

PEMBROKE

Olive Downs Coking Coal Project
Draft Environmental Impact Statement

Appendix M
Soil and Land
Suitability
Assessment

Soil and Land Suitability Assessment

Olive Downs Coking Coal Project

Draft Version 6

Pembroke Olive Downs Pty Ltd
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EXECUTIVE SUMMARY

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke Olive Downs Pty Ltd to complete a soil and land suitability assessment of the Olive Downs Coking Coal Project (the Project).

The Project includes a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres south-east of Moranbah, Queensland. The Project is comprised of the Olive Downs South domain (Mining Lease Application [MLA] 700032 and 700033) and Willunga domain (MLA 700034), associated linear infrastructure (MLA 700035) and waste dump (MLA 700036).

Guidelines and standards of McKenzie et al. (2008) were developed to provide a consistent approach to soil survey methodology across Australia. This approach has been applied by GTE to the description and classification of soils for the Project in line with best practice as recommended by the Queensland Department of Natural Resources and Mines.

The following conclusions have been made:

- Twelve soil mapping units (SMUs), were identified across the Project on the basis of 1010 investigation sites, incorporating 192 detailed sites and 818 observation sites.
- Twelve SMUs are present within the Project site; C1, C2, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2.
- The Project site includes areas of flat to gently undulating plains dominated by uniform and gradational clays (C1 and C2), gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2), relic alluvial plains and low-lying plains (B1 and B2) and recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2).
- Land use suitability assessment of the twelve SMUs reported for rainfed cropping, Class 4: C1, S1, S2, R1, R2 and B1, and Class 5: C2, S1, L1, L2, B2, A1 and A2. Assessment of beef cattle grazing reported Class 3: C1 and S2 and Class 4: C2, S1, R1, R2, L1, L2, B1, B2, A1 and A2. Review of Regional Frameworks for the Inland Fitzroy and Southern Burdekin area assessed SMU C1 having marginal cropping potential for dryland cropping and SMU S2 moderately suitable for dryland cropping with Barley, Chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.
- The majority of topsoil from the loamy sand and clayey sand SMUs (S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2) would be suitable for rehabilitation use in supporting native vegetation and grasses with application preferred on level surface to sloped backfill batters. Topsoils consisting of clay (C1 and C2) would be preferable on level to very gently undulating areas with slopes <1%.

- Six SMUs (S2, R1, R2, B1, B2 [0.20-0.50 metres below ground level] and A1) may be suitable for rehabilitation situations and limited natural vegetation growth with additional soil fertility conditioning on level surface to sloped backfill batters. Five SMUs (C1, S1, L1, L2 and A2) were suitable for use as buried supporting subsoils for topsoil. The remaining SMU (C2) is recommended as capping material over waste rock.
- The Project site is not located within Regional Planning Interests Areas of Strategic Cropping Land and Priority Agricultural Areas.
- The majority of the Project site is shown as 'No Known Occurrence' with respect to Acid Sulfate Soils (ASS). Field observations reported very low indicators in ten SMUs of neutral and neutral to alkaline pH. It is assessed as highly unlikely the SMUs contain soils impacted by actual acid sulphate soils and potential acid sulphate soils however, environmental management plans should include procedures to monitor and identify ASS during the life of the Project.
- The proposed post mine final land use for the majority of the Project site will be a return to beef cattle grazing activities. Final void areas have been assessed as unsuitable for post mine land use and will be fenced off as required to prevent fauna access. Existing infrastructure that is not planned to be decommissioned such as railway lines will be unsuitable for cropping and grazing land uses. It is expected that undisturbed areas of the Project site will remain the same classes identified pre-mine.

1 INTRODUCTION

1.1 Project Details

Pembroke Olive Downs Pty Ltd (Pembroke) proposes to develop the Olive Downs Coking Coal Project (the Project), a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland (Figure 1). The Project provides an opportunity to develop an open cut metallurgical coal resource within the Bowen Basin mining precinct that can deliver up to 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke to complete a soil and land suitability assessment of the Project Mining Lease Application areas (MLAs) MLA 700032, MLA 700033, MLA 700034, MLA 700035 and MLA 700036. The Project would cover parts of Mineral Development Licences 277, 3012 and 3013, and Exploration Permits for Coal 649, 676, 688, 721 755, 850, 1949 and 1951.

The Project comprises the Olive Downs South and Willunga domains and associated linear infrastructure corridors, including a rail spur connecting to the Norwich Park Branch Railway, a water pipeline connecting to the Eungella pipeline network, an electricity transmission line (ETL) and access roads (Figure 2). The ETL is not included as part of this soil and land suitability assessment.

The coal resource would be mined by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal. Up to 20 Mtpa of ROM coal would be extracted over the anticipated Project operational life of approximately 79 years.

The Project covers an area of approximately 26,000 hectares (ha), of which 16,300 ha is proposed as active mining disturbance from infrastructure and mining activities.

1.2 Scope of Report

This report provides a baseline assessment of the soil and land suitability for the Project site and includes:

- a description of the regulatory requirements relevant to the Project;
- a review of available background material;
- identification and description of soil mapping units (SMUs) and their distribution across the Project site;
- assessment of the suitability of each SMU for reuse in mine rehabilitation activities including determination of soil stripping volumes;
- assessment of the potential for acid sulphate soils;
- land suitability for rainfed broadacre cropping, beef cattle grazing and Agricultural Land Classes (ALC);

- Priority Agricultural Areas (PAA) and Strategic Cropping Land (SCL) review and assessment; and
- proposed final land use following completion of mining.

A Contaminated Land Site Inspection of the Project was also conducted as part of the Soil and Land Suitability Assessment and is included as Attachment 1.

2 BACKGROUND

2.1 Regulatory Requirements

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

The proposed water pipeline and access road will include 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 a soil surveys. In addition, GTE have 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 2002). 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 *Land Suitability Assessment Techniques* (LSAT) within the Department of Minerals and Energy (DME) guideline *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

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 Heritage Protection [EHP] 2013), *EIS information guidelines – Land* (EHP, accessed 2017) and the Terms of Reference provided by the Coordinator-General.

2.2 Local Setting

2.2.1 Land Use and Vegetation

Grazing is the primary activity undertaken across the Project site on the Olive Downs South and Willunga Domains. No agriculture activities were observed to be undertaken within, or in the vicinity of, the Project site.

The land within and surrounding the Project site comprises natural bushland, consisting of tall woodlands of Poplar Box, Bloodwood and Ironbark; medium to sparse shrub land of Brigalow and native grasses.

2.2.2 Topography and Hydrology

The landscape of the Project site includes level plains to gently undulating plains with elevations of approximately 200 metres (m) Australian Height Datum (AHD). The overall elevation of the Project site ranges from 150 m in the low-lying southeast of the Project to 250 m in the higher areas to the north of the Project site (Queensland Government 2016).

The Project is bordered by a cluster of small mountains to the north-east, approximately 400 m high, as well as a range of low-lying mountains ranging from 300-400 m high, 10 km to the south-west of the Project.

The Olive Downs South domain is located to the south and west of the Isaac River. The Willunga Domain is located to the north and east of the Isaac River, further downstream of the Olive Downs South domain.

2.2.3 Regional Geology

Regional mapping of the Project shows the Fair Hill and Rangal formations in the north of the Project, and Rewan and Blackwater formations in the south and east of the Project site.

Broad scale geology undertaken by the Department of Environment and Resource Management (DERM) in 2011, indicates the Project region is dominated by Tertiary sediments, the Project site predominantly containing Cainozoic alluvium, as well as mesozonic sediments (Raymond and McNeil 2011).

Soils mapping of the Land of Isaac Comet (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 surveys, is described below.

3.1 Desktop Review

GTE reviewed the available soils and land resources information for the Project site to develop preliminary SMUs and 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:

The following references were utilised for reviewing previous soils and land suitability fieldwork and recommendations:

- Burgess J.W. (2003) *Land Resource Assessment of the Windeyers Hill Area Isaac-Connors and Mackenzie River Catchment, 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 within the Isaac-Connors and Mackenzie River catchments.

- Gunn et al. (1967) *Lands of Isaac Comet (1:500,000)*;

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 Project site 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 Project site, as contained in the *Atlas of Australian Soils*, include Kandosols, Dermosols, Sodosols and Vertosols. Although these classifications are mapped at a very broad scale (1:2,000,000), they are useful for identifying specific variants of these soil classes.

3.1.2 Aerial Photography

Aerial photography was utilised from Google Earth™ and the Queensland Government which were reviewed as part of the desktop evaluations. Initial map units and boundaries were identified using Google Earth imagery.

3.1.3 Preliminary Soils Mapping

After the detailed review of reports and aerial photography, prior to field work, a preliminary soils map was created. This preliminary mapping provided an initial understanding of the different types of soil and landscapes likely to occur across the Project site and provided a basis for planning the field work and determining survey locations.

Table 1 lists the land systems and soil types that were anticipated to be found on site.

