN	Brown Sodosol	Detailed - 50mm hand auger	20/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	**Natural Vegetation**	**Microrelief Disturbance Erosion**	**Surface condition, surface rock**	**Soil Profile Description**									
				Horizon Depth (m), Boundary	**Texture**	**Structure, Strength**	**Inclusions Segregations**	**Colour, Mottle**	**Moisture, Drainage**	**Roots**	**Depth (m) / Field pH**	**Sample (m)**	**Observations**
Grazing, very gently undulating plains, 1%	Very Sparse, Moreton Bay Ash, Blackbutt	Semi cleared	Firm, nil coarse fragments	A11 0.0 – 0.22 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, rapid	Few, very fine	0.1 / 6.5	No samples taken	No additional observations
				A12 0.22 – 0.7 Abrupt	Clayey sand	Weak subangular peds 20mm, weak	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Humid, well drained	Few, very fine	0.3 / 7.0 0.6 / 7.0		
				B2 0.7 – 1.0	Sandy clay loam	Weak subangular peds 40mm, weak	2% coarse fragments, 2-10mm	7.5YR4/4 Brown Brown Mottle: 2.5YR4/6 Red Red Nil bleaching	Dry, imperfectly drained	Nil	0.9 / 7.0		

SITE OD-26a

Soil Mapping Unit:	**CSIRO Land Systems (Gunn et al 1967):**	**Location (GDA ZONE 55):**	**Aust. Soil Class.** :	**Site Survey Type**:	**Survey Date:**
C2 - C1-BR interfingering with C1-BL	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	640146 mE 7543555 mN	Brown Vertosol	Detailed - 50mm hand auger	22/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	**Natural Vegetation**	**Microrelief Disturbance Erosion**	**Surface condition, surface rock**	**Soil Profile Description**									
				Horizon Depth (m), Boundary	**Texture**	**Structure, Strength**	**Inclusions Segregations**	**Colour, Mottle**	**Moisture, Drainage**	**Roots**	**Depth (m) / Field pH**	**Sample (m)**	**Observations**
Grazing, very gently undulating plain, <1% slope	Tall Brigalow and Brigalow regrowth, semi sparse, limited clearing 20-30% coverage	Normal gilgai, 30% coverage, <0.3m deep	Cracking, crust 5% coarse fragments <5mm	A1 0.00 – 0.19 Abrupt	Light medium clay	Weak, <10mm peds, subangular, strength-firm	2% coarse fragments	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Nil	0.00 / 6.5	0.00 – 0.10 0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	Site located in gilgai depression
				B2 0.19 – 1.00	Medium clay	Strong structure <20mm, very firm strength	<2% black nodules <5mm <1% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, well drained	Nil	0.30 / 6.5 0.60 / 7.0 09.0 / 7.0		

SITE OD-26b

Soil Mapping Unit:	**CSIRO Land Systems (Gunn et al 1967):**	**Location (GDA ZONE 55):**	**Aust. Soil Class.** :	**Site Survey Type**:	**Survey Date:**
C2 - C1-BR interfingering with C1-BL	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	640146 mE 7543555 mN	Brown Vertosol	Detailed - 50mm hand auger	22/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	**Natural Vegetation**	**Microrelief Disturbance Erosion**	**Surface condition, surface rock**	**Soil Profile Description**									
				Horizon Depth (m), Boundary	**Texture**	**Structure, Strength**	**Inclusions Segregations**	**Colour, Mottle**	**Moisture, Drainage**	**Roots**	**Depth (m) / Field pH**	**Sample (m)**	**Observations**
Grazing, very gently undulating plain, <1% slope	Tall Brigalow and Brigalow regrowth, semi sparse, limited clearing 20-30% coverage	Normal gilgai, 30% coverage, <0.3m deep	Crust, 5% coarse fragments <5mm	A1 0.00 – 0.25 Abrupt	Light medium clay	Moderate, <10mm peds, subangular, strength-firm	2% coarse fragments	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Nil	0.00 / 6.5	0.00 – 0.10	Site located on gilgai mound
				B2 0.25 – 1.00	Medium clay	Strong structure <20mm, very firm strength	<2% black nodules <5mm <1% calcium carbonate	10YR4/3 Brown Nil mottles / bleaching	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 09.0 / 7.0	0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	

SITE OD-28

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1 interfingering / grading with S1	Somerby, Monteagle, Humboldt	639637 mE 7542190 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	22/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating plain, mid slope 1-2%	Ironbark, Poplar Box, Moreton Bay Ash	Nil	Hard setting, <5% coarse fragments <10mm	A11 0.00 – 0.30 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.30 – 0.55 Clear	Loamy sand	Weak 0-10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.55 – 1.00	Silty clay loam	Weak subangular, Moderate 6-10mm peds	<2% manganese nodules	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE OD-31

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2 grading into S4	Somerby, Monteagle, Connors, Humboldt, Blackwater	639834 mE 7541276 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	22/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, upper slope 1.5%	Very sparse Blackbutt and Ironbark	Extensive clearing	Firm, nil coarse fragments	A1 0.00 – 0.13 Abrupt	Clayey sand	Weak, peds 2-10mm, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Few, very fine	0.00 / 7.0	No samples taken	No additional observations
				B21 0.13 – 0.37 Clear	Loamy sand	Weak subangular peds 5-20mm, weak	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.37 – 1.00	Loamy sand	Weak subangular peds 10-30mm, weak	<2% Coarse fragments 2-5mm and red nodules	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Moderately moist, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

SITE OD-34

Soil Mapping Unit:	**CSIRO Land Systems (Gunn et al 1967):**	**Location (GDA ZONE 55):**	**Aust. Soil Class.** :	**Site Survey Type**:	**Survey Date:**
C2, grading into C3-BL	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	639343 mE 7540015 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	**Natural Vegetation**	**Microrelief Disturbance Erosion**	**Surface condition, surface rock**	**Soil Profile Description**									
				Horizon Depth (m), Boundary	**Texture**	**Structure, Strength**	**Inclusions Segregations**	**Colour, Mottle**	**Moisture, Drainage**	**Roots**	**Depth (m) / Field pH**	**Sample (m)**	**Observations**
Grazing, mid slope, very gently undulating plain, 1.5%	Brigalow regrowth	Extensive clearing, previously blade ploughed	Hard setting, cracking – fine to moderate cracks, <5% coarse fragments 2-4mm	A1 0.00 – 0.18 Clear	Light clay	Weak angular peds <10mm, firm	<2% coarse fragments 2-6mm	10YR3/1 Very dark grey Nil mottles / bleaching	Humid – moderately moist, well drained	Very fine, few	0.00 / 6.5	0.00 – 0.10 0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	No additional observations
				B21 0.18 – 0.70 Diffuse	Medium clay	Moderate angular peds <20mm, firm	<5% coarse fragments 2-6mm and black nodules	10YR3/1 Very dark grey Nil mottles / bleaching	Moderately moist, well drained	Very fine, few	0.30 / 6.5		
				B22 0.70 – 0.81 Abrupt	Medium clay	Moderate angular peds <20mm, firm	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Moderately moist, well to moderately drained	Nil	0.60 / 7.0		

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
				B23 0.81 – 1.05	Silty clay loam	Weak angular peds <10mm, firm	-	10YR4/2 Dark greyish brown Nil mottles / bleaching	Dry, moderately moist	-	0.90 / 7.0		

SITE OD-94

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2, grading into C3-BL	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	636346 mE 7538814 mN	Brown Vertosol	Detailed - 50mm hand auger	12/7/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, upper slope, 1.0%	Regrowth, shrubs	Shallow gilgai, Extensive clearing	Cracking, Nil coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B2 0.10-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR3/1 Very dark grey Nil mottles / bleaching	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

SITE OD-170

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	637680 mE 7547045 mN	Brown Sodosol	Detailed - 50mm hand auger	4/8/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plain, mid-slope 1.0%	Poplar box, minor Ironbark	Nil	Soft to firm, nil coarse fragments	A1 0.00-0.38 Diffuse	Loamy sand	Massive, weak	Nil	10YR3/3 Dark Nil mottles / bleaching	Dry, rapid	Very fine, very few	0.10 / 6.5 0.30 / 6.5	No samples taken	No additional observations
				B2 0.38-1.00	Clay loam sand	Moderate, angular, 5-20 weak	<2% coarse fragments 2mm	10YR4/3 Brown Brown Mottle 5% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.60 / 7.5 0.90 / 7.5		

SITE OD-180

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	638448 mE 7545811 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plain, lower slope <2.0%	Poplar box, minor Eucalypts	Nil	Soft, loose, nil coarse fragments	A11 0.00-0.12 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.12-0.32 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.30 / 6.5		
				A13 0.32-0.70 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/6 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.60 / 6.5		
				B2 0.70-0.85	Clay loam sandy	Weak, weak, <5mm sub-angular	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, Well drained	Nil	0.90 / 7.0		

SITE OD-181

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	636937 mE 7547191 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plain, mid-slope <2.0%	Sparse Poplar box	Nil	Firm, nil coarse fragments	A1 0.00-0.10 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No recovery from 0.80m
				A2 0.10-0.44 Abrupt	Clayey sands	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Nil	0.30 / 6.5		
				A2 0.47-0.70 Abrupt	Clayey sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, well drained	Nil	0.60 / 6.5		
				B2 0.70-0.80	Clay loam sand	Weak, weak, <5mm sub-angular	Nil	10YR4/3 Brown Nil mottles / bleaching	Dry, rapid	Nil	0.90 / 7.0		

SITE OD-182

Soil Mapping Unit:	**CSIRO Land Systems (Gunn et al 1967):**	**Location (GDA ZONE 55):**	**Aust. Soil Class.** :	**Site Survey Type**:	**Survey Date:**
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	635944 mE 7548438 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	**Natural Vegetation**	**Microrelief Disturbance Erosion**	**Surface condition, surface rock**	**Soil Profile Description**									
				Horizon Depth (m), Boundary	**Texture**	**Structure, Strength**	**Inclusions Segregations**	**Colour, Mottle**	**Moisture, Drainage**	**Roots**	**Depth (m) / Field pH**	**Sample (m)**	**Observations**
Grazing, Gently undulating plain, lower slope <1.5%	Poplar box, Ironbark	Semi cleared, No microrelief No Erosion	Soft to firm, nil coarse fragments	A1 0.00-0.27 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
				B21 0.27-0.86 Abrupt	Clay loam sandy	Moderate, weak <10mm sub-angular	Nil	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Nil	0.30 / 6.0 0.60 / 6.5		
				B22 0.86-1.00	Clay loam sandy	Moderate, weak, <10mm sub-angular	<2% calcium carbonate	10YR4/4 Dark yellowish brown Nil mottles / bleaching	Dry, well drained	Nil	0.90 / 7.0		

SITE OD-183

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2 grading into C1-BL	Somerby, Monteagle, Connors, Humboldt, Blackwater	634838 mE 7549412 mN	Brown Vertosol	Detailed - 50mm hand auger	25/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Minor normal gilgai <20% coverage 3-5m wide and <0.30m in depth	Cracking with crust, firm	A1 0.00-0.11 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown Nil mottles / bleaching	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B2 0.11-1.00	Light clay	Moderate, firm, 20-50mm sub-angular	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE OD-184

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	633712 mE 7550670 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	25/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plain, lower slope 2.0%	Eucalypts Poplar box, minor Moreton Bay Ash	Nil	Firm, nil coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
				A12 0.15-0.50 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.30 / 6.0		
				A13 0.50-1.00	Loamy sand	Massive, weak	Nil	10YR3/6 Dark yellowish brown Nil mottles / bleaching	Dry, rapid	Nil	0.60 / 6.0 0.90 / 6.0		

SITE OD-187

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2 grading into T3	Somerby, Monteagle, Connors, Humboldt, Blackwater	632756 mE 7551848 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	26/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, lower slope <1.0%	Mixed vegetation, Brigalow regrowth and Poplar Box	Nil	Firm to hard setting Nil coarse fragments	A11 0.00-0.10 Abrupt	Silty loam	Weak, weak	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.10-0.60 Abrupt	Silty loam	Moderate, weak, 5-20mm	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Very few, very fine	0.30 / 6.5		
				B2 0.60-1.00	Light clay	Firm, sub-angular 10-30mm	<2% calcium carbonate nodules	10YR2/2 Very dark brown Mottle 10YR3/6 Dark yellowish brown Dark yellowish brown 10-20% Nil bleaching	Dry, Imperfect	Nil	0.60 / 7.0 0.90 / 7.5		

SITE OD-188

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2 grading to S4	Somerby, Monteagle, Connors, Humboldt, Blackwater	631308 mE 7552792 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	26/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Open Depression	Eucalypts, minor Brigalow	Gully erosion, No microrelief No disturbance	Loose, <5% <5mm coarse fragments	A11 0.00-0.40 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-1.00 Abrupt	Loamy sand	Massive, weak	<10% coarse fragments <5mm	10YR6/3 Dark brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.30 / 6.0		

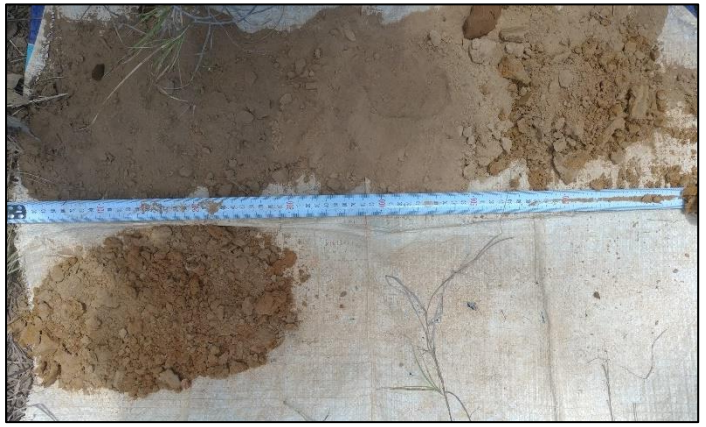
SITE OD-189

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	629781 mE 7553506 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017

Landscape

Surface

Soil Profile



Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, lower slope <1.0%	Poplar box	Nil	Firm, Nil coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
				A12 0.28-0.54 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, rapid	Very few, fine	0.30 / 6.5		
				B2 0.54-1.00	Clay loam sandy	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown Mottle <2% 10YR5/8 Dark yellowish brown Nil bleaching	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

SITE OD-190

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	627807 mE 7553767 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017