Table 1: Expected Land Systems and Soil Types (Gunn et al. 1967)

Gunn et al. (1967)	Concept	Major expected land and soil types
Humboldt (Hu)	Undulating plains with Tertiary clay and sands.	25% cracking Brigalow, Blackbutt clay – Rolleston 45% thin duplex and texture contrast – Poplar Box. Taurus, Broadmeadow 10% gilgaied Brigalow clay. Pegunny 20% mosaic of all above units
Somerby (So)	Gilgaied clay plains with soils on weathered tertiary clay	60% gilgaied clay with acid subsoils Brigalow. Pegunny, Rolleston 10% alluvial flats with Brigalow clay. Vermont 30% Texture contrast Blackbutt, Box, and Brigalow. Retro, Taurus
Monteagle (Mo)	Plains with sandy duplex soils	80% Texture contrast. Poplar Box- Taurus 20% non and cracking clays - Rolleston
Blackwater (Bl)	Brigalow clay plains on alkaline Tertiary clay	70% cracking clay Brigalow - Rolleston 10% gilgaied clay – Pegunny 30% duplex – Taurus, Wyseby – Poplar Box
June (J)	Ridgelines of red sandy soils.	70% - loamy red earths. Ironbark, bloodwood, Dunrobin, Annandale 30% - texture contrast soils Luxor, Broadmeadow
Connors (Co)	Higher and lower (recent) alluvia	70% - duplex soils with alkaline subsoil , Poplar Box – Springwood, Luxor 10% clay – Vermont. Mixed Brigalow 20% alluvial loam, deep sandy alluvia Clematis, Davy – Mixed Poplar Box

3.2 Field Work

3.2.1 Survey Timing

A detailed field survey was undertaken over the dates 17 to 26 June 2017, 7 to 16 July 2017, 27 July to 5 August 2017 and 24 to 26 November 2017.

3.2.2 Survey Techniques

Survey techniques were based upon pre-determined sampling locations derived from the desktop review of background information, existing available soils information and an examination of aerial photography 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 soil unit 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. It is suited to detailed-scale surveys and has been the method used in most developed countries.

Sampling along linear features such as pipelines and transport corridors were conducted by utilising existing soils information, aerial photography review and free survey techniques. This determined intervals along the linear feature at which SMUs would be surveyed.

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

Detailed Sites

Detailed sites were undertaken at 192 locations (Figures 3.1-3.4). These sites were used to describe the range of soil profile morphological attributes as per the *National Committee on Soil and Terrain guidelines* (2009) (including soil colour as per *Munsell Soil Colour Charts* 2009), in addition to landforms, slope, surface conditions, rock cover and major vegetation. At each detailed site an assessment was made of the quality, depth and quantities of reusable topsoil that may be excavated in the future.

Soil profiles were primarily sampled using 50 millimetres (mm) hand augers. 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 twelve of the detailed sites for laboratory analysis. Soil sampling of profiles was conducted as per McKenzie et al. (2008), with samples taken at standard depths incorporating the surface and every horizon change within the soil profile (typically at depths of 0.0-0.10 m, 0.30-0.40 m, 0.60-0.70 m and 0.90-1.00 m) based upon specimen collection as per *Guidelines for Surveying Soil and Land Resources* (McKenzie et al. 2008).

These depths were modified for sites in which field observations revealed 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.

The initial water pipeline design consists of pipe of 350 mm to 400 mm in diameter being buried a minimum of 600 mm to the top of the pipe. Final design depths are being finalised, however based on the soil survey work completed to date within the Project site and information available, a soil profile to 1 metre below ground level (mbgl) was assessed as suitable. The access road was assessed as predominantly surface disturbance and a soil profile to one metre below ground level was assessed as suitable.

The information recorded from 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 (per Munsell Soil Colour Charts 2009) and mottling of each horizon;
- for each horizon, observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence, pedality and moisture content;
- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining, jarosite presence and field pH; and
- photographs of the soil profile and surrounding landscape.

Observation Sites

Observation sites were undertaken at 818 locations (Figures 3.1–3.4). These sites were used to confirm SMU types and refine mapped soil boundaries. Where necessary, auger boring was undertaken within surface soils to determine the SMU (e.g. surface texture, depth to clay, B horizons).

Basic soil attributes were recorded to confirm the SMU, and surface conditions, which can include rock, slope percentage, landform type and position, major vegetation and land condition, were also noted.

3.2.3 Laboratory Analysis

Soil samples were collected from the 12 sites considered to be the most representative of the SMUs found within the Project site were submitted for laboratory analysis.

Laboratory analysis was undertaken to assist in determining the overall characterisation of the soils and to establish the physical and chemical limitations of surface soils for use in rehabilitation works. Laboratory testing was also used to identify soils that may require specific management measures.

Samples were supplied to E.S.S.A, which supervised the laboratory analysis at Phosyn EAL, National Association of Testing Authorities (NATA) accredited and certified by Australasian Soil and Plant Analysis Council (ASPAC). For each SMU, the surface soil horizon was sampled and analysed for the following parameters

- pH (1:5);
- Electrical Conductivity (EC [1:5]);
- Chloride;
- Bicarbonate extractable P;
- Exchangeable Cations (Calcium [Ca], Magnesium [Mg], Sodium [Na], Potassium [K]);
- Cation Exchange Capacity (CEC);
- Calcium/Magnesium (Ca/Mg) Ratio;
- Exchangeable Sodium Percentage (ESP);
- Total N, Nitrates;
- Organic matter content;
- Particle Size Analysis (PSA) – Hydrometer Method (Coarse Sand [CS], Fine Sand [FS], Silt, Clay);
- R1 Dispersion;
- Air Dry Moisture Content (ADMC);
- Sulfate; and
- Metals - Total (Manganese [Mn], Boron [B], Copper [Cu], Iron [Fe], Zinc [Zn], Aluminium [Al]).

Subsequent samples lower in the soil profile were also analysed for a limited suite of parameters (pH, EC, chloride, exchangeable ions, CEC, Ca/Mg Ratio, and ESP) sufficient to determine reuse potential for rehabilitation of disturbed areas. The rationale for the selection of individual analyses is presented in Table 2.

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

The laboratory results are summarised in Section 4 and detailed in Appendix C (Laboratory Certificates).

Table 2: Analytical Program and Number of Samples

Test	Number of Samples Tested	Application	Justification
In situ measurements: Field pH	Field pH – 631 Meter pH/EC -39	Indication of possible limitations from pH and salinity	Used for 'on the spot' estimates of possible pH and salinity problems and to confirm the effective soil depth.
pH	57	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	57	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts	The measure of EC 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	57	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.
Bicarbonate Extractable Phosphorus	14	Measurement of the total phosphorus in the soil	While both acid extractable P (acid extr. P) and bicarbonate extractable P (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	57	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.
Available Nitrogen	14	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	14	Soil organic matter comprises an accumulation of partially disintegrated and decomposed plant and animal residues and other organic compounds synthesized by the soil microbes as the decay occurs. Soil organic matter forms a substantial reserve of potentially mineralizable 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)	14	Nutrient retention, exchange properties, erodibility, droughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil qualities	Particle size distribution data provides an assessment of the composition of a soil (based upon the dominant grain size within a soil). This assists with confirmation of field observations as well as providing better grounds for identification of soil mapping unit and water holding capacity.
R1 Dispersion	14	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	14	Detection of heavy metals	The analysis of aluminum, 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.
Sulfate	14	Measurement of total sulfur in soil	Total levels of sulfur help identify whether organic matter or gypsum are present in a profile.

3.3 Land Suitability Assessment

Land suitability is primarily based upon classifications provided within the LSAT Guidelines within the DME's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

Guidelines for agricultural land evaluation in Queensland (Department of Science, Information Technology and Innovation [DSITI] and DNRM 2015) and *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) were also reviewed for relevant SMUs in conjunction with ALC assessment.

3.4 Regional Planning Interests Assessment

The *Regional Planning Interests Act 2014* (RPI Act) and *Regional Planning Interests Regulation 2014* (RPI Regulation) identifies and protects areas of Queensland that are of regional interest. The RPI Act protects Priority Living Areas (PLAs), Strategic Environmental Areas (SEAs), PAAs and SCL. The Project site was assessed against the SCL and PAAs.

3.5 Acid Sulfate Soils Assessment

Review of the Australian Soil Resource Information System (ASRIS) including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken. The Acid Sulfate Soils (ASS) mapping is classified with a national consistent legend that includes a risk assessment.

4 RESULTS

4.1 Soil Mapping Units

Twelve SMUs were identified across the Project site on the basis of 1010 investigation sites, incorporating 192 detailed sites and 818 observation sites (Figures 3.1-3.4). Descriptions of the detailed and observation sites are presented within Appendix A and Appendix B respectively.

The SMUs are summarised in Table 3, and 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 2002). Land systems where SMUs are located, as described by Gunn et al. (1967), are also provided in Table 3.

Figures 3.1-3.4 illustrates the spatial distribution of all SMUs within the Project site and detailed descriptions of each SMU are provided in Sections 4.1.1 to 4.1.12.

Table 3: Summary of Project Site Soils

SMU	Concept	Land Systems (Gunn et al. 1967)	Major Vegetation	Detailed sites (*Lab site)
Flat to gently undulating plains dominated by uniform and gradational clays				
C1	Brown light clays with melon hole microrelief	Somerby, Monteagle, Connors, Humboldt, Blackwater	Brigalow	12a/12b*, 13, 14, 18, 19, 20, 21, 22, 63, 75, 122, 127, 133, 134, 135, 136, 138, 139, 140, 141, 142, 143, 144, 146, 148, 149, 150, 159, 160, 162, 164, 166
C2	Grey to brown light to medium clay with normal gilgai microrelief	Somerby, Monteagle, Connors, Humboldt, Blackwater	Brigalow and associated Blackbutt and Poplar Box	25a/25b*, 26, 34, 35, 36, 37, 38, 39, 40, 41, 42, 46, 55, 56, 71, 75, 80, 81, 83, 84, 86, 87, 88, 89, 94, 97, 99, 102, 103, 105, 114, 117, 118, 153, 154, 155, 157, 183
Gently undulating plains dominated by sandy duplex with gradational sandy loams incorporated				
S1	Brown shallow to deep duplex loamy sands to clay loam sandy earths	Somerby, Monteagle, Connors, Humboldt, Blackwater	Poplar box	1, 2*, 3, 4, 5, 6, 15, 32, 33, 44, 45, 47, 48, 53, 57, 58, 59, 67, 72, 73, 76, 92, 98, 130, 158, 163, 170, 171, 172, 180, 181, 182, 185, 189, 190, 191, 192
S2	Brown gradational sands, loamy to clayey sands	Somerby, Monteagle, Connors, Humboldt, Blackwater	Blackbutt, Eucalypts	7, 8*, 9, 10, 11, 23, 31, 51, 54, 65, 66, 90, 107, 108, 109, 110, 119, 120, 121, 123, 126, 128, 132, 161, 165, 167, 168, 174, 179, 184, 186, 188
R1	Light red loamy sands to reddish loamy/clayey sands	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Blackbutt, Poplar Box	49*, 50, 52, 64, 95, 124, 125, 129, 145, 156