Landscape

Surface

Soil Profile

Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Poplar box	Nil	Firm, Nil coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown Nil mottles / bleaching	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
				A12 0.28-0.54 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR4/4 Brown Nil mottles / bleaching	Dry, rapid	Very few, fine	0.30 / 6.5		
				B2 0.54-1.00	Clay loam sandy	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown Mottle <2% 10YR5/8 Dark yellowish brown Nil bleaching	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C1	638193 7543626	C1-BL	Brigalow with small area nearby of Polpar Box Melonholes 0.3m deep	-
C2	638024 7542376	C1-BL	Grazing, flat plain, Brigalow, melonholes, cracking surface	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C3	637791 7541963	C1-BR	Gently undulating plaing, flat plain 1%, Brigalow Normal gilgai 0.2m deep with occasional melon holes 0.3-0.4m deep, 30% coverage Cracking surface	
C4	637725 7539819	C1-BR	Gently undulating plaing, flat plain 1%, Brigalow, melon holes, cracking surface	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C5	637830 7540693	Boundary T3 / C1-BL	Torwards the south: Gilgai <0.3m deep, depression, flat plain, Brigalow, cracking surface Towards to north, no microrelief, silty loam surface, firm, some cracking <1mm	-
C6	637073 7541733	C1-BR	Grazing, Gently undulating plaing, flat plain 1%. Brigalow regrowth, melonholes, cracking surface	-
C7	636179 7541751	C1-BR	Grazing, Gently undulating plaing, flat plain 1%. Cleared, grass cover, melonholes 0.3m+ deep, cracking surface	
C8	635940 7541064	C1-BR	Grazing, Gently undulating plaing, flat plain 2%. Cleared, grass cover, melonholes 0.3m+ deep, cracking surface	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C9	635998 7540972	S3	Nil microrelief, firm surface, loamy sand,	
C10	636879 7539888	C1-BR	Grazing, Brigalow regrowth, melonholes 0.3m+ deep, cracking surface	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C11	635483 7541974	S3	Poplar Box regrowth, surface firm, sandy loam, flat plain	 
C12	634989 7540049	C1-BR	Melon holes, 30% coverage, firm surface with cracking,brown	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C13	632603 7540962	C1-BL	Brigalow regrowth, melon holes, 40% coverage, firm surface with cracking, brown, light clay	-
C14	637237 7544307	Boundary S1 / C1-BR	Poplar Box to the east, Brigalow to the west	-
C15	635171 7544510	C3-BR	Gently undulating plain, upper slope 1-2% Brigalow; minor regrowth to the north, established to the south – aligning with east/west fence line	-
C16	634749 7544070	C3-BR	Gently undulating plain, upper slope 1-2% Nil microrelief, brown light clay surface with cracking, grass cover	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C17	635075 7543420	C1-BR	Gup upper slope, grass cover Melonholes 25% coverage, 3-6m wide, 0.35-0.45 deep Brown firm surface with cracking	 
C18	633305 7543178	C1-BR	Brigalow regrowth, melon holes, 40% coverage, 0.3 m+ deep, 3-5m wide, firm surface with cracking, brown, light clay	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C19	633068 7544673	C1-BR	Mid slope 1-2%, Brigalow regrowth, melon holes, 25% coverage, 0.25-0.4m deep, firm surface with cracking, brown, light clay	-
C20	634753 7545925	C3-BR	Gently undulating plain, mid slope 2% Minor gilgai in area, <1% coverage 0.2-0.3 m deep, brown light clay surface with cracking	-
C21	635132 7546037	C3-BR	Minor gilgai in area, <5% coverage 0.2-0.3 m deep, brown light clay surface with cracking	-
C22	635300 7546264	C3-BR	Gently undulating plain, mid slope 2% Nil gilgai in area, deep, brown light clay surface with cracking Extensively disturbed	-
C23	636756 7547170	S1	Flat plain, soft loamy sand surface, Poplar Box	-
C24	636526 7547164	S1	Flat plain, soft loamy sand surface, Poplar Box	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C25	636311 7547192	Boundary S1 / C3-BL	Grey clay surface with cracking to west, firm, loamy sand surface with Poplar Box to the east	-
C26	636240 7546889	Boundary C1-BR / C3 BL	Cracking surface, light clay Toward east, grey surface, no microrelief Toward west, brown surface, melonholes 30% coverage	-
C27	635988 7546752	Boundary C1-BR / C3-BL	Cracking surface, light clay Toward west, grey surface, no microrelief Toward east, brown surface, melonholes 30% coverage	-
C28	635692 7548205	C3-BL	Firm crackingsurface, light clay, grey/black	-
C29	635860 7548047	S1	Soft, surface, no cracking, loamy sand, Poplar Box	-
C30	635592 7547610	C3-BL	Firm crackingsurface, light clay, grey/black	-
C31	635145 7547077	Boundary C3-BR / C3-BL	Brown firm cracking surface, changes to grey clay towards the east	-
C32	635958 7545868	C1-BR	Small area of browb clay with melon holes, 0.3m deep, 50% coverage Areas surrounding this area are grey clay with no melon holes or microrelief	-
C33	638382 7545308	S1	Soft, surface, no cracking, loamy sand, Poplar Box	-
C34	638267 7544219	C3-BL	Grey clay with no microrelief, surface firm with cracking, areas of sandy surface (S1) to the north (100-200m away)	-
C35	638117 7543337	C1-BR	Cracking brown clay, melon holes 40-50% coverage 0.3-0.4m deep	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C36	637634 7539855	S3	Firm surface, <1mm, texture silty loam, no coarse fragments	-
C37	636513 7539097	C3-BR	Firm cracking (clay surface, brown, 1% normal gilgai <0.15m deep, no melon holes	-
C38	635585 7539143	C1-BR	Brown clay with melonholes 30-40% coverage 0.3-0.4m deep	-
C39	635054 7539207	C1-BL	Grey clay with melonholes 30-40% coverage 0.3-0.4m deep	-
C40	634676 7539255	C3-BL	Grey light clay, cracking, surface firm, <2% normal gilgai <0.10m deep	-
C41	634888 7539675	Boundary C1-BR / C1-BL	Cracking clay with melonholes 40% coverage, Grey clay to the south, brown clay to the north	-
C42	635069 7541087	C1-BR	Brown cracking clay with 20-30% coverage of melon holes average 0.30m deep	-
C43	635076 7541324	C1-BR	Brown cracking clay with 30-40% coverage of melon holes average 0.30m deep	-
C44	633994 7542221	Boundary C1-BR / C3-BR	Flat plain, surface firm with cracking, light clay, no coarse fragments, <1% gilgai to the east, 30%+ melon holes to the west	-
C45	632753 7542369	C3-BL	Grey light clay surface firm, cracking, no microrelief	-
C46	632687 7541691	Boundary C1-BL / C3-BL	Mid slope, 1-2% Grey light clay surface firm, cracking No microrelief to the north Melon holes starting towards south	-
C47	632856 7543279	Boundary C1-BR / C3-BR	Flat plain, surface firm with cracking, light clay, no coarse fragments, <1% gilgai to the north, 30%+ melon holes to the south	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C48	633211 7543611	C3-BR	Flat plain <1%, surface self mulching with cracking <10mm, minor gilgai <2% <0.10m deep	-
C49	632991 7544376	C3-BR	Flat plain <1%, surface self mulching with cracking <10mm, minor gilgai <2% <0.10m deep	-
C50	633450 7545055	C1-BR	Brown cracking clay with 30-40% coverage of melon holes average 0.30m deep	-
C51	633052 7545022	C3-BR	Flat plain <1%, surface self mulching with cracking <10mm, minor gilgai <2% <0.10m deep	-
C52	633335 7545264	C1-BR	Brown cracking clay with 30-40% coverage of melon holes average 0.30m deep	-
C53	633783 7545526	C1-BR	Brown cracking clay 2-10mm with 40-50% coverage of melon holes 0.30-0.40m deep	-
C54	633959 7545620	C3-BR	surface firm to self mulching with cracking, no microrelief	-
C55	634103 7545697	C1-BR	Brown cracking clay with 30-40% coverage of melon holes average 0.30m deep	-
C56	634233 7545771	C3-BR	Surface firm to self mulching with cracking, no microrelief	-
C57	634562 7545947	C3-BR	Mid slope 1% Minor gilgai in area, <1% coverage 0.2m deep, brown light clay surface with cracking	-
C58	634967 7546177	Boundary C3-BR / C3-BL	Boundary; grey surface to north, brown to south Cracking light clay, no microrelief	-
C59	634867 7549299	C1-BL	Melon holes with grey surface colour, cracking, light clay	-
C60	634915 7549098	C3-BL	Surface grey with cracking, no coarse fragments, no microrelief	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C61	635009 7548586	C3-BL	Surface grey with cracking, no coarse fragments, no microrelief	-
C62	635116 7548005	C3-BL	Surface grey with cracking, no coarse fragments, no microrelief	-
C63	635016 7545526	C1-BR	Brown cracking clay with 30-40% coverage of melon holes average 0.30m deep	-
C64	634643 7545369	C3-BR	Surface brown with cracking, no coarse fragments, no microrelief	-
C65	634610 7545179	C1-BR	Brown cracking clay with 30% coverage of melon holes average 0.30m deep	-
C66	634447 7545085	C3-BR	Surface brown with cracking, no coarse fragments, no microrelief	-
C67	634166 7545223	C1-BR	Brown cracking clay with 30% coverage of melon holes average 0.30m deep	-
C68	634599 7544948	C1-BR	Brown cracking clay with 30% coverage of melon holes average 0.30m deep	-
C69	634342 7544847	C3-BR	Surface brown with cracking, no coarse fragments, no microrelief	-
C70	634428 7544745	C1-BR	Brown cracking clay with 50% coverage of melon holes average 0.30m deep	-
C71	634147 7544580	C3-BR	Surface brown with cracking, no coarse fragments, minor gilgai, <0.1m deep, 5% coverage	-
C72	634342 7544561	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30m deep	-
C73	633958 7544585	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30m deep	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C74	633570 7544592	C3-BR	Surface brown, with cracking, no microrelief	-
C75	633371 7544635	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30m deep	-
C76	636195 7540915	Boundary S3 / C1-BR	Cracking clay with 50% melon hole coverage to the north, firm sandy loam surface to the south	-
C77	636539 7540493	Boundary S3 / C1-BR	Cracking clay with 50% melon hole coverage to the east, firm sandy loam surface to the west	-
C78	636164 7540341	Boundary S3 / C1-BR	Cracking clay with 50% melon hole coverage to the west, firm sandy loam surface to the east	-
C79	636409 7540255	S3	Firm surface , texture sandy loam, tall woodlands	-
C80	636195 7540075	Boundary S3 / C1-BR	Cracking clay with 50% melon hole coverage to the west, firm sandy loam surface to the east	-
C81	636539 7539833	Boundary S3 / C1-BR	Cracking clay with 50% melon hole coverage to the south, firm sandy loam surface to the north	-
C82	636317 7539777	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30-0.40m deep	-
C83	636603 7539640	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30-0.40m deep	-
C84	636705 7539493	Boundary C1-BR / C3-BR	Brown cracking clay, with melon holes to the north, but no major microrelief evident towards the south	-
C85	636685 7539429	C3-BR	Surface brown with cracking, no microrelief	-
C86	636593 7542686	S3	Firm surface , texture sandy loam	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C87	636875 7542694	C1-BR	Brown cracking clay with 40% coverage of melon holes 0.30-0.40m deep	-
C88	636357 7543271	S3	Firm surface , texture sandy loam	-
C89	637275 7542333	C1-BR	Brown cracking clay with 50% coverage of melon holes 0.30-0.40m deep	-
C90	637378 7542177	Boundary S3 / C1-BR	Cracking clay with 40% melon hole coverage to the north, firm sandy loam surface to the south	-
C91	637373 7542018	S3	Firm surface texture sandy loam	-
C92	637178 7541919	S3	Firm surface	-
C93	637029 7541990	C1-BR	Brown cracking clay with 50% coverage of melon holes 0.30-0.40m deep	-
C94	635417 7543363	C1-BR	Brown cracking clay with 50% coverage of melon holes 0.30-0.40m deep	-
C95	635479 7543796	C3-BR	Surface brown light clay with cracking 2-6mm, no coarse fragments, no microrelief	-
C96	635497 7543964	C1-BR	Brown cracking clay with 30% coverage of melon holes 0.30m deep	-
C97	635520 7544107	C3-BR	Surface brown light clay with cracking, no coarse fragments, no microrelief	-
C98	635562 7544339	C1-BR	Brown cracking clay with 50% coverage of melon holes 0.30-0.40m deep	-
C99	638680 7544806	S1	Poplar box, surface soft loamy sand	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C100	638693 7543756	C1-BL	Brigalow, cracking surface, normal gilgai 0.05-0.20 m deep	-
C101	638071 7542587	C1-BL	Gently undulating plain, flat plain 1% slope Grass cover, surface firm grey light clay, cracking, grass cover Normal gilgai and melon holes 0.2-0.35 m deep	-
C102	637974 7541858	C1-BL	Brigalow regrowth, flat plain Surface firm, light clay with cracking, grey with brown interfingering surface colour in immediate area	-
C103	638374 7541539	C1-BL	Gently undulating plain, flat plain <1% slope Brigalow, surface firm grey light clay, cracking, grass cover Melon holes 0.35+ m deep	-
C104	638912 7541446	S4	Firm surface, loamy sand, no cracking, sparse mixed vegetation regrowth	-
C105	639193 7544359	S1	Poplar Box, loamy sand on surface, soft to firm	-
C106	639045 7544204	C1-BL	Flat plain <1% slope Brigalow, surface firm grey light clay, cracking, Melon holes 0.30+ m deep	-
C107	638915 7544067	C3-BL	Surface firm, light clay, cracking	-
C108	639053 7543890	R3	Surface firm, reddish brown colour, loamy sand on surface, soft to firm	-
C109	639146 7543730	C3-BL	Surface firm, light clay, cracking	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C110	639073 7543638	C1-BL	Brigalow, surface firm grey light clay, cracking Melon holes 50% coverage 0.20-0.30 m deep	-
C111	638721 7543453	Boundary C1-BL / C3-BL	Light clay surface with cracking, grey No major microrelief to the east, melon holes 40% coverage to the west	-
C112	638680 7544035	S1	Poplar Box, loamy sand on surface, soft to firm	-
C113	638431 7543606	C1-BL	Brigalow, surface firm grey/black light clay, cracking, Melon holes 0.30+ m deep	-
C114	638409 7540239	C3-BL	Surface firm, light clay, cracking No microrelief evident in immediate area	-
C115	632030 7544817	C3-BR	Mid slope 2%, Buffel grass cover, firm brown cracking surface, light clay	-
C116	631528 7545447	C3-BR	Exposed profile at drilling location observed; Mid slope 1-2 %, Buffel grass cover with sparse Brigalow regrowth. Surface firm, brown, with cracking. No microrelief observed. Profile to approximately 1 m observed with cracking clay throughout, cracks wider at depth suggesting light clay changing to medium clay.	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C117	632021 7545698	C3-BR	Gently undulating plain, slope 1-2%, Brigalow regrowth, <2% melon holes 0.3 m deep in wider area, surface colour 10YR4/3 light clay	-
C118	630484 7545555	C3-BR	Narrow depression and drainage line, Narrow Leave Ironbark, gully erosion, surface light clay, 7.5YR3/2, cracking	
C119	630315 7545764	C3-BR	Light clay brown surface with cracking, <1% minor gilgai present	-
C120	630651 7546114	C3-BR	Light clay brown surface with cracking, Brigalow regrowth in the area	-
C121	630492 7546461	C3-BR	Light clay brown surface with cracking	-
C122	631484 7546501	C3-BR	Light clay brown surface with cracking	-
C123	631887 7546928	C3-BR	Light clay brown surface with cracking	-
C124	632521 7546894	C3-BR	Light clay brown surface with cracking	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C125	632869 7547016	C3-BR	Light clay brown surface with cracking	-
C126	632999 7546153	C3-BR	Light clay brown surface with cracking	-
C127	632556 7545743	C3-BR	Light clay brown surface with cracking	-
C128	632448 7545489	C1-BR	Surface clay with cracking, 30% melon hole coverage	-
C129	632564 7545276	C1-BR	Surface clay with cracking, 30% melon hole coverage Areas with minimal microrelief starts towards the east	-
C130	622237 7549366	C4	Gently undulating plain, mid slope 2%, surface 10YR3/2 cracking and self mulching, light clay, mixed vegetation	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C131	622225 7549021	C4	Lower slope 2% Surface self mulching with cracking Colour 10YR3/2 – grey Linear gilgai <0.2m deep	-
C132	621808 7548506	C4	Lower slope 2% Surface self mulching with cracking Linear gilgai <0.2m deep	-
C133	621424 7549144	C4	Lower slope 2% Surface self mulching with cracking Linear gilgai <0.2m deep	-
C134	621170 7548647	C4	Lower slope 2% Surface self mulching with cracking Linear gilgai <0.2m deep	-
C135	622730 7549999	C4	Lower slope 2% Surface self mulching with cracking Linear gilgai <0.2m deep	-
C136	622966 7550307	C4	Cracking grey clay with linear gilgai to the south, to the north (outside project site) surface becomes firm, reddish brown, sandy loam	-
C137	623704 7550913	C4	Light clay, grey, surface with cracking, minor linear gilgai	-
C138	623957 7550997	Boundary C4 / T1-R	Cracking (<10mm) grey clay to the west, firm, clay loam with cracking to the east	-
C139	625139 7551214	T1-R	Firm to hard setting surface, light brown clay loam, cracking	-
C140	625249 7551407	C3-BL	Light clay surface, light grey, crackingfirm to soft, no microrelief	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C141	625800 7552015	C3-BL	Light clay surface, light grey, cracking, firm to soft, no microrelief	-
C142	626227 7552024	C1-BR	Melon holes 30-40% coverage, brown colour light clay surface, cracking	-
C143	624562 7540402	Disturbance Area	Infrastructure, dams and roads	-
C144	625635 7540458	Disturbance Area	Infrastructure, dams and roads	-
C145	625962 7540594	C3-BL	Upper slope 1-2%, Brigalow and mixed shrubs, linear gilgai, surface grey self mulching, with cracks	