SMU	Concept	Land Systems (Gunn et al. 1967)	Major Vegetation	Detailed sites (*Lab site)
R2	Brown to reddish brown loamy sands to sandy clay loams	Somerby, Monteagle, Humboldt, Blackwater, Junee	Poplar Box	131*, 137, 147, 151, 152,
L1	Shallow (0.20 m) loamy sands to deep light clay	Monteagle, Connors, Humboldt, Blackwater	Poplar Box, Ironbark	68*, 69, 70, 85, 113,
L2	Deeper (0.40-0.60 m) loamy sands to light clay	Monteagle, Connors, Humboldt, Blackwater	Poplar Box, Ironbark	60*, 78, 79, 82, 91, 93, 115,
Relic alluvial plains and low-lying plains				
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	Poplar box, Ironbark, Blackbutt, minor Moreton Bay Ash	16, 17*, 24, 27, 28, 29, 30, 43, 169
B2	Brown silty loams to light clays with cracking surface on lower flat plains	Somerby, Connors, Humboldt, Blackwater	Poplar Box, minor Brigalow	61, 106*, 111, 112, 116, 173, 175, 177, 178, 187
B2-DV	Drainage Variant of B2, surface horizon removed by stream bank erosion.		Poplar Box, Brigalow	176
Recent alluvial floodplain and active channels with stratified loamy sands				
A1	Loam to loamy sands within active channels	Monteagle, Connors, Blackwater	Moreton Bay Ash, Paperbark Eucalypts	62*, 74, 77
A2	Clayey sands to light medium clay within alluvial depression	Somerby, Monteagle, Connors, Humboldt, Blackwater	Moreton Bay Ash, Eucalypts	96*, 100, 104

4.1.1 Soils of flat to gently undulating plains: Soil Mapping Unit C1

Overview

This SMU is located within the north east and south-east areas of the Project site. The SMU is associated with flat to gently undulating clay plains with prominent melon hole microrelief. Vegetation includes medium to tall Brigalow. C1 soils in depression positions are firm, with a cracking and crusting surface, featuring uniform dark clays extending 1.0 m below the surface.

Soils associated with mound and inter-gilgai positions are similar but with higher likelihood of poorer quality subsoils from increased salt, sodium and sodic qualities.

Soil Characteristics and Chemistry

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

- very high clay content with hard coarse pedal conditions which suggests poorly structured and aerated medium throughout the mound and depression profile;
- pH is alkaline to slightly alkaline;
- EC is very low to high throughout profile;
- moderate CEC;
- non-sodic within the topsoil profile to strongly sodic subsoils;
- Ca to Mg ratios very high within topsoil profile to moderate within subsoil;
- low dispersive qualities increasing in subsoils; and
- overall fertility is moderate.

Representative Site

Site 12 was chosen as the representative site of this SMU for chemical analysis.

A site description is presented in Table 4, and a soil profile morphology summary is presented in Table 5 and Table 6 for the Site 12a 'depression' and 12b 'mound and inter-gilgai'. The soil chemistry results for Sites 12a and 12b are presented in Table 7 and Table 8.

Table 4: Land Summary for Representative Site 12

SMU	C1	Representative Site Number	Site 12
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Brigalow, Brigalow with scrub
Location (GDA94)	640307 mE 7546621 mN	Disturbance	No effective disturbance
Landform pattern/ element	Flat plain, level	Micro relief	Melon holes, approximately 4.0 m diameter, 0.4 m deep at 50% coverage.
		Permeability	Slowly permeable
Slope (%)	0.0	Drainage	Depression Position – Imperfectly drained Mound Position - Moderately-Well drained
Surface coarse fragments	2%, 2-5 mm coarse fragments and manganese	Surface condition	Surface is firm, cracking with crust, peds >2 mm
ASC Order (s)	Endohypersodic Brown Vertisol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Humboldt, Somerby, Monteagle, Blackwater, Junee, Connors	Substrate	Tertiary, weathered tertiary clays and clay plains.
Soils (Gunn et al. 1967)	Pegunny	Principal Profile Form (Northcote 1974)	Ug5.16, Ug5.24, Ug5.34, Ug5.38
Land suitability summary	Effective rooting depth: 0.40 mbgl Estimated soil water storage: Soil water storage is based upon the Burgess (2003) Indicus Melonhole phase (IdMp) soil, effective rooting depth and sodicity limitations of the SMU exhibited across both gilgai positions. PAWC 75-100 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995).		

	Rain fed Cropping class: 4 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: B Regional Frameworks: Group A:4, Group B:4, Group C:5
Erosion potential	This SMU is located on long, flat plains and undulating sloping areas with a firm clay surface. It has a low water erosion hazard in situ. Laboratory results indicated for the mound and depression locations; Mound - Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil soil profile; - ESP (sodicity) rating indicates that the topsoil profile is low steadily increasing to sodic levels by 0.60 m to strongly sodic at 0.90 m depth - The high Ca/Mg ratio results throughout indicate aggregation of clay particles throughout the profile. Depression - Dispersion Ratio (R1) (Baker et al. 1993) indicate low to moderate dispersion ratings (0.6-0.8) within the topsoil soil profile; - ESP (sodicity) rating indicates that the topsoil profile is low increasing to sodic and extremely sodic levels from 0.30 m to 0.90 m; - Very high Ca/Mg ratio results for topsoil decrease to moderate levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. Erosion potential for the SMU takes into account the results for both the mound and depression locations. Topsoil erosive qualities are assessed as low however, subsoils have moderate to high dispersive qualities and must be managed appropriately when stockpiling and for reuse of this SMU for rehabilitation activities.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.10 mbgl <u>Potential topsoil double stripping depth:</u> 0.00-0.20 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope) <u>Recommended subsoil strip depth:</u> 0.10/0.20–1.00 mbgl <u>Recommended subsoil use:</u> Buried supporting subsoils for topsoil
AASS/PASS Field Assessment	No field indication of AASS/PASS.
Land condition	Good condition
Total area (ha)	7,631

PAWC = plant available water capacity.

Table 5: Soil Profile Morphology Summary for Representative Site 12a

Site 12a – Depression	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m), Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.00 – 0.09 Boundary: Abrupt	Colour: 10YR3/2 Very dark greyish brown Mottle: No mottles Bleach: No bleaching	Moisture: Dry Depth: 0.05 Field pH: 6.5 Meter pH/EC: 7.9 / 0.05	Texture: Light Clay Structure: Weak, 3-10 mm sub-angular Strength: Firm	Coarse Fragments: 2% coarse fragments and manganese, 2- 5 mm Roots: Very few, fine down to 0.05 m
	Horizon: B2 Horizon Depth: 0.09-1.00	Colour: 10YR3/3 Dark brown Mottle: No mottling Bleach: No bleaching	Moisture: Dry Depth: 0.30, 0.60, 0.90 Field pH: 7.0, 7.0, 7.0 Meter pH/EC: 8.1 / 0.03	Texture: Light clay Structure: Moderate, 20-50 mm sub-angular Strength: Firm	Coarse Fragments: No coarse fragments Roots: No roots observed

Table 6: Soil Profile Morphology Summary for Representative Site 12b

Site 12b – Mound	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.0 – 0.10 Boundary: Abrupt	Colour: 10YR3/2 Very dark greyish brown Mottle: No mottles Bleach: No bleaching	Moisture: Dry Depth: 0.05 Field pH: 6.5 Meter pH/EC: 7.8 / 0.03	Texture: Light Clay Structure: Weak, 3-10 mm sub-angular Strength: Firm	Coarse Fragments: 2% coarse fragments and manganese, 2- 5 mm Roots: Very few, fine down to 0.05 m
	Horizon: B2 Horizon Depth: 0.10-1.00	Colour: 10YR3/3 Dark brown Mottle: No mottles Bleach: No bleaching	Moisture: Dry Depth: 0.30, 0.60, 0.90 Field pH: 7.0, 7.0, 7.0 Meter pH/EC: 8.2 / 0.65	Texture: Light clay Structure: Moderate, 20-50 mm sub-angular Strength: Firm	Coarse Fragments: No coarse fragments Roots: No roots observed

Table 7: Soil Chemistry Results for Representative Site 12a

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.80 – 0.90
Soil pH	8.2	8.2	8.9	8.8
Soil EC (dS/m)	0.08	0.05	0.13	0.29
Soil Cl (mg/kg)	16	21	59	275
P (Olsen) (mg/kg)	16	---- ¹	----	----
Exch.Ca (meq/100g)	17.74	13.51	12.5	10.31
Exch. Mg (meq/100g)	3.25	3.75	5.26	5.86
Exch. Na (meq/100g)	0.1	0.4	1.7	2.83
Exch.K (meq/100g)	0.83	0.45	0.4	0.38
CEC (meq/100g)	22.0	18.1	19.9	19.4
Ca/Mg	5.5	3.6	2.4	1.8
ESP (%)	0	2	9	15
Total N (mg/kg)	0.113	----	----	----
Nitrate N (mg/kg)	3.1	----	----	----
Organic Matter (%)	2.3	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	26	----	----	----
PSA-Fine Silt (%)	10	----	----	----
PSA-Silt (%)	19	----	----	----
PSA-Gravel (%)	45	----	----	----
Disp Ratio (%)	0.88	----	----	----
ADMC (%)	3.7	3.9	3.8	3.3
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	8.7	----	----	----
Boron (mg/kg)	0.3	----	----	----
Copper (mg/kg)	1.2	----	----	----
Iron (mg/kg)	25	----	----	----
Zinc (mg/kg)	0.4	----	----	----
Aluminium (meq/100g)	0.07	0.03	0.03	0.03