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C146	626865 7541097	C3-BL	Pit observed, suggests profile is uniform grey-black clay thoughout Upper slope, Brigalow, linear gilgai observed, surface grey, self mulching	
C147	627216 7541296	S1	Surface firm to soft, loamy sand, light brown	-
C148	628403 7541959	C3-BL	Grey clay surface, cracking	-
C149	628850 7542181	C3-BL	Minor depression, inactive drainage line Grey clay surface, cracking	-
C150	629329 7542780	C3-BL	Brigalow, mid slope 2% Surface grey light clay with cracking	-
C151	629348 7543293	C3-BL	Brigalow, mid slope 2% Surface grey light clay with cracking	-
C152	629385 7543907	C3-BL	Brigalow, mid slope 2% Surface grey light clay with cracking	-
C153	629568 7544007	C3-BR	Grazing, gently undulating plain, Brigalow, soft, self mulching, cracking observed	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C154	629447 7544344	T1-B	Surface firm, light brown, cracking, clay loam, mixed vegetation	-
C155	629652 7544575	C3-BR	Grazing, gently undulating plain, Brigalow, soft, self mulching, cracking observed, some gilgai in the area <0.15 m depth, <5% coverage	-
C156	631710 7544280	C3-BR	Mosaic of grey clay (this site - surface 10YR3/2) in larger area of brown clay observed, Brigalow	-
C157	632455 7544156	C3-BR	Brown clay surface with cracking, Brigalow, no microrelief	-
C158	632701 7544131	C1-BR	Brown light clay surface, melon holes 30% coverage, 0.2-0.4m deep	-
C159	632912 7543697	Boundary C1-BR / C3-BL	Brown light clay surface, melon holes to south, no major microrelief to the north and grey surface	-
C160	632262 7542473	C3-BL	Grey light clay with surface cracking	-
C161	631701 7542565	C1-BR	Brown light clay with melon holes	-
C162	630865 7542702	Boundary C1-BR / C3-BL	Brown light clay surface, melon holes to east, grey with no major microrelief to the west	-
C163	630382 7543016	C3-BR	Cracking, self mulching surface, Brigalow regrowth, light brown colour	-
C164	630356 7543372	C3-BR	Brown surface, gilgai in the area 0.1-0.2 m deep, 10% coverage	-
C165	630168 7543393	Boundary T1-B / C3-BR	Brown clay to the east, firm non cracking surface to the west	-
C166	630247 7543386	C3-BR	Brown surface with subdominant areas of grey clay (C3-BL), minor gilgai <5% coverage	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C167	630791 7542547	Boundary C3-BL / C1-BR	Grey clay surface to the west, no gilgai, brown clay surface with melon holes to the east	-
C168	631397 7542863	C1-BR	Brown cracking clay surface, 50% melon hole coverage 0.3-0.4 m deep	-
C169	630692 7542492	C3-BL	Cracking surface, firm, grey light clay	-
C170	631840 7541249	Boundary T1-B / C1-BR	Brown cracking clay surface starts towards the east, non-cracking surface to the west	-
C171	632110 7541280	C1-BR	Brown cracking clay surface, 50% melon hole coverage 0.3-0.4 m deep	-
C172	632421 7541119	C1-BL	Grey-black cracking clay surface, 30% melon hole coverage 0.3-0.4 m deep	-
C173	631486 7541294	T1-B	Firm surface , clay loam	-
C174	631386 7541126	T1-B	Firm surface , clay loam	-
C175	631209 7541306	C3-BL	Cracking surface, firm, grey light clay	-
C176	630862 7541474	C1-BL	Grey cracking clay surface, 30% melon hole coverage 0.3-0.4 m deep	-
C177	630659 7541639	C3-BL	Cracking surface, firm, grey light clay	-
C178	630365 7541828	C1-BL	Grey cracking clay surface, 30% melon hole coverage 0.3-0.4 m deep	-
C179	629906 7542117	C3-BL	Flat plain <1% slope, cracking surface, firm, grey light clay	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C180	630195 7543045	T1-B	Firm surface , clay loam	-
C181	630821 7543870	C3-BR	Mid slope 2%, Buffel grass cover, firm brown cracking surface, light clay	-
C182	631405 7544060	C1-BR	Brown cracking clay surface, 50% melon hole coverage 0.3-0.4 m deep	-
C183	631963 7544503	C1-BR	Brown cracking clay surface, 50% melon hole coverage 0.3-0.4 m deep	-
C184	632485 7544800	C3-BR	Mid slope 1%, firm brown cracking surface, light clay	-
C185	633208 7545199	Boundary C3-BR / C1-BR	Brown light clay surface with cracking, melon holes starting towards north-east	-
C186	633137 7545840	C3-BR	Firm to self mulching, brown cracking surface, light clay	-
C187	632646 7546344	C3-BR	Surface self mulching, brown, cracking, light clay	-
C188	629708 7546560	C3-BR	Surface self mulching, brown, cracking, light clay	-
C189	629374 7546597	C3-BL	Grey surface colour, light clay with cracking m, flat plan, Brigalow regrowth	-
C190	629312 7546227	C3-BL	Grey surface colour, light clay with cracking, flat plan, Brigalow regrowth	-
C191	629265 7545820	C3-BL	Grey surface colour, light clay with cracking, flat plan, Brigalow regrowth Some gilgai <2% coverage	-
C192	629434 7544876	C3-BL	Grey surface colour, light clay with cracking	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C193	629418 7544625	T1-B	Surface firm, light brown, cracking, clay loam, mixed vegetation	-
C194	630010 7545270	C3-BR	Brown surface colour, light clay, no microrelief evident	-
C195	629637 7546069	C3-BL	Flat plain <1% slope, Brigalow Surface grey cracking, light clay Gilgai <0.1 m deep, <3 m wide, < 30% coverage	-
C196	629001 7546472	C3-BL	Flat plain <1% slope, Brigalow Surface grey cracking, light clay	-
C197	628139 7546554	C4	Self mulching, some cracking in the area, dark grey / black colour, light clay surface, linear gilgai apparent in aerial imagery	-
C198	627376 7546953	T2	Reddish brown sandy clay loam surface, firm, no cracking	-
C199	627622 7546587	T2	Reddish brown sandy clay loam surface, firm, no cracking	-
C200	627856 7546551	C4	Dark grey light clay surface with cracking, mid slope	-
C201	629435 7547150	C3-BR	Cracking light clay surface, brown	-
C202	629586 7547375	C3-BR	Cracking light clay surface, brown	-
C203	629882 7548004	C3-BR	Sparse Brigalow, upper sleop, near crest Melon holes 5% coverage Cracking light clay surface, grey	-
C204	633242 7547090	C3-BL	10% gilgai <0.3m deep, cracking light clay surface, grey colour	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C205	632799 7547676	C3-BL	Open depression with grass cover, gully erosion Surface grey, self mulching and cracking	
C206	630759 7547905	C3-BL	Surface cracking light clay, colour 2.5YR3/2 Olive grey	-
C207	630136. 7547484	C3-BR	Cracking, brown light clay	-
C208	630942 7547569	C3-BR	Cracking, brown light clay, Brigalow regrowth	-
C209	629573 7547755	C3-BR	Cracking, brown light clay, Brigalow regrowth	-
C210	628796 7547845	C3-BR	Cracking, brown light clay	-
C211	628493 7547651	C3-BR	Cracking, brown light clay	-
C212	628301 7547264	C3-BR	Cracking, brown light clay	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C213	628126 7546911	C3-BR	Cracking, brown light clay, minor depression and inactive drainage line	-
C214	628025 7546728	C4	Minor linear gilgai starting towards the south, dark grey light clay	-
C215	627783 7546196	C4	Minor linear gilgai starting towards the north, dark grey light clay	-
C216	627576 7545776	T2	Reddish brown sandy clay loam surface, firm, no cracking	-
C217	627657 7544781	T2	Reddish brown sandy clay loam surface, firm, no cracking	-
C218	627866 7544861	C3-BL	Cracking light clay, grey, no microrelief	-
C219	628437 7544766	C3-BL	Cracking light clay, grey, no microrelief	-
C220	629020 7544689	C3-BL	Cracking light clay, grey, no microrelief	-
C221	630747 7544411	C3-BR	Cracking, brown light clay	-
C222	629997 7544734	C3-BR	Cracking, brown light clay, Brigalow	-
C223	629952 7548810	C3-BL	Cracking light clay, grey, no microrelief	-
C224	630007 7549332	C3-BR	Cracking light clay, brown, no microrelief	-
C225	630094 7550082	C3-BR	Cracking light clay, brown, no microrelief	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C226	630167 7550568	C3-BR	Cracking, brown light clay, Brigalow	-
C227	630203 7550782	C3-BL	Cracking light clay, grey, no microrelief	-
C228	630755 7550572	C3-BL	Cracking light clay, grey, no microrelief, mid slope 2%, Brigalow regrowth	-
C229	630876 7550687	T3	Surface silty loam	-
C230	630855 7549864	C3-BL	Gently undulating plain, upper slope 2% Mixed vegetation with Brigalow Surface grey, self mulching, cracking	-
C231	630897 7549997	K1	Surface hard setting, light brown, light clay Cracking, 1% rocks 100-200 mm	
C232	631852 7550369	C3-BL	Brigalow, with very minor gilgai 2% coverage Surface cracking and soft, light clay 10YR3/2 grey colour	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C233	630630 7550219	K1	Firm to hard setting surface, light clay with rocks 100-250 mm 2% coverage	-
C234	630381 7550329	K1	Firm to hard setting surface, light clay with rocks 100-250 mm 2% coverage	-
C235	630293 7551278	C3-BL	Cracking light clay, grey, no microrelief	-
C236	630424 7551552	C5	Dark grey, self mulching surface, light clay	-
C237	630720 7551763	C5	Lower slope, wide aluvial plain Dark grey, self mulching surface, light clay	-
C238	630633 7552584	C3-BL	Cracking light clay, grey, no microrelief	-
C239	631139 7552700	S4	Firm to soft, loamy sand surface, Poplar Box	-
C240	631345 7553211	S4	Firm to soft, loamy sand surface, Poplar Box	-
C241	630574 7553775	S1	Firm to soft, loamy sand surface, gums	-
C242	630033 7553723	S1	Firm to soft, loamy sand surface, gums	-
C243	633506 7548975	C3-BL	Surface cracking, light clay, colour grey	-
C244	633408 7548112	C3-BR	Mixed vegetation Surface cracking, light clay, colour brown	-
C245	633364 7547728	C3-BL	Upper slope, mixed vegetation with Brigalow Surface cracking, light clay, colour grey	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C246	630677 7548430	Boundary T3 / C3-BL	Toward south – grey cracking clay Toward north – light brown firm surface clay loam	-
C247	630772 7548721	T3	Firm to hard setting, clay loam, <2% coarse fragments, light brown	-
C248	630762 7549115	C3-BL	Grey to black light clay, cracking, <1% coarse fragments <2mm	-
C249	631498 7550042	C3-BL	Cracking light clay, grey, no microrelief, Brigalow	-
C250	632504 7550487	C3-BL	Brigalow, with very minor gilgai 2% coverage Surface cracking and soft, light clay 10YR3/2 grey colour	-
C251	632567 7550760	Boundary C3-BL / S1	Grey cracking clay to the south west, firm loamy sand surface to the north east	-
C252	632761 7550859	C1-BR	Light clay surface, brown, cracking, melonh holes 40% coverage	-
C253	632933 7551101	S1	Loamy sand surface, firm, Poplar box and mixed vegetation	-
C254	633019 7551273	T3	Cracking, silty loam surface, light grey-brown	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C255	633598 7547130	C3-BR	Crest, upper slope 2% Mixed veg., some Poplar Box nearby Surface soft, self mulching 0.00-0.10 Light clay 10YR3/3 Weak 0.10-0.30+ Light clay 10YR3/3 Moderate 	 
C256	633585 7547081	C3-BR	Mixed vegetation Surface cracking, light clay, colour brown	-
C257	629831 7550374	C3-BR	Surface cracking, light clay, colour brown	-
C258	629495 7549669	C3-BR	Surface cracking, light clay, colour brown	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C259	629098 7548886	C3-BR	Surface cracking, light clay, colour brown	-
C260	629097 7548251	C3-BR	Surface cracking, light clay, colour brown	-
C261	629831 7551283	C3-BL	Brigalow, with very minor gilgai 2% coverage Surface cracking and soft, light clay 10YR3/2 grey colour	-
C262	629521 7551350	C3-BL	Surface cracking and soft, light clay, grey	-
C263	628894 7551420	C3-BL	Surface cracking and soft, light clay, grey	-
C264	628437 7551644	C1-BL	Light clay, grey, melon holes, small isolated polygon	-
C265	628344 7551735	S4	Loamy sand surface, no coarse fragments, firm, light brown	-
C266	628098 7551816	C1-BR	Self mulching with cracking, brown, melon holes 30% coverage, 0.3-0.5m deep	-
C267	629045 7551635	S4	Loamy sand surface, no coarse fragments, firm, light brown	-
C268	629756 7550784	C3-BR	Surface cracking, light clay, colour brown	-
C269	628305 7550326	C3-BR	Surface cracking, light clay, colour brown	-
C270	628040 7549334	C3-BR	Mid slope 2%, Brigalow regrowth Surface cracking light clay, Brown 2.5YR4/3	-
C271	627865 7547958	C3-BL	Mid slope, near crest, Brigalow regrowth Surface cracking light clay, 2.5YR4/2 grey	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C272	627558 7547195	T2	Reddish brown sandy clay loam surface, firm, no cracking	-
C273	626046 7542315	C3-BL	Flat plain <1%, Brigalow regrowth Surface cracking light clay, grey	-
C274	626232 7542473	S1	Ajacent to drainage line, loamy sand surface	-
C275	626204 7542946	C3-BL	Grey light clay surface, cracking	-
C276	626298 7543162	T3	Cracking, silty loam surface, light grey-brown	-
C277	626538 7543651	T3	Cracking , silty loam surface, mixed vegetation	-
C278	626807 7544055	C5	Wide alluvial plain, very dark grey – black light clay surface, cracking	-
C279	627162 7544006	C3-BL	Grey light clay surface, cracking	-
C280	626940 7544479	C3-BL	Grey light clay surface, cracking	-
C281	627325 7550086	C3-BR	Self mulching with cracking, brown	-
C282	627490 7550412	C3-BR	Brigalow, self mulching with cracking, brown	-
C283	627668 7550817	C3-BL	Brigalow, self mulching with cracking, grey	-
C284	627886 7551270	C3-BL	Self mulching to firm with cracking, grey	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C285	627968 7551639	C1-BR	Self mulching with cracking, brown, melon holes 30% coverage, 0.3-0.5m deep	-
C286	628175 7551675	C3-BL	Light clay, grey	-
C287	628247 7551088	C3-BL	Light clay, grey, Brigalow, cracking	-
C288	628200 7550716	C3-BR	Flat plain, Brigalow, not disturbed / extensive disturbed in the past Surface cracking light clay, brown	
C289	628246 7551032	C3-BL	Mid slope, Brigalow regrowth Surface cracking light clay, 10YR3/2 grey	-
C290	630050 7542855	C3-BL	Upper slope 2-3%, Brigalow regrowth Surface cracking light clay, grey	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C291	629161 7542391	C3-BL	Drepression, drainage line Gully erosion, gums Surface cracking light clay, grey	
C292	627620 7541496	S1	Gully erosion, wide depression Mixed vegetation Soil profile sandy loan to sandy clay loam	
C293	622862 7550419	T1-R	Aerial imagery assessment indicates light reddish brown surface colour with <50% grass cover which is indicative of T1-R	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
C294	623837 7551520	T1-R	Aerial imagery assessment indicates light reddish brown surface colour with <50% grass cover which is indicative of T1-R	-
C295	634198 7538865	S1	Aerial imagery assessment shows woodlands with light brown surface colour which is indicative of S1 areas observed	-
OD-C63	639479 7544206	C1-BL	Cracking surface, normal gilgai	-
OD-C81	639693 7542920	C3-BL	Cracking surface, minor normal gilgai	-
OD-C82	639308 7543232	C3-BL	Cracking surface, minor normal gilgai	-
OD-C83	639389 7542297	C3-BL	Brigalow regrowth and cracking surface starts to the north and west	-
OD-C84	639291 7541919	S1	Poplar Box and Blackbutt	-
OD-C85	639588 7541646	S1/S4 Boundary	Poplar Box to the north, cleared to the south	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
OD-C129	639315 7540373	S4	Firm light brown surface, cleared	
OD-C144	639623 7539560	C3-BL	Cracking surface, normal gilgai <0.2m deep, 20% coverage	-
OD-C179	638202 7538826	C3-BR	Cracking surface, normal gilgai <0.2m deep <20% coverage.	-
OD-C180	638554 7538939	C1-BL	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow	-
OD-C185	635851 7538289	C3-BL	Cracking surface, normal gilgai <0.2m deep <20% coverage. Brigalow regrowth	-
OD-C188	636551 7538527	C1-BR	Cracking surface to the north	-
OD-C753	637656 7546475	C3-BL	Minor gilgai, cracking clay surface	-
OD-C768	639285 7540134	C3-BL/S4 Boundary	Cracking clays to the south, Poplar box woodlands to the north	-