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

dS/m = deciSiemens per metre

mg/kg = milligrams per kilogram

meq/100g = milliequivalents per 100 grams of soil

Table 8: Soil Chemistry Results for Representative Site 12b

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	8	8.8	8.6	8.6
Soil EC (dS/m)	0.04	0.48	0.72	0.81
Soil Cl (mg/kg)	20	362	611	846
P (Olsen) (mg/kg)	6	---- ¹	----	----
Exch.Ca (meq/100g)	13.47	10.69	8.02	7.44
Exch. Mg (meq/100g)	6.3	8.23	8.66	8.76
Exch. Na (meq/100g)	0.18	3.53	4.21	5.08
Exch.K (meq/100g)	0.56	0.39	0.37	0.39
CEC (meq/100g)	20.6	22.9	21.3	21.7
Ca/Mg	2.1	1.3	0.9	0.9
ESP (%)	1	15	20	23
Total N (mg/kg)	0.116	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	3.1	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	29	----	----	----
PSA-Fine Silt (%)	7	----	----	----
PSA-Silt (%)	15	----	----	----
PSA-Gravel (%)	49	----	----	----
Disp Ratio (%)	0.72	----	----	----
ADMC (%)	4.3	3.3	3.4	3.3
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	7.9	----	----	----
Boron (mg/kg)	0.8	----	----	----
Copper (mg/kg)	1.1	----	----	----
Iron (mg/kg)	10	----	----	----
Zinc (mg/kg)	0.3	----	----	----
Aluminium (meq/100g)	0.05	0.05	0.03	0.02

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

4.1.2 Clay soils of flat to gently undulating plains: Soil Mapping Unit C2

Overview

This SMU is located across the north-west and transects south-east of the Project site within multiple soil polygons. The SMU is associated with flat to gently undulating clay plains with normal gilgai microrelief. Vegetation includes sparse medium to tall Brigalow. Soils are firm, cracking dark clays to gradational extending 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- clay texture throughout the profile;
- pH is strongly alkaline;
- EC is low in topsoil profiles increasing to extremely high to 1.00 m depth;
- high CEC;
- non-sodic within the topsoil profile to strongly sodic subsoils;
- very high to high Ca to Mg ratios;
- dispersive qualities increasing in subsoils; and
- overall fertility is high.

Representative Site

Site 25 was chosen as the representative site of this SMU for chemical analysis.

A site description is presented in Table 9, and a soil profile morphology summary is presented in Table 10 and Table 11 for the Site 25a 'depression' and 25b 'mound and inter-gilgai'. The soil chemistry results for Sites 25a and 25b are presented in Table 12 and Table 13.

Table 9: Land Summary for Representative Site 25

SMU	C2	Representative Site Number	Site 25
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Brigalow
Location (GDA94)	644923 mE 7542220 mN	Disturbance	Slight to extensive clearing
Landform pattern/element	Level, Flat Plain	Micro relief	Gilgai, approximately 3.0 m diameter, 0.3 m deep at 20-30% coverage.
		Permeability	Slowly permeable
Slope (%)	0.0	Drainage	<u>Depression Position</u> Poorly to imperfect drained <u>Mound Position</u> Moderately-well drained
Surface coarse fragments	2%, <5mm coarse fragments	Surface condition	Surface is firm, cracking, peds >2 mm
ASC Order (s)	Brown Vertosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater, June	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains.
Soils (Gunn et al. 1967)	Pegunny	Principal Profile Form (Northcote 1974)	Ug5.16, Ug5.24, Ug5.34, Ug5.38
Land suitability summary	Effective rooting depth: <0.30 mbgl Estimated soil water storage: Soil water storage is based upon the Burgess (2003) Pomegranate melonhole phase (PgMp) soil, the salinity limitations of the SMU exhibited within the both the mound and depression positions. PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on long, flat plains and undulating sloping areas with a firm clay surface. It has a low water erosion hazard in situ. Laboratory results indicated for the mound and depression locations; Mound • Dispersion Ratio (R1) (Baker et al. 1993) indicate high dispersion ratings (0.8-0.95) within the topsoil soil profile; • ESP (sodicity) rating indicates the topsoil profile is low increasing sodic (0.30 m) and strongly sodic levels (0.60m) to depth; and • Very high Ca/Mg ratio results throughout indicate aggregation of clay particles throughout the profile. Depression • Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil soil profile; • ESP (sodicity) rating indicates that the topsoil profile is low increasing to strongly sodic and extremely sodic levels from 0.30 m to 0.90 m; and • Very high Ca/Mg ratio results for topsoil decrease to high levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. Erosion potential for the SMU takes into account the results for both the mound and depression locations. Topsoil erosive qualities are assessed low to moderate with, subsoils showing preferred high levels of calcium to magnesium, however, ESP indicates poor physical conditions and strong to extremely high levels of sodicity. Subsoils must be managed appropriately when stockpiling and rehabilitation reuse to reduce their dispersive and erosive qualities.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.20 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope) <u>Recommended subsoil strip depth:</u> 0.20 -1.00 mbgl <u>Recommended subsoil use:</u> Capping material over waste rock.
AASS/PASS Field Assessment	No field indication of AASS/PASS.
Land condition	Good condition
Total area (ha)	5,528

Table 10: Soil Profile Morphology Summary for Representative Site 25a

Site 25a – Depression	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A1 <i>Depth:</i> 0 – 0.21 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.10 <i>Field pH:</i> 8.0 <i>Meter pH/EC:</i> 8.4 / 0.08	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <10 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% calcium carbonate <i>Roots:</i> Fine, few
	<i>Horizon:</i> B21 <i>Depth:</i> 0.21 – 0.68 <i>Boundary:</i> Clear	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Moderately moist, well drained <i>Depth:</i> 0.30, 0.60 <i>Field pH:</i> 7.5, 8.0 <i>Meter pH/EC:</i> 8.7 / 0.32 8.6 / 1.03	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> Very fine, few
	<i>Horizon:</i> B22 <i>Depth:</i> 0.68 – 1.00	<i>Colour:</i> 10YR4/4 Dark yellow brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Moderately moist, well drained <i>Depth:</i> 0.90 <i>Field pH:</i> 8.0 <i>Meter pH/EC:</i> 8.4 / 0.95	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> No roots observed

Table 11: Soil Profile Morphology Summary for Representative Site 25b

Site 25b – Mound	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A1 <i>Depth:</i> 0 – 0.21 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.10 <i>Field pH:</i> 8.0 <i>Meter pH/EC:</i> 8.2 / 0.08	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <10 mm peds <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% calcium carbonate <i>Roots:</i> Fine, few
	<i>Horizon:</i> B21 <i>Depth:</i> 0.21 – 0.76 <i>Boundary:</i> Clear	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Moderately moist, well drained <i>Depth:</i> 0.30, 0.60 <i>Field pH:</i> 7.5, 8.0 <i>Meter pH/EC:</i> 8.7 / 0.98 8.6 / 1.84	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> Very fine, few
	<i>Horizon:</i> B22 <i>Depth:</i> 0.76 – 1.00	<i>Colour:</i> 10YR4/4 Dark yellow brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Moderately moist, well drained <i>Depth:</i> 0.90 <i>Field pH:</i> 8.0 <i>Meter pH/EC:</i> 8.5 / 1.88	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> No roots observed

Table 12: Soil Chemistry Results for Representative Site 25a

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	8.6	8.8	8.6	8.7
Soil EC (dS/m)	0.1	0.38	1.11	1
Soil Cl (mg/kg)	21	274	1330	944
P (Olsen) (mg/kg)	17	---- ¹	----	----
Exch.Ca (meq/100g)	23.29	19.68	17.1	15.88
Exch. Mg (meq/100g)	5.98	9.33	9.29	9.15
Exch. Na (meq/100g)	0.33	2.86	5.46	5.42
Exch.K (meq/100g)	1.26	0.82	0.9	0.78
CEC (meq/100g)	30.9	32.7	32.8	31.2
Ca/Mg	3.9	2.1	1.8	1.7
ESP (%)	1	9	17	17
Total N (mg/kg)	0.128	----	----	----
Nitrate N (mg/kg)	2	----	----	----
Organic Matter (%)	4.1	----	----	----
Ammonia (mg/kg)	<20	----	40	----
PSA-Clay (%)	18	----	----	----
PSA-Fine Silt (%)	2	----	----	----
PSA-Silt (%)	31	----	----	----
PSA-Gravel (%)	49	----	----	----
Disp Ratio (%)	0.87	----	----	----
ADMC (%)	4.3	3.8	3.5	3.3
Total S	0.02	----	----	----
Sulfate-S (%)	9	----	----	----
Manganese (mg/kg)	7.7	----	----	----
Boron (mg/kg)	0.4	----	----	----
Copper (mg/kg)	1.2	----	----	----
Iron (mg/kg)	13	----	----	----
Zinc (mg/kg)	0.5	----	----	----
Aluminium (meq/100g)	0.04	0.04	0.03	0.02