Site No.	Location - mE, mN (GDA94 Zone 55)	Soil Mapping Unit	Comments	Plates
OD-C804	637213 7546895	S1	Firm sandy surface, some Poplar Box	-
OD-C806	636039 7548170	S1	Firm sandy surface, Poplar Box	-
OD-C808	634294 7550076	S1	Poplar Box, Gums, firm loamy sand surface, creek nearby	-
OD-C809	632117 7552418	T3	Very fine cracking surface with Poplar Box, field texture – silty loam	-
OD-C813	628563 7553666	S1	Firm sandy surface, Poplar Box	-

ESSA Pty Ltd /EAL NATA (ASPAC certified)

For Info Refer ESSA Pty Ltd
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References: I3569

Date Received: 24/10/2019
Date Completed: 04/11/2019

FINAL REPORT

Project:

Project -19WS

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: GT Environmental

Contact: Mr Reece Mc Cann

Sample Type: Soil

Number of samples: 90

ESSA /EAL Pty Ltd **(NATA,ASPAC Approved)**

Soil Analysis Report
Batch Numbers: I7194 And I7195

Client: GTE 19WS- Results Page 1 of 4

ESSA Ref	field ref	Soil pH	Soil EC	Soil Cl	Exch.Ca	Exch. Mg	Exch.K	Exch. Na	CEC	ESP	Ca/Mg	Cation
	depth (m)		dS/m	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%Na/CEC	Ratio	Method
i7194/1	**1-0.0-0.10**	6.53	0.011	12	2.1	0.58	0.19	<0.065	2.9	0.8	3.7	**15D3**
i7194/2	**2-m-0.00-0.10**	6.74	0.345	275	9.7	9.3	1.3	0.40	21	1.9	1.0	**15D1**
i7194/3	**2-d-0.00-0.10**	6.44	0.040	25	8.0	8.0	0.62	0.59	17	3.4	1.00	**15D3**
i7194/4	**6-0.00-0.10**	6.63	0.022	11	2.1	2.5	0.43	0.28	5.4	5.2	0.83	**15D3**
i7194/5	**9-m-0.00-0.10**	7.10	0.051	45	7.3	8.0	0.33	0.64	16	3.9	0.91	**15D3**
i7194/6	**9-d-0.00-0.10**	5.51	0.023	5.2	5.0	3.8	0.62	0.30	11	2.6	1.3	**15D3**
i7194/7	**10-0.00-0.10**	6.69	1.027	472	7.4	3.6	3.4	<0.065	14	0.1	2.1	**15D1**
i7194/8	**31-0.00-0.10**	6.51	0.022	5.5	2.3	0.93	0.45	<0.065	3.7	0.9	2.5	**15D3**
i7194/9	**35-m-0.00-0.10**	7.39	0.059	23	23.80	9.56	0.80	0.22	34.4	0.6	2.5	**15C1**
i7194/10	**35-d-0.00-0.10**	8.12	0.141	46	27.42	8.72	0.80	0.48	37.4	1.3	3.1	**15C1**
i7194/11	**36-0.00-0.08**	7.30	0.030	5.8	7.40	1.88	0.68	0.08	10.0	0.8	3.9	**15C1**
i7194/12	**37-0.00-0.10**	7.32	0.049	11	15.25	4.52	0.90	0.15	20.8	0.7	3.4	**15C1**
i7194/13	**42-0.00-0.09**	7.32	0.062	9.8	12.57	2.57	1.24	0.11	16.5	0.7	4.9	**15C1**
i7194/14	**51-0.00-0.10**	8.42	0.117	25	28.14	6.41	1.01	0.14	35.7	0.4	4.4	**15C1**
i7194/15	**55-0.00-0.10**	5.92	0.030	12	5.3	2.1	0.54	0.23	8.3	2.8	2.5	**15D3**
i7194/16	**68-0.00-0.10**	6.39	0.011	3.8	2.1	0.48	0.28	<0.065	2.9	0.6	4.4	**15D3**
i7194/17	**70-0.00-0.10**	7.54	0.065	32	20.69	7.55	0.23	0.39	28.9	1.4	2.7	**15C1**
i7194/18	**75-0.00-0.10**	6.50	0.043	17	9.7	3.9	1.4	0.07	15.1	0.5	2.5	**15D3**
i7195/1	**1-0.20-0.30**	6.12	0.010	34	1.25	0.54	0.27	<0.065	2.08	1.1	2.3	**15D3**
i7195/2	**1-0.35-0.45**	7.08	0.073	35	0.97	0.59	0.25	<0.065	1.87	3.2	1.6	**15D3**
i7195/3	**1-0.60-0.70**	7.11	0.078	146	4.25	3.84	0.35	1.03	9.48	10.9	1.1	**15D3**
i7195/4	**1-0.90-1.00**	7.98	0.091	182	4.60	4.46	0.26	1.41	10.73	13.1	1.0	**15C1**
i7195/5	**2-m-0.20-0.30**	6.55	0.801	1215	5.09	8.32	0.28	3.39	17.07	19.8	0.6	**15D3**
i7195/6	**2-m-0.50-0.60**	5.81	1.028	1480	1.99	4.92	<0.12	2.65	9.66	27.4	0.4	**15D3**
i7195/7	**2-m-0.70-0.80**	5.69	1.057	1555	1.26	3.58	<0.12	2.15	7.06	30.4	0.4	**15D3**
i7195/8	**2-m-0.90-1.00**	5.79	0.975	1453	1.62	4.34	0.13	2.46	8.54	28.8	0.4	**15D3**
i7195/9	**2-d-0.20-0.30**	7.03	0.363	633	7.92	7.88	0.23	2.53	18.56	13.6	1.0	**15D3**
i7195/10	**2-d-0.50-0.60**	7.66	0.548	849	7.71	7.10	0.13	3.93	18.87	20.8	1.1	**15C1**
i7195/11	**2-d-0.70-0.80**	7.57	0.767	1134	4.09	5.28	0.05	4.00	13.42	29.8	0.8	**15C1**
i7195/12	**2-d-0.90-1.00**	7.57	0.869	1406	4.16	5.96	0.07	4.94	15.13	32.6	0.7	**15C1**
i7195/13	**6-0.20-0.30**	7.82	0.137	173	2.02	4.71	0.05	1.80	8.58	21.0	0.4	**15C1**
i7195/14	**6-0.50-0.57**	8.96	0.409	605	2.19	6.04	0.07	3.05	11.34	26.9	0.4	**15C1**
i7195/15	**6-0.65-0.75**	9.29	0.731	995	1.69	5.17	0.03	3.23	10.12	31.9	0.3	**15C1**
i7195/16	**6-0.90-1.00**	9.26	0.861	1188	1.46	4.79	0.04	3.06	9.35	32.7	0.3	**15C1**
i7195/17	**9-m-0.20-0.30**	8.63	0.784	1040	5.22	6.60	0.08	2.61	14.52	18.0	0.8	**15C1**
i7195/18	**9-m-0.50-0.60**	8.35	1.067	1480	2.84	5.70	0.05	3.15	11.75	26.8	0.5	**15C1**
i7195/19	**9-m-0.70-0.80**	7.63	1.248	1710	2.16	5.35	0.07	3.02	10.61	28.5	0.4	**15C1**
i7195/20	**9-m-0.90-1.00**	6.22	1.352	1875	1.16	3.02	<0.12	1.90	6.16	30.9	0.4	**15D3**
i7195/21	**9-d-0.20-0.30**	5.99	0.038	20	5.56	4.86	0.26	1.06	11.74	9.0	1.1	**15D3**
i7195/22	**9-d-0.50-0.60**	5.33	0.288	472	4.14	5.91	0.20	2.99	13.25	22.6	0.7	**15D3**
i7195/23	**9-d-0.70-0.80**	5.03	0.644	1084	1.95	4.53	<0.12	2.66	9.24	28.8	0.4	**15D3**
i7195/24	**9-d-0.90-1.00**	4.93	0.881	1422	1.13	3.14	<0.12	2.36	6.71	35.2	0.4	**15D3**
i7195/25	**10-0.20-0.30**	6.77	0.052	32	3.37	2.29	1.44	0.15	7.25	2.1	1.5	**15D3**
i7195/26	**10-0.48-0.58**	6.73	0.044	20	3.90	3.13	0.56	0.25	7.83	3.2	1.2	**15D3**
i7195/27	**10-0.70-0.80**	6.99	0.045	31	4.27	3.59	0.25	0.46	8.57	5.3	1.2	**15D3**
i7195/28	**10-0.90-1.00**	7.40	0.049	85	5.19	4.07	0.03	0.53	9.83	5.4	1.3	**15C1**
i7195/29	**31-0.20-0.30**	6.56	0.013	11	1.99	0.73	0.36	<0.065	3.11	1.2	2.7	**15D3**
i7195/30	**31-0.50-0.60**	6.48	0.017	16	1.94	0.92	0.27	<0.065	3.19	1.4	2.1	**15D3**
i7195/31	**31-0.70-0.80**	6.42	0.016	5.0	1.98	1.24	0.22	<0.065	3.48	1.0	1.6	**15D3**
i7195/32	**31-0.90-1.00**	6.47	0.009	5.5	1.86	1.38	0.18	<0.065	3.44	0.8	1.3	**15D3**

Client: GTE 19WS- Results Page 2 of 4

ESSA Ref	field ref	Soil pH	Soil EC	Soil Cl	Exch.Ca	Exch. Mg	Exch.K	Exch. Na	CEC	ESP	Ca/Mg	
	depth (m)		dS/m	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%Na/CEC	Ratio	
i7195/33	**35-m-0.20-0.30**	8.43	0.139	20	29.07	11.62	0.46	1.70	42.86	4.0	2.5	**15C1**
i7195/34	**35-m-0.50-0.60**	8.46	0.266	210	24.07	11.07	0.30	2.45	37.89	6.5	2.2	**15C1**
i7195/35	**35-m-0.70-0.80**	8.49	0.604	618	26.70	12.43	0.27	3.94	43.35	9.1	2.1	**15C1**
i7195/36	**35-m-1.10-1.20**	8.33	1.013	1381	23.54	12.43	0.35	4.29	40.62	10.6	1.9	**15C1**
i7195/37	**35-m-1.40-1.50**	8.32	0.981	941	20.62	10.84	0.39	3.61	35.46	10.2	1.9	**15C1**
i7195/38	**35-d-0.20-0.30**	8.69	0.184	125	25.02	9.93	0.30	1.67	36.93	4.5	2.5	**15C1**
i7195/39	**35-d-0.50-0.60**	8.66	0.426	354	22.87	10.50	0.30	2.97	36.64	8.1	2.2	**15C1**
i7195/40	**35-d-0.80-0.90**	8.50	0.578	572	25.98	11.34	0.38	3.18	40.88	7.8	2.3	**15C1**
i7195/41	**35-d-1.10-1.20**	8.31	0.928	939	23.11	11.60	0.41	3.80	38.92	9.8	2.0	**15C1**
i7195/42	**35-d-1.40-1.50**	7.75	3.238	1131	26.22	9.90	0.39	1.80	38.30	4.7	2.6	**15C1**
i7195/43	**36-0.10-0.20**	7.36	0.051	15	11.28	1.59	0.34	0.16	13.37	1.2	7.1	**15C1**
i7195/44	**36-0.20-0.30**	8.19	0.096	12	16.28	2.13	0.28	0.16	18.84	0.8	7.7	**15C1**
i7195/45	**36-0.50-0.60**	8.75	0.098	15	13.62	2.08	0.12	0.16	15.98	1.0	6.5	**15C1**
i7195/46	**36-0.90-1.00**	8.98	0.096	28	13.84	3.12	0.08	0.23	17.27	1.3	4.4	**15C1**
i7195/47	**36-1.40-1.50**	9.23	0.070	7.1	13.02	3.11	0.02	0.26	16.41	1.6	4.2	**15C1**
i7195/48	**37-0.20-0.30**	8.78	0.191	120	17.17	7.78	0.24	1.26	26.44	4.8	2.2	**15C1**
i7195/49	**37-0.50-0.60**	8.92	0.515	443	12.71	10.54	0.16	3.59	27.00	13.3	1.2	**15C1**
i7195/50	**37-0.70-0.80**	8.86	0.845	966	10.70	10.92	0.30	4.48	26.41	17.0	1.0	**15C1**
i7195/51	**37-0.90-1.00**	8.77	1.082	1105	10.49	11.49	0.19	4.60	26.76	17.2	0.9	**15C1**
i7195/52	**42-0.10-0.20**	7.97	0.054	28	17.72	3.11	0.68	0.18	21.69	0.8	5.7	**15C1**
i7195/53	**42-0.25-0.35**	8.49	0.117	46	22.63	4.11	0.21	0.21	27.16	0.8	5.5	**15C1**
i7195/54	**42-0.50-0.60**	8.93	0.115	88	13.84	3.99	0.08	0.26	18.17	1.4	3.5	**15C1**
i7195/55	**42-0.80-0.90**	9.20	0.093	36	11.97	3.70	0.00	0.28	15.96	1.8	3.2	**15C1**
i7195/56	**51-0.20-0.30**	9.02	0.167	99	26.70	13.11	0.20	1.75	41.76	4.2	2.0	**15C1**
i7195/57	**51-0.50-0.60**	9.05	0.406	313	21.10	16.14	0.17	4.23	41.64	10.2	1.3	**15C1**
i7195/58	**51-0.70-0.80**	8.94	0.635	574	20.19	17.35	0.17	5.55	43.26	12.8	1.2	**15C1**
i7195/59	**51-0.90-1.00**	8.86	0.835	770	19.32	17.66	0.20	6.06	43.24	14.0	1.1	**15C1**
i7195/60	**68-0.20-0.30**	6.60	0.017	8.0	2.07	0.44	0.25	<0.065	2.80	1.6	4.7	**15D3**
i7195/61	**68-0.50-0.60**	7.43	0.019	3.8	1.11	0.24	0.06	0.07	1.48	4.7	4.6	**15C1**
i7195/62	**68-0.70-0.80**	7.54	0.009	4.8	0.81	0.20	0.03	0.08	1.12	7.3	4.1	**15C1**
i7195/63	**68-0.90-1.00**	7.44	0.011	7.0	0.83	0.18	0.05	0.08	1.14	6.9	4.6	**15C1**
i7195/64	**70-0.20-0.30**	8.65	0.136	74	22.39	8.46	0.05	0.78	31.67	2.4	2.6	**15C1**
i7195/65	**70-0.50-0.60**	8.63	0.266	244	20.26	9.18	0.02	1.33	30.79	4.3	2.2	**15C1**
i7195/66	**70-0.70-0.80**	8.57	0.333	340	20.07	9.40	0.01	1.41	30.89	4.6	2.1	**15C1**
i7195/67	**70-0.90-1.00**	8.62	0.359	394	18.87	9.22	0.01	3.75	31.84	11.8	2.0	**15C1**
i7195/68	**75-0.20-0.30**	6.53	0.012	6.4	6.65	3.53	0.75	0.09	11.02	0.9	1.9	**15D3**
i7195/69	**75-0.50-0.60**	7.11	0.034	5.9	12.42	6.52	0.39	0.42	19.75	2.1	1.9	**15D3**
i7195/70	**75-0.70-0.80**	8.08	0.053	14	11.25	5.58	0.19	0.59	17.61	3.3	2.0	**15C1**
i7195/71	**75-0.90-1.00**	8.48	0.133	14	16.59	3.56	0.22	0.31	20.69	1.5	4.7	**15C1**
i7195/72	**75-1.40-1.50**	8.84	0.105	10	18.65	3.58	0.06	0.38	22.67	1.7	5.2	**15C1**