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

Table 13: Soil Chemistry Results for Representative Site 25b

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	8.6	8.7	8.6	8.6
Soil EC (dS/m)	0.11	1.19	2.13	2.32
Soil Cl (mg/kg)	19	1654	2678	2690
P (Olsen) (mg/kg)	13	---- ¹	----	----
Exch.Ca (meq/100g)	23.47	17.85	15.32	14.75
Exch. Mg (meq/100g)	5.27	9.55	10.22	10.61
Exch. Na (meq/100g)	0.39	6.12	9.97	12.16
Exch.K (meq/100g)	1.37	1.35	1.74	1.9
CEC (meq/100g)	30.5	34.9	37.3	39.5
Ca/Mg	4.5	1.9	1.5	1.4
ESP (%)	1	18	27	31
Total N (mg/kg)	0.256	----	----	----
Nitrate N (mg/kg)	2	----	----	----
Organic Matter (%)	5	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	11	----	----	----
PSA-Fine Silt (%)	14	----	----	----
PSA-Silt (%)	27	----	----	----
PSA-Gravel (%)	48	----	----	----
Disp Ratio (%)	0.79	----	----	----
ADMC (%)	4.2	3.6	3.7	3.7
Total S	0.02	----	----	----
Sulfate-S (%)	5	----	----	----
Manganese (mg/kg)	9.1	----	----	----
Boron (mg/kg)	1	----	----	----
Copper (mg/kg)	0.9	----	----	----
Iron (mg/kg)	12	----	----	----
Zinc (mg/kg)	0.5	----	----	----
Aluminium (meq/100g)	0.02	0.02	0.03	0.05

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

4.1.3 Gently undulating plains of sandy earths: Soil Mapping Unit S1

Overview

The majority of this SMU is located within the Olive Downs South domain with four small polygons located within the Willunga domain. The SMU is associated with gently undulating plains with duplex sand to clay loam sand earths.

Vegetation predominantly is tall woodlands of Poplar Box. Soils are hard setting, dark yellow brown loamy sands to brown clay loam sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- high sand content with texture increase to clay loam sandy subsoils;
- pH is acidic increasing to strongly alkaline within subsoils;
- EC is very low throughout;
- very low CEC;
- non-sodic topsoil profile to strongly sodic within subsoils;
- very high to moderate Ca to Mg ratios with depth;
- low dispersive qualities within topsoil increasing to moderate in subsoils; and
- overall fertility is very low to low.

Representative Site

Site 2 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 14, and a soil profile morphology summary is presented in Table 15. The soil chemistry results for this site are presented in Table 16.

Table 14: Land Summary for Representative Site 2

SMU	S1	Representative Site Number	Site 2
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Ironbark, Bloodwood, Blackbutt
Location (GDA94)	638862 mE 7548002 mN	Disturbance	No effective disturbance
Landform pattern/ element	Gently undulating Plain, Upper slope	Micro relief	None
		Permeability	Highly to slowly permeable
Slope (%)	<2.0	Drainage	Rapid to imperfect
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting
ASC Order (s)	Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting depth: 0.40 mbgl Estimated soil water storage: Soil water storage is based upon subsoil below 0.35 m structure increasing to hard strength and poorer growth medium PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995) Rain fed Cropping class: 4 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on gently undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ. Laboratory results indicated for the mound and depression locations; • Dispersion Ratio (R1) (Baker et al. 1993) indicate high dispersion ratings (0.8-0.95) within the topsoil soil profile; • ESP (sodicity) rating indicates that the topsoil profile is very low increasing to sodic and strongly sodic levels from 0.60 m to 0.90 m; • Very high Ca/Mg ratio results for topsoil decrease to moderate levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. Erosion potential through dispersion is assessed low within topsoil with minor dispersive qualities. Subsoils are considered moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio which will promote dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.30 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.30–1.00 mbgl <u>Recommended subsoil use:</u> Buried supporting subsoils for topsoil
AASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	3,278

Table 15: Soil Profile Morphology Summary for Representative Site 2

Site 2	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A11 <i>Horizon Depth:</i> 0.00 – 0.20 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR3/4 Dark yellow brown <i>Mottle:</i> No mottles <i>Bleach:</i> None	<i>Moisture:</i> Dry <i>Depth:</i> 0.10 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.3 / 0.01	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, few
	<i>Horizon:</i> A12 <i>Horizon Depth:</i> 0.20 – 0.60 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottles <i>Bleach:</i> None	<i>Moisture:</i> Dry <i>Depth:</i> 0.30 <i>Field pH:</i> 7.0 <i>Meter pH/EC:</i> 6.8 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Very weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed
	<i>Horizon:</i> B21 <i>Horizon Depth:</i> 0.60 – 1.00	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> 5% 10YR5/8 Yellowish brown <i>Bleach:</i> None	<i>Moisture:</i> Dry <i>Depth:</i> 0.60 / 0.90 <i>Field pH:</i> 7.5 / 7.5 <i>Meter pH/EC:</i> 7.6 / 0.03	<i>Texture:</i> Clay loam sandy <i>Structure:</i> Strong structure, sub angular peds <10 mm <i>Strength:</i> Very firm	<i>Coarse Fragments:</i> <2% manganese nodules <i>Roots:</i> No roots observed

Table 16: Soil Chemistry Results for Representative Site 2

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	6.3	6.9	8.1	8.6
Soil EC (dS/m)	0.01	<0.01	0.04	0.11
Soil Cl (mg/kg)	10	14	97	108
P (Olsen) (mg/kg)	5	---- ¹	----	----
Exch.Ca (meq/100g)	1.19	0.63	2.3	2.77
Exch. Mg (meq/100g)	0.34	0.25	2.97	4.1
Exch. Na (meq/100g)	<0.08	<0.08	0.73	1.35
Exch.K (meq/100g)	0.16	0.12	0.26	0.26
CEC (meq/100g)	1.7	1.1	6.4	8.5
Ca/Mg	3.5	2.5	0.8	0.7
ESP (%)	<1	1	11	16
Total N (mg/kg)	0.033	----	----	----
Nitrate N (mg/kg)	1.4	----	----	----
Organic Matter (%)	1	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	75	----	----	----
PSA-Fine Silt (%)	13	----	----	----
PSA-Silt (%)	6	----	----	----
PSA-Gravel (%)	6	----	----	----
Disp Ratio (%)	0.81	----	----	----
ADMC (%)	0.4	0.3	1.8	2.5
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	21.8	----	----	----
Boron (mg/kg)	<0.1	----	----	----
Copper (mg/kg)	0.2	----	----	----
Iron (mg/kg)	22	----	----	----
Zinc (mg/kg)	0.3	----	----	----
Aluminium (meq/100g)	0.03	0.1	0.14	0.06

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

4.1.4 Gently undulating plains of sandy earths: Soil Mapping Unit S2

Overview

The majority of this SMU is located along the Isaac River. Four minor areas are located within the Olive Downs South domain and one within the Willunga domain. The SMU is associated with gently undulating plains with gradational sandy earths.

Vegetation is predominantly tall woodlands of Blackbutt and associated Eucalypts. Soils are firm with no coarse fragments, dark brown clayey sands to loamy sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- high sand content throughout the profile;
- pH is neutral throughout;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high to high Ca to Mg ratios;
- low dispersive qualities; and
- overall fertility is very low.

Representative Site

Site 8 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 17, and a soil profile morphology summary is presented in Table 18. The soil chemistry results for this site are presented in Table 19.

Table 17: Land Summary for Representative Site 8

SMU	S2	Representative Site Number	Site 8
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Blackbutt, Assorted Eucalyptus
Location (GDA94)	640823 mE 7547668 mN	Disturbance	No effective disturbance
Landform pattern/ element	Very gently undulating plain, Upper slope	Micro relief	None
		Permeability	Highly permeable
Slope (%)	<1.0	Drainage	Well drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is firm, no coarse fragments
ASC Order (s)	Haplic Brown Dermosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Clematis	Principal Profile Form (Northcote 1974)	Um5.5, Uf6.31
Land suitability summary	Effective rooting depth: 0.60 mbgl Estimated soil water storage: PAWC 75-100 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 4 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: B Regional Frameworks: Group A:3, Group B:4, Group C:5		

Erosion potential	The SMU is generally located on very gently undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ. Laboratory results indicated; - Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile; - ESP (sodicity) rating indicates very low to low levels; and - the high Ca/Mg ratio results throughout promotes aggregation of clay particles and low dispersive qualities. Erosion potential through dispersion is assessed as low throughout the soil profile.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.50 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.50–1.00 mbgl <u>Potential subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil
ASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	3,373

Table 18: Soil Profile Morphology Summary for Representative Site 8

Site 8	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A1 <i>Horizon Depth:</i> 0 – 0.23 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR3/2 <i>Dark brown</i> <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.1 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.6 / 0.01	<i>Texture:</i> Clayey sand <i>Structure:</i> Weak, peds <10 mm <i>Strength:</i> Very weak,	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, few
	<i>Horizon:</i> B21 <i>Horizon Depth:</i> 0.23 – 0.57 <i>Boundary:</i> Gradual	<i>Colour:</i> 10YR3/3 <i>Dark brown</i> <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, humid <i>Depth:</i> 0.3 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.7 / 0.01	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak, peds <10 mm <i>Strength:</i> Very weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed
	<i>Horizon:</i> B21 <i>Horizon Depth:</i> 0.57 – 1.00	<i>Colour:</i> 7.5YR4/4 <i>Dark brown</i> <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, humid <i>Depth:</i> 0.6, 0.9 <i>Field pH:</i> 7.0, 6.5 <i>Meter pH/EC:</i> 7.1 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Moderate, peds 5-20 mm <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

Table 19: Soil Chemistry Results for Representative Site 8

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	6.7	6.8	7.1	7.3
Soil EC (dS/m)	0.02	0.01	<0.01	<0.01
Soil Cl (mg/kg)	24	24	53	39
P (Olsen) (mg/kg)	11	---- ¹	----	----
Exch.Ca (meq/100g)	3.05	1.86	1.61	1.69
Exch. Mg (meq/100g)	0.97	0.56	0.71	0.97
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08
Exch.K (meq/100g)	0.37	0.2	0.16	0.16
CEC (meq/100g)	4.4	2.7	2.6	3.0
Ca/Mg	3.2	3.3	2.3	1.7
ESP (%)	<1	1	1	1
Total N (mg/kg)	0.081	----	----	----
Nitrate N (mg/kg)	7.4	----	----	----
Organic Matter (%)	1.3	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	65	----	----	----
PSA-Fine Silt (%)	18	----	----	----
PSA-Silt (%)	7	----	----	----
PSA-Gravel (%)	11	----	----	----
Disp Ratio (%)	0.77	----	----	----
ADMC (%)	1.0	0.6	0.6	0.7
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	20.8	----	----	----
Boron (mg/kg)	0.1	----	----	----
Copper (mg/kg)	0.3	----	----	----
Iron (mg/kg)	21	----	----	----
Zinc (mg/kg)	0.4	----	----	----
Aluminium (meq/100g)	0.02	0.04	0.12	0.11

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

4.1.5 Gently undulating plains of sandy earths: Soil Mapping Unit R1

Overview

This SMU is located within four minor areas within the Olive Downs South domain and three areas within the Willunga domain. The SMU is associated with gently undulating plains with uniform sandy earths.

Vegetation predominantly is tall woodlands of Blackbutt, blue gum and associated Eucalypts. Soils are soft with no coarse fragments, reddish loamy sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- high sand content throughout the profile;
- pH is slightly acidic to neutral to depth;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high Ca to Mg ratios;
- low dispersive qualities; and
- overall fertility is very low.

Representative Site

Site 49 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 20, and a soil profile morphology summary is presented in Table 21. The soil chemistry results for this site are presented in Table 22.

Table 20: Land Summary for Representative Site 49

SMU	R1	Representative Site Number	Site 49
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Assorted Eucalypts and Wattle spp.
Location (GDA94)	643862 mE 7535154 mN	Disturbance	Limited clearing
Landform pattern/ element	Very gently undulating plain, Upper slope	Micro relief	None
		Permeability	Highly permeable
Slope (%)	2.0	Drainage	Rapid
Surface coarse fragments	No coarse fragments	Surface condition	Surface is soft, no coarse fragments
ASC Order (s)	Red Rudosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater, Juneë	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Annandale	Principal Profile Form (Northcote 1974)	Gn1.12, Gn2.11, Gn2.12
Land suitability summary	Effective rooting depth: 0.80 mbgl Estimated soil water storage: PAWC 75-100 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 4 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ. Laboratory results indicated; • Dispersion Ratio (R1) (Baker et al. 1993) indicate low to moderate dispersion ratings (0.6) within the topsoil; • ESP (sodicity) rating indicates very low to low levels; and • very high Ca/Mg ratio results throughout promotes aggregation of clay particles and low dispersive qualities. Erosion potential through dispersion is assessed as low throughout the soil profile. Appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.35 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.35–1.00 mbgl <u>Potential subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
ASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS
Land condition	Good condition
Total area (ha)	1,191

Table 21: Soil Profile Morphology Summary for Representative Site 49

Site 49	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A11 <i>Horizon Depth:</i> 0.00 – 0.10 <i>Boundary:</i> Abrupt	<i>Colour:</i> 2.5YR3/3 Dark reddish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.05 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.4 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	<i>Horizon:</i> A12 <i>Horizon Depth:</i> 0.10 – 0.37 <i>Boundary:</i> Abrupt	<i>Colour:</i> 2.5YR3/4 Dark reddish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.30 <i>Field pH:</i> 6.5	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	<i>Horizon:</i> A21 <i>Horizon Depth:</i> 0.37 – 0.80 <i>Boundary:</i> Abrupt	<i>Colour:</i> 2.5YR2.5/3 Very dusky red <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.60 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.5 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak, rounded peds <20 mm <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	<i>Horizon:</i> A22 <i>Horizon Depth:</i> 0.80 – 1.00	<i>Colour:</i> 2.5YR2.5/3 Very dusky red <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.90 <i>Field pH:</i> 6.5	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak, rounded peds <20 mm <i>Strength:</i> Weak	<i>Coarse Fragments:</i> <5% Manganese nodules <i>Roots:</i> No roots observed

Table 22: Soil Chemistry Results for Representative Site 49

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.25-0.35	0.60-0.70	0.90-1.00
Soil pH	6.4	6.5	6.6	6.7
Soil EC (dS/m)	0.01	<0.01	<0.01	<0.01
Soil Cl (mg/kg)	2	3	13	15
P (Olsen) (mg/kg)	4	---- ¹	----	----
Exch.Ca (meq/100g)	1.31	1.03	1.08	2.91
Exch. Mg (meq/100g)	0.4	0.28	0.32	0.83
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08
Exch.K (meq/100g)	0.16	0.15	0.1	0.09
CEC (meq/100g)	1.9	1.6	1.7	4.2
Ca/Mg	3.3	3.6	3.4	3.5
ESP (%)	0	1	1	1
Total N (mg/kg)	0.045	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	1.4	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	75	----	----	----
PSA-Fine Silt (%)	9	----	----	----
PSA-Silt (%)	7	----	----	----
PSA-Gravel (%)	9	----	----	----
Disp Ratio (%)	0.60	----	----	----
ADMC (%)	0.5	0.5	0.5	0.7
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	26.1	----	----	----
Boron (mg/kg)	<0.1	----	----	----
Copper (mg/kg)	0.3	----	----	----
Iron (mg/kg)	8	----	----	----
Zinc (mg/kg)	0.3	----	----	----
Aluminium (meq/100g)	0.07	0.11	0.22	0.3

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

4.1.6 Gently undulating plains of sandy earths: Soil Mapping Unit R2

Overview

This SMU is located within the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy earths.

Vegetation is predominantly tall woodlands of Poplar Box and Blackbutt. Soils are dark brown to reddish brown loamy sands to reddish sandy clay loams extending 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- high sand content within topsoil to increased clay content in subsoils to 1.0 m depth;
- pH is slightly acidic to neutral to 1.0m depth;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high Ca to Mg ratios;
- very low dispersive qualities increasing slightly in subsoils; and
- overall fertility is very low.

Representative Site

Site 131 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 23, and a soil profile morphology summary is presented in Table 24. The soil chemistry results for this site are presented in Table 25.

Table 23: Land Summary for Representative Site 131

SMU	R2	Representative Site Number	Site 131
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Blackbutt, Eucalypts and wattles
Location (GDA94)	656738 mE 7527426 mN	Disturbance	No effective disturbance
Landform pattern/ element	Very gently undulating plain, mid-slope	Micro relief	None
		Permeability	Highly permeable
Slope (%)	1.0	Drainage	Rapid to well drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is firm, no coarse fragments
ASC Order (s)	Haplic Red Chromosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Humboldt, Blackwater, June	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,
Land suitability summary	Effective rooting depth: 0.60 mbgl Estimated soil water storage: PAWC 75-100 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 4 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on very undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ. Laboratory results indicated; • Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile; • ESP (sodicity) rating indicates that the topsoil profile is very low to low levels. Subsoils are assessed as non-sodic; • Very high to high Ca/Mg ratio results throughout indicate aggregation of clay particles. Erosion potential through dispersion is considered low however, appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.50 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.50–1.00 mbgl <u>Potential subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
AASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	1,063

Table 24: Soil Profile Morphology Summary for Representative Site 131

Site 131	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A11 <i>Horizon Depth:</i> 0.00 – 0.09 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/3 <i>Brown</i> <i>Mottle:</i> No mottles	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.05 <i>Field pH:</i> 7.0 <i>Meter pH/EC:</i> 6.4 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	<i>Horizon:</i> A12 <i>Horizon Depth:</i> 0.09 – 0.60 <i>Boundary:</i> Diffuse	<i>Colour:</i> 5YR3/3 <i>Dark reddish brown</i> <i>Mottle:</i> No mottles	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.30, 0.60 <i>Field pH:</i> 7.0, 7.0	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	<i>Horizon:</i> B2 <i>Horizon Depth:</i> 0.60 – 1.00 <i>Boundary:</i> 	<i>Colour:</i> 2.5YR3/3 <i>Dark reddish brown</i> <i>Mottle:</i> No mottles	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.90 <i>Field pH:</i> 7.0 <i>Meter pH/EC:</i> 6.8 / 0.00	<i>Texture:</i> Sandy clay loam <i>Structure:</i> Moderate rounded peds 10-30mm <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

Table 25: Soil Chemistry Results for Representative Site 131

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	6.5	6.7	6.8	6.6
Soil EC (dS/m)	0.01	0.02	<0.01	0.01
Soil Cl (mg/kg)	8	23	22	18
P (Olsen) (mg/kg)	4	---- ¹	----	----
Exch.Ca (meq/100g)	1.58	1.62	1.65	2.1
Exch. Mg (meq/100g)	0.41	0.41	0.61	1.61
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08
Exch.K (meq/100g)	0.15	0.26	0.26	0.15
CEC (meq/100g)	2.1	2.3	2.6	3.9
Ca/Mg	3.8	3.9	2.7	1.3
ESP (%)	----	0	0	1
Total N (mg/kg)	0.059	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	1.3	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	76	----	----	----
PSA-Fine Silt (%)	9	----	----	----
PSA-Silt (%)	8	----	----	----
PSA-Gravel (%)	8	----	----	----
Disp Ratio (%)	0.55	----	----	----
ADMC (%)	0.4	0.5	0.6	1.0
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	31.4	----	----	----
Boron (mg/kg)	<0.1	----	----	----
Copper (mg/kg)	0.3	----	----	----
Iron (mg/kg)	10	----	----	----
Zinc (mg/kg)	0.6	----	----	----
Aluminium (meq/100g)	0.02	0.02	0.05	0.04

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

4.1.7 Gently undulating plains of sandy earths: Soil Mapping Unit L1

Overview

This SMU is located in two areas, the south-eastern portion of the Olive Downs South domain and northern area of the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy/clay earths.