Lab No	Sample No	Zinc	Mn	Iron	Copper	Boron	Silicon
	Depth (m)	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
i7194/1	**1-0.0-0.10**	0.56	15	25	0.19	0.21	17
i7194/2	**2-m-0.00-0.10**	<0.5	81	30	1.6	1.2	53
i7194/3	**2-d-0.00-0.10**	0.93	57	76	2.9	0.72	73
i7194/4	**6-0.00-0.10**	<0.5	29	38	1.1	0.57	37
i7194/5	**9-m-0.00-0.10**	<0.5	38	25	1.7	0.89	58
i7194/6	**9-d-0.00-0.10**	2.3	86	206	3.8	0.72	62
i7194/7	**10-0.00-0.10**	3.2	75	83	0.67	1.1	126
i7194/8	**31-0.00-0.10**	1.1	45	23	0.46	0.19	44
i7194/9	**35-m-0.00-0.10**	<0.5	26	15	1.6	0.44	41
i7194/10	**35-d-0.00-0.10**	<0.5	9.4	13	1.4	0.53	20
i7194/11	**36-0.00-0.08**	0.61	24	9.4	0.51	0.42	73
i7194/12	**37-0.00-0.10**	1.4	30	17	1.7	0.49	47
i7194/13	**42-0.00-0.09**	0.71	26	16	0.44	0.51	61
i7194/14	**51-0.00-0.10**	<0.5	6.5	12	0.67	0.32	18
i7194/15	**55-0.00-0.10**	<0.5	35	50	1.1	0.30	48
i7194/16	**68-0.00-0.10**	<0.5	15	38	0.25	0.20	19
i7194/17	**70-0.00-0.10**	<0.5	10	11	0.83	0.36	56
i7194/18	**75-0.00-0.10**	2.3	75	55	1.5	0.46	91

Lab No	Sample No	Org	Tot Org	Tot	Colwell	Nitrate	Total S	Sulfate
		Matter	Carbon	Nitrogen	P	N		SO4S
	Depth (m)		%	%	%	mg/kg	mg/kg	%
i7194/1	**1-0.0-0.10**	1.5	0.86	0.05	3.6	0.90	<50	<1
i7194/2	**2-m-0.00-0.10**	4.0	2.3	0.18	12	60	244	26
i7194/3	**2-d-0.00-0.10**	2.7	1.6	0.12	50	4.5	122	3.8
i7194/4	**6-0.00-0.10**	1.5	0.86	0.06	8.5	0.99	<50	2.1
i7194/5	**9-m-0.00-0.10**	1.8	1.0	0.08	8.2	3.5	75	3.3
i7194/6	**9-d-0.00-0.10**	2.9	1.6	0.13	40	1.8	92	6.4
i7194/7	**10-0.00-0.10**	8.1	4.6	0.37	99	480	350	36
i7194/8	**31-0.00-0.10**	2.1	1.2	0.07	5.9	8.0	67	3.6
i7194/9	**35-m-0.00-0.10**	2.7	1.6	0.11	5.6	8.9	145	3.8
i7194/10	**35-d-0.00-0.10**	2.3	1.3	0.08	3.0	32	114	7.2
i7194/11	**36-0.00-0.08**	3.1	1.8	0.10	6.2	1.7	111	5.3
i7194/12	**37-0.00-0.10**	3.8	2.2	0.16	6.2	8.1	172	5.3
i7194/13	**42-0.00-0.09**	5.7	3.3	0.25	18	6.7	232	3.5
i7194/14	**51-0.00-0.10**	4.6	2.6	0.17	6.9	5.0	199	5.9
i7194/15	**55-0.00-0.10**	2.5	1.4	0.10	9.2	4.8	95	4.5
i7194/16	**68-0.00-0.10**	1.2	0.69	0.04	3.9	2.3	<50	<1
i7194/17	**70-0.00-0.10**	2.7	1.6	0.08	4.6	3.2	<50	3.9
i7194/18	**75-0.00-0.10**	7.0	4.0	0.25	17	4.0	233	5.6

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Lab No	Sample No	ADMC	Gravel	CS>50µm	CS>20µm	2-50µm-Silt	2-20µm-Silt	Clay <2µm	R1
	Depth (m)	%	%	%	%	%	%	%	Ratio
i7194/1	1-0.0-0.10	1	1	85	87	13	11	2	0.36
i7194/2	2-m-0.00-0.10	5	1	31	32	29	27	40	0.33
i7194/3	2-d-0.00-0.10								
i7194/4	6-0.00-0.10	2	1	55	61	29	23	17	0.48
i7194/5	9-m-0.00-0.10	4	3	29	44	29	13	43	0.39
i7194/6	9-d-0.00-0.10								
i7194/7	10-0.00-0.10	3	2	44	49	42	37	14	0.39
i7194/8	31-0.00-0.10	1	0	76	82	19	13	5	0.42
i7194/9	35-m-0.00-0.10	6	2	18	23	29	24	53	0.28
i7194/10	35-d-0.00-0.10								
i7194/11	36-0.00-0.08								
i7194/12	37-0.00-0.10	5	2	28	44	36	20	35	0.31
i7194/13	42-0.00-0.09	5	0	54	58	23	18	24	0.44
i7194/14	51-0.00-0.10	9	7	33	46	26	13	41	0.27
i7194/15	55-0.00-0.10	3	13	52	64	33	21	15	0.54
i7194/16	68-0.00-0.10	1	0	83	85	17	15	0	0.26
i7194/17	70-0.00-0.10								
i7194/18	75-0.00-0.10	3	1	53	56	32	29	15	0.49
i7195/1	1-0.20-0.30	2	1	92	92	3	3	5	0.48
i7195/2	1-0.35-0.45	8	3	80	82	11	9	9	0.35
i7195/3	1-0.60-0.70	8	9	50	61	15	4	35	0.48
i7195/4	1-0.90-1.00	8	4	50	58	16	7	35	0.68
i7195/5	2-m-0.20-0.30	8	3	24	31	29	22	48	0.75
i7195/6	2-m-0.50-0.60	9	14	25	34	28	20	46	0.82
i7195/7	2-m-0.70-0.80	9	17	25	32	25	18	50	0.75
i7195/8	2-m-0.90-1.00	9	15	26	33	29	22	45	0.67
i7195/9	2-d-0.20-0.30								
i7195/10	2-d-0.50-0.60								
i7195/11	2-d-0.70-0.80								
i7195/12	2-d-0.90-1.00								
i7195/13	6-0.20-0.30	6	6	41	46	29	24	30	0.64
i7195/14	6-0.50-0.57	7	1	44	48	22	18	34	0.67
i7195/15	6-0.65-0.75	8	4	40	48	25	16	36	0.69
i7195/16	6-0.90-1.00	9	5	39	47	25	17	36	0.72
i7195/17	9-m-0.20-0.30	8	4	27	33	26	19	48	0.62
i7195/18	9-m-0.50-0.60	8	6	28	36	23	14	49	0.82
i7195/19	9-m-0.70-0.80	10	6	20	27	31	24	49	0.74
i7195/20	9-m-0.90-1.00	10	4	22	31	29	20	49	0.80
i7195/21	9-d-0.20-0.30								
i7195/22	9-d-0.50-0.60								
i7195/23	9-d-0.70-0.80								
i7195/24	9-d-0.90-1.00								
i7195/25	10-0.20-0.30	7	15	37	44	20	13	43	0.37
i7195/26	10-0.48-0.58	9	19	24	28	17	14	59	0.32
i7195/27	10-0.70-0.80	9	27	27	32	17	12	56	0.34
i7195/28	10-0.90-1.00	8	13	24	31	23	16	53	0.47