Vegetation is predominantly tall woodlands of Poplar Box and Ironbark. Soils are shallow grey brown sands to brown light clays extending 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- sand content within topsoil to clay content in subsoils to 1.0 m depth;
- pH is slightly acidic within topsoils to alkaline and strongly alkaline to 1.0 m depth;
- EC is very low within topsoil profile but increasing with depth. and high from 0.35 m to 1.0 m depth;
- low to moderate CEC;
- non-sodic topsoils increasing to strongly sodic subsoils;
- very high decreasing to moderate/high Ca to Mg ratios;
- low dispersive topsoils with dispersive subsoils; and
- overall fertility is low.

Representative Site

Site 68 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 26, and a soil profile morphology summary is presented in Table 27. The soil chemistry results for this site are presented in Table 28.

Table 26: Land Summary for Representative Site 68

SMU	L1	Representative Site Number	Site 68
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Poplar Box, Ironbark
Location (GDA94)	641301 mE 7533293 mN	Disturbance	No effective disturbance
Landform pattern/ element	Flat plain, level	Micro relief	None
		Permeability	Rapid to slowly permeable
Slope (%)	0.5	Drainage	Rapid to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting, very minor cracking, no coarse fragments
ASC Order (s)	Mesonatric Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting depth : 0.20 mbgl Estimated soil water storage: PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located level to very gently undulating sloping areas with a sandy surface. It has a low water erosion hazard in situ. Laboratory results indicated; • Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile; • ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as strongly sodic; and • high Ca/Mg ratio within topsoil results throughout, indicates aggregation of clay particles. Moderate to high levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.10 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.10–0.35 mbgl <u>Recommended subsoil use:</u> Buried supporting subsoils for topsoil. Soils below 0.35 m are not recommended to be reused however may be marginally suitable with possible use as capping material over waste rock.
AASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	591

Table 27: Soil Profile Morphology Summary for Representative Site 68

Site 68	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.00 – 0.18 Boundary: Abrupt	Colour: 10YR4/2 Dark greyish brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, rapid Depth: 0.10 Field pH: 6.5 Meter pH/EC: 6.5 / 0.01	Texture: Clayey sand Structure: Massive Strength: Weak	Coarse Fragments: No coarse fragments Roots: Very few, very fine
	Horizon: B21 Horizon Depth: 0.18 – 0.35 Boundary: Abrupt	Colour: 10YR3/3 Dark brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained Depth: 0.30 Field pH: 6.5 Meter pH/EC: 7.4 / 0.27	Texture: Light clay Structure: Moderate sub-angular peds 10-20 mm Strength: Firm	Coarse Fragments: No coarse fragments Roots: No roots observed
	Horizon: B22 Horizon Depth: 0.35 – 0.75 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained Depth: 0.60 Field pH: 7.5 Meter pH/EC: 8.3 / 0.71	Texture: Light clay Structure: Hard. Moderate sub-angular peds 10-20 mm, Strength: Strong	Coarse Fragments: <2% calcium carbonate Roots: No roots observed
	Horizon: B23 Horizon Depth: 0.75 – 1.00	Colour: 7.5YR4/3 Brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained Depth: 0.90 Field pH: 7.5 Meter pH/EC: 8.4 / 0.72	Texture: Light clay Structure: Moderate sub-angular peds 10-20 mm, very Strength: Strong	Coarse Fragments: <2% calcium carbonate Roots: No roots observed

Table 28: Soil Chemistry Results for Representative Site 68

Site, Horizon,	Sample Depth (m)			
	0.00-0.10	0.3-0.4	0.60-0.70	0.90-1.00
Soil pH	6.5	8	9.2	9.3
Soil EC (dS/m)	0.03	0.32	0.79	0.78
Soil Cl (mg/kg)	16	394	898	864
P (Olsen) (mg/kg)	8	---- ¹	----	----
Exch.Ca (meq/100g)	4.06	4.92	9.84	9.23
Exch. Mg (meq/100g)	1.84	5.99	6.89	5.8
Exch. Na (meq/100g)	<0.08	3.34	5.46	5.4
Exch.K (meq/100g)	0.44	0.27	0.29	0.29
CEC (meq/100g)	6.4	14.6	22.5	20.8
Ca/Mg	2.2	0.8	1.4	1.6
ESP (%)	1	23	24	26
Total N (mg/kg)	0.131	----	----	----
Nitrate N (mg/kg)	1	----	----	----
Organic Matter (%)	3.9	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	46	----	----	----
PSA-Fine Silt (%)	19	----	----	----
PSA-Silt (%)	20	----	----	----
PSA-Gravel (%)	16	----	----	----
Disp Ratio (%)	0.7	----	----	----
ADMC (%)	1.3	2.5	2.3	2.3
Total S	<0.01	----	----	----
Sulfate-S (%)	4	----	----	----
Manganese (mg/kg)	46.8	----	----	----
Boron (mg/kg)	0.4	----	----	----
Copper (mg/kg)	0.6	----	----	----
Iron (mg/kg)	40	----	----	----
Zinc (mg/kg)	1	----	----	----
Aluminium (meq/100g)	0.03	0.03	0.03	0.03

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

4.1.8 Gently undulating plains of sandy earths: Soil Mapping Unit L2

Overview

This SMU is located in two areas, the western portion of the Olive Downs South domain and northern area of the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy/clay earths.

Vegetation is predominantly tall woodlands of Poplar Box and Ironbark. Soils are duplex grey brown sands to brown light clays extending 1.0 m below the surface.

Soil Characteristics and Chemistry

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

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic within topsoils to alkaline and strongly alkaline to 1.0 m depth;
- EC is very low within topsoils increasing from low to high with subsoil depth;
- low increasing to moderate CEC with subsoil depth;
- non-sodic topsoils increasing to extremely strongly sodic subsoils;
- very high to high Ca to Mg ratios;
- low dispersive topsoils with dispersive subsoils; and
- overall fertility is low.

Representative Site

Site 60 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 29, and a soil profile morphology summary is presented in Table 30. The soil chemistry results for this site are presented in Table 31.

Table 29: Land Summary for Representative Site 60

SMU	L2	Representative Site Number	Site 60
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Poplar Box, Ironbark
Location (GDA94)	640162 mE 7535256 mN	Disturbance	No effective disturbance
Landform pattern/ element	Gently undulating plain, mid slope	Micro relief	None
		Permeability	Rapid to slowly permeable
Slope (%)	1.5	Drainage	Rapid to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting, very minor cracking, no coarse fragments
ASC Order (s)	Mesonatric Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Broadmeadow	Principal Profile Form (Northcote 1974)	Db1.23, Db1.13, Dr2.13, Dy3.23, Dy3.43
Land suitability summary	Effective rooting depth:: 0.30 mbgl Estimated soil water storage: PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ. Laboratory results indicated; • Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile; • ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as strongly sodic; and • high Ca/Mg ratio within topsoil throughout indicates aggregation of clay particles. High levels within subsoils indicate the subsoils may have poor physical conditions with dispersive qualities. Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.30 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.30–1.00 mbgl <u>Recommended subsoil use:</u> Capping material over waste rock.
ASS/PASS Assessment	Field
	Very low field indication of PASS. No field indicators of AASS
Land condition	Good condition
Total area (ha)	585

Table 30: Soil Profile Morphology Summary for Representative Site 60

Site 60	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0 – 0.12 Boundary: Abrupt	Colour: 10YR3/3 Dark Brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, rapid Depth: 0.05 Field pH: 6.5 Meter pH/EC: 6.7 / 0.00	Texture: Clayey sand Structure: Massive Strength: Loose	Coarse Fragments: No coarse fragments Roots: Fine, very few
	Horizon: A12 Horizon Depth: 0.12 – 0.42 Boundary: Abrupt	Colour: 10YR3/3 Dark brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, rapid Depth: 0.2 Field pH: 6.5	Texture: Clayey sand Structure: Massive to weak, <10% peds <10 mm Strength: Weak	Coarse Fragments: No coarse fragments Roots: Fine, very few
	Horizon: B21 Horizon Depth: 0.42 – 0.60 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained Depth: 0.6 Field pH: 7.5 Meter pH/EC: 7.3 / 0.11	Texture: Clay loam sandy Structure: Moderate peds 10-30 mm sub angular Strength: Weak	Coarse Fragments: No coarse fragments Roots: No roots observed
	Horizon: B22 Horizon Depth: 0.60 – 0.73 Boundary: Abrupt	Colour: 7.5YR4/3 Brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained	Texture: Light clay Structure: Moderate peds 10-30 mm sub angular Strength: Weak	Coarse Fragments: No coarse fragments Roots: No roots observed
	Horizon: B23 Horizon Depth: 0.73 – 1.00	Colour: 10YR3/3 Dark brown Mottle: No mottle Bleach: No bleaching	Moisture: Dry, well drained Depth: 0.9 Field pH: 7.5	Texture: Light clay Structure: Moderate peds 10-30 mm sub angular Strength: Weak	Coarse Fragments: No coarse fragments Roots: No roots observed