Lab No	Sample No	ADMC	Gravel	CS>50µm	CS>20µm	2-50µm-Silt	2-20µm-Silt	Clay <2µm	R1
	Depth (m)	%	%	%	%	%	%	%	
i7195/29	31-0.20-0.30	3	1	76	83	14	7	11	0.43
i7195/30	31-0.50-0.60	4	3	74	77	9	6	17	0.42
i7195/31	31-0.70-0.80	4	3	65	70	18	13	17	0.44
i7195/32	31-0.90-1.00	5	3	69	74	12	7	19	0.45
i7195/33	35-m-0.20-0.30	12	9	26	30	18	15	55	0.38
i7195/34	35-m-0.50-0.60	13	13	18	24	23	17	59	0.44
i7195/35	35-m-0.70-0.80	14	4	22	26	20	16	58	0.45
i7195/36	35-m-1.10-1.20	16	12	16	19	22	18	62	0.41
i7195/37	35-m-1.40-1.50	15	9	20	25	23	18	57	0.42
i7195/38	35-d-0.20-0.30								
i7195/39	35-d-0.50-0.60								
i7195/40	35-d-0.80-0.90								
i7195/41	35-d-1.10-1.20								
i7195/42	35-d-1.40-1.50								
i7195/43	36-0.10-0.20								
i7195/44	36-0.20-0.30								
i7195/45	36-0.50-0.60								
i7195/46	36-0.90-1.00								
i7195/47	36-1.40-1.50								
i7195/48	37-0.20-0.30	12	8	35	42	20	13	45	0.51
i7195/49	37-0.50-0.60	13	4	33	36	21	18	46	0.59
i7195/50	37-0.70-0.80	13	2	33	36	21	17	47	0.62
i7195/51	37-0.90-1.00	12.9	0.9	28	35	27	20	45	0.60
i7195/52	42-0.10-0.20	10.3	0.7	46	49	21	17	33	0.40
i7195/53	42-0.25-0.35	10.7	0.6	49	50	12	10	39	0.37
i7195/54	42-0.50-0.60	6.7	13.2	58	65	19	12	23	0.50
i7195/55	42-0.80-0.90	5.7	4.4	62	67	22	18	16	0.46
i7195/56	51-0.20-0.30	12.5	2.4	40	45	18	13	42	0.39
i7195/57	51-0.50-0.60	14.9	4.2	35	39	17	14	47	0.44
i7195/58	51-0.70-0.80	14.4	3.8	34	40	17	10	50	0.49
i7195/59	51-0.90-1.00	14.3	36.2	29	32	21	17	51	0.51
i7195/60	68-0.20-0.30	0.9	0.8	86	91	13	9	1	0.37
i7195/61	68-0.50-0.60	0.6	0.3	88	91	10	7	2	0.41
i7195/62	68-0.70-0.80	0.6	0.4	89	90	10	9	1	0.41
i7195/63	68-0.90-1.00	0.7	1.5	88	91	11	8	1	0.41
i7195/64	70-0.20-0.30								
i7195/65	70-0.50-0.60								
i7195/66	70-0.70-0.80								
i7195/67	70-0.90-1.00								
i7195/68	75-0.20-0.30	8.4	6.5	42	49	31	24	27	0.39
i7195/69	75-0.50-0.60	12.9	0.4	39	42	15	12	46	0.46
i7195/70	75-0.70-0.80	12.2	4.0	38	45	18	11	44	0.58
i7195/71	75-0.90-1.00	13.4	16.8	20	22	20	18	60	0.40
i7195/72	75-1.40-1.50	9.3	18.9	65	69	10	6	25	0.60

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METHOD DESCRIPTIONS

Soil

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCl extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
Exch.Ca	15B/C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0/8.5 leach, AAS
Exch.Mg	15B/C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4OAc @ pH 7.0/8.5 leach, AAS
Exch.Na	15B/C1	9.6	0.09	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0/8.5 leach, AAS
Exch.K	15B/C1	4.8	0.02	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0/8.5 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric & Sieve
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager Analytical Services: **D E Baker BSc MASSSI**

Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.

Soluble Salts included in Exchangeable Cations - Except PRE-WASHED (if EC>0.3dS/m).

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QUALITY CONTROL DATA

Soil

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Test Method	Units		Actual Value	Acceptance Criteria [Range]
pH	pH	B		5.0 - 5.3
EC	dS/m	B		0.27 - 0.32
Cl	mg/kg	B		10 - 35
NO3-N	mg/kg	B		10 - 16
NH4-N	mg/kg	NA		NA
Bicarb.P	mg/kg	B		51 -75
Total Kjeldahl N	%	ASPAC 34	0.110	.100 - .120
Total P	%	ASPAC 34	0.02	.019 - .021
Organic Carbon	%	B		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	B		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	B		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	B		.057 - .182
K (Exch. cations)pH7	meq/100g	B		1.209 - 1.411
Exch. Acidity	meq/100g			NA
ECEC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	B	17.0	17.3 - 22.4
Fine Sand	%	B	22.0	20.0 - 25.7
Silt	%	B	16.0	10.5 - 19.8
Clay	%	B	44.0	37.9 - 48.9
R1		B		0.23 - 0.38

Test Method	Units	Test Soil	Actual Value	Acceptance Criteria [Range]
DTPA-Cu	mg/kg	SB		2.37 - 3.25
DTPA-Zn	mg/kg	SB		3.15 - 3.81
DTPA-Mn	mg/kg	SB		97.7 - 149.0
DTPA-Fe	mg/kg	SB		24.3 - 32.6
0.33 Bar	%	G		32 - 51
15 Bar	%	G		23 - 30
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 35.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.88 - 24.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

Appendix D - Regional Frameworks Land Suitability Limitations Review

Table D-1: Summary of Land Suitability classes for SMU C1-BL[1]

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[2]	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	33	4	4	4	4	4	4	4	4	4	4	4	4	4
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	7	4	4	4	4	4	4	4	4	4	4	4	4	4
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	7	3	3	3	3	3	3	3	3	3	3	3	3	3
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

1. *As this SMU includes a mound and depression, results were selected based on the most limiting attribute.*
2. *Water erosion assessed k-factor of 0.039, moderate (Foster et al. 1981), ESP of 1.9 and R1 dispersion of 0.33.*

Table D-2: Summary of Land Suitability classes for SMU C1-BR[1]

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[2]	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	33	4	4	4	4	4	4	4	4	4	4	4	4	4
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	7	4	4	4	4	4	4	4	4	4	4	4	4	4
Surface Condition (Ps)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	7	3	3	3	3	3	3	3	3	3	3	3	3	3
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

1. *As this SMU includes a mound and depression, results were selected based on the most limiting attribute.*
2. *Water erosion assessed k-factor of 0.031, moderate (Foster et al. 1981), ESP of 3.9 and R1 dispersion of 0.39.*

Table D-3: Summary of Land Suitability classes for SMU C3-BL

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	3	3	3	4	3	3	3	3	3	3	3	3	3	3
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		3	3	4	3	3	3	3	3	3	3	3	3	3

1. *Water erosion assessed on k-factor of 0.025, moderate (Foster et al., 1981), ESP of 0.4 and R1 dispersion of 0.27.*

Table D-4: Summary of Land Suitability classes for SMU C3-BR

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	33	4	4	4	4	4	4	4	4	4	4	4	4	4
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	4	4	5	4	5	4	4	4	4	5	5

1. *Water erosion assessed on k-factor of 0.028, moderate (Foster et al., 1981), ESP of 0.7 and R1 dispersion of 0.31*

Table D-5: Summary of Land Suitability classes for SMU C4

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)[2]	2	3	3	2	2	3	2	3	2	2	2	2	3	3
Narrow Moisture Range (Pm)	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Wetness (W)	4S	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3

1. *Water erosion assessed on k-factor of 0.026, moderate (Foster et al., 1981), ESP of 0.6 and R1 dispersion of 0.28.*
2. *PAWC for the profile is 120 mm/100 centimetres (cm), however assessed at 125-150 mm due to the high clay content.*

Table D-6: Summary of Land Suitability classes for SMU C5

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)[2]	2	3	3	2	2	3	2	3	2	2	2	2	3	3
Narrow Moisture Range (Pm)	5	3	3	4	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	7	4	4	4	4	4	4	4	4	4	4	4	4	4
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

1. *Water erosion assessed on k-factor: 0.015, low (Rosewell.1993) and ESP of 1.4.*
2. *PAWC for the profile is 120 mm/100 cm, however assessed at 125-150mm due to the high clay content.*

Table D-7: Summary of Land Suitability classes for SMU K1

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	4	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G4	2	2	2	2	2	3	2	2	2	3	2	2	2
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	5	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

1. *Water erosion assessed on k-factor of 0.021, moderate (Foster et al., 1981), ESP of 2.8 and R1 dispersion of 0.54*

Table D-8: Summary of Land Suitability classes for SMU R3

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

1. *Water erosion assessed on k-factor of 0.018, low (Foster et al., 1981). ESP of 0.9 and R1 dispersion of 0.42.*

Table D-9: Summary of Land Suitability classes for SMU S1

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	4	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

1. *Water erosion assessed on k-factor of 0.020, moderate (Foster et al., 1981), ESP of 0.8 and R1 dispersion of 0.36*

Table D-10: Summary of Land Suitability classes for SMU S3

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)[2]	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

1. *Water erosion assessed on k-factor of 0.028, moderate (Foster et al., 1981), ESP of 0.1 and R1 dispersion of 0.39.*
2. *PAWC is 100 mm, on a crisp boundary for assessment.*

Table D-11: Summary of Land Suitability classes for SMU S4

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	5	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

1. *Water erosion assessed on k-factor of 0.010, low (Foster et al., 1981), ESP of 0.6 and R1 dispersion of 0.26.*

Table D-12: Summary of Land Suitability classes for SMU T1-B

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	31	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

1. *Water erosion assessed on k-factor of 0.020, moderate (Foster et al., 1981), ESP of 0.7 and R1 dispersion of 0.44.*

Table D-13: Summary of Land Suitability classes for SMU T1-R

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	31	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

1. *Water erosion assessed on k-factor of 0.020 (SMU T1-B), moderate (Foster et al., 1981), second assessment against ESP of 0.8 and R1 Dispersion of 0.44 (SMU T1-B).*

Table D-14: Summary of Land Suitability classes for SMU T2

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	31	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	3	3	3	4	3	3	3	3	3	3	3	3	3	3
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		3	3	4	3	3	3	3	3	3	3	3	3	3

1. *Water erosion assessed on k-factor of 0.024, moderate (Foster et al., 1981), ESP of 0.5 and R1 dispersion of 0.49.*

Table D-15: Summary of Land Suitability classes for SMU T3

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)[1]	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	23	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

1. *Water erosion assessed on k-factor of 0.029, moderate (Foster et al., 1981), ESP of 5.2 and R1 dispersion of 0.48.*

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