Table 31: Soil Chemistry Results for Representative Site 60

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	6.4	6.9	7.8	8.9
Soil EC (dS/m)	0.02	0.03	0.18	0.61
Soil Cl (mg/kg)	12	80	212	622
P (Olsen) (mg/kg)	8	---- ¹	----	----
Exch.Ca (meq/100g)	2.36	1.49	3.6	6.79
Exch. Mg (meq/100g)	0.56	0.77	3.28	5.15
Exch. Na (meq/100g)	<0.08	0.29	2.07	5.14
Exch.K (meq/100g)	0.19	0.1	0.21	0.35
CEC (meq/100g)	3.2	2.7	9.2	17.5
Ca/Mg	4.2	1.9	1.1	1.3
ESP (%)	1	11	23	30
Total N (mg/kg)	0.079	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	2.1	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	61	----	----	----
PSA-Fine Silt (%)	16	----	----	----
PSA-Silt (%)	7	----	----	----
PSA-Gravel (%)	16	----	----	----
Disp Ratio (%)	0.66	----	----	----
ADMC (%)	0.7	0.6	1.7	2.8
Total S	0.02	----	----	----
Sulfate-S (%)	5	----	----	----
Manganese (mg/kg)	24.3	----	----	----
Boron (mg/kg)	0.1	----	----	----
Copper (mg/kg)	0.3	----	----	----
Iron (mg/kg)	16	----	----	----
Zinc (mg/kg)	0.6	----	----	----
Aluminium (meq/100g)	0.05	0.06	0.05	0.02

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

4.1.9 Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B1

Overview

This SMU is associated with the relic alluvial drainage pathways and low-lying plains within the Olive Downs South domain. Landforms are flat to gently undulating plains with soils that are dark brown with a hard setting surface. Soils throughout profile area are massive loamy sands to silty clay loams with rapid to well drained within the first metre.

Soil Characteristics and Chemistry

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

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is neutral;
- EC is very low;
- low CEC;
- non-sodic topsoils increasing to sodic subsoils;
- very high to moderate Ca to Mg ratios;
- low dispersive qualities increasing slightly with deeper subsoils; and
- overall fertility is very low.

Representative Site

Site 17 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 32, and a soil profile morphology summary is presented in Table 33. The soil chemistry results for this site are presented in Table 34.

Table 32: Land Summary for Representative Site 17

Representative site number	B1	Representative Site Number	Site 17
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, and minor skeletal soils vegetation
Location (GDA94)	640643 mE 7544470 mN	Disturbance	No effective disturbance
Landform pattern/element	Gently undulating plain, Midslope	Micro relief	Nil
		Permeability	Highly permeable
Slope (%)	2.5	Drainage	Rapid to well drained
Surface coarse fragments	<2% black nodules and coarse fragments 2-6 mm diameter	Surface condition	Surface is hard setting and dry
ASC Order (s)	Subnatric Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Humboldt,	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,
Land suitability summary	Effective rooting depth: 0.60 mbgl Estimated soil water storage: PAWC 75-100 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 4 Beef Cattle Grazing of native pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low water erosion hazard in situ. Laboratory results indicated; • Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile. • ESP (sodicity) rating indicates that the profile to 0.46 m is non-sodic. Subsoils from this depth are assessed as sodic. • Very high Ca/Mg ratio within topsoil is results throughout indicates aggregation of clay particles. Moderate levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.30 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.30–1.00 mbgl <u>Recommended subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves for level plains Buried supporting subsoils for topsoil.
AASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	1,336

Table 33: Soil Profile Morphology for Representative Site 17

Site 17	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) / Field pH	Texture, Structure, Strength	Coarse Fragments, Roots.
	<i>Horizon:</i> A11 <i>Horizon Depth:</i> 0.0 – 0.36 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR3/2 <i>Very dark brown</i> <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.10 <i>Field pH:</i> 7.0 <i>Meter pH/EC:</i> 6.8 / 0.00	<i>Texture:</i> Loamy Sand <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine roots
	<i>Horizon:</i> A12 <i>Horizon Depth:</i> 0.36 – 0.47 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/2 <i>Dark greyish brown</i> <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.36 <i>Field pH:</i> 6.5	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak 1-10 mm peds, sub-angular, <i>Strength:</i> Weak	<i>Coarse Fragments:</i> <2% black nodules <i>Roots:</i> No roots observed
	<i>Horizon:</i> B2 <i>Horizon Depth:</i> 0.47 – 1.0	<i>Colour:</i> 10YR4/4 <i>Dark yellowish brown</i> <i>Mottle:</i> Mottles: <5% 10YR6/8 Brownish yellow <2% 2.5YR4/6 Red <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.60, 0.90 <i>Field pH:</i> 6.5, 7.0 <i>Meter pH/EC:</i> 6.5 / 0.00	<i>Texture:</i> Silty clay loam <i>Structure:</i> Weak 1-10 mm peds, <i>Strength:</i> Weak to firm	<i>Coarse Fragments:</i> <5% black nodules and coarse fragments <i>Roots:</i> No roots observed

Table 34: Soil Chemistry Results for Representative Site 17

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.36-0.46	0.60-0.70	0.90-1.00
Soil pH	6.7	6.7	6.6	7
Soil EC (dS/m)	0.01	<0.01	0.02	0.03
Soil Cl (mg/kg)	11	16	9	16
P (Olsen) (mg/kg)	5	---- ¹	----	----
Exch.Ca (meq/100g)	1.74	0.83	1.89	1.95
Exch. Mg (meq/100g)	0.65	0.8	2.32	2.38
Exch. Na (meq/100g)	<0.08	<0.08	0.28	0.47
Exch.K (meq/100g)	0.21	0.22	0.17	0.1
CEC (meq/100g)	2.7	2.0	4.7	5.0
Ca/Mg	2.7	1.0	0.8	0.8
ESP (%)	1	3	6	10
Total N (mg/kg)	0.05	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	1.4	----	----	----
Ammonia (mg/kg)	<20	----	<20	----
PSA-Clay (%)	75	----	----	----
PSA-Fine Silt (%)	9	----	----	----
PSA-Silt (%)	10	----	----	----
PSA-Gravel (%)	7	----	----	----
Disp Ratio (%)	0.66	----	----	----
ADMC (%)	0.6	0.6	1.6	1.7
Total S	<0.01	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	27	----	----	----
Boron (mg/kg)	0.2	----	----	----
Copper (mg/kg)	0.3	----	----	----
Iron (mg/kg)	25	----	----	----
Zinc (mg/kg)	0.2	----	----	----
Aluminium (meq/100g)	0.03	0.07	0.07	0.05

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

4.1.10 Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B2

Overview

This SMU is associated with the relic alluvial drainage pathways and low-lying plains within the central portion of the Project site, Landforms are flat plains to gently undulating plains with soils that are brown with a cracking surface. Soils throughout profile area are massive silty loams to moderately structured light clays that are well drained within the first metre.

A variant of B2 (B2-DV) was observed at detailed site 176 where the alluvial plain has an active drainage line. Visual inspection of the area shows the topsoil horizon (Silty Loam) removed through water erosion with the subsoil horizons (clay) remaining.

Soil Characteristics and Chemistry

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

- Silt content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic increasing to neutral throughout profile;
- EC is very low increasing to moderate within subsoils;
- low CEC increasing to moderate levels within clay subsoils;
- non sodic topsoils increasing to strongly sodic subsoils;
- overall high Ca to Mg ratios throughout;
- low dispersive qualities in topsoil increasing with subsoils; and
- overall fertility is low.

Representative Site

Site 106 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 35, and a soil profile morphology summary is presented in Table 36. The soil chemistry results for this site are presented in Table 37.

Table 35: Land Summary for Representative Site 106

Representative site number	B2	Representative Site Number	Site 106
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Tall open woodland with Poplar Box and minor Brigalow regrowth
Location (GDA94)	651192 mE 7531738 mN	Disturbance	No effective disturbance
Landform pattern/element	Flat plain, level	Micro relief	Nil
		Permeability	Moderately to slowly permeable
Slope (%)	0.5	Drainage	Well to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is cracking and dry. Fine self mulch and peds <10 mm
ASC Order	Mesonatric Grey Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,
Land suitability summary	Effective rooting depth: 0.40 mbgl Est. soil water storage: Soil water storage is based upon the effective rooting depth, poor structure as observed in the soil profile and marginal sodicity levels within 0.60m of the SMU. PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of Native Pastures class: 3 Agricultural Land Class: C2		

Erosion potential	The SMU is generally located on flat plains and very undulating sloping areas with a silty loam surface. It has a very low to low water erosion hazard in situ. Laboratory results indicated: • Dispersion Ratio (R1) (Baker et al. 1993) indicates moderate dispersion ratings (0.6-0.8) within the topsoil profile. • ESP (sodicity) rating indicates that the profile to 0.26m is non-sodic. Subsoils from this depth are assessed as sodic to strongly sodic (0.90 m). • Very high to high Ca/Mg ratio within topsoil profile A11 and A12 indicates aggregation of clay particles. Moderate levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.20 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.20–0.50 mbgl (but poor quality due to structural attributes of hard setting and sealing) <u>Recommended subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Subsoil below 0.5 m would not be favourable for supporting native vegetation growth due to poorly structured, poor water holding and fertility attributes. It would be recommended as buried supporting soils for SMUs within this category.
ASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	675 (including B2-DV 30ha)

Table 36: Soil Profile Morphology for Representative Site 106

Site 106	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A11 <i>Horizon Depth:</i> 0.0 – 0.26 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/2 Dark grayish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.05, 0.20 <i>Field pH:</i> 6.0, 6.0 <i>Meter pH/EC:</i> 6.1 / 0.00	<i>Texture:</i> Silty loam <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine roots
	<i>Horizon:</i> A12 <i>Horizon Depth:</i> 0.26 – 0.56 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/4 Dark yellowish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.40 <i>Field pH:</i> 6.0	<i>Texture:</i> Silty loam <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine roots
	<i>Horizon:</i> B2 <i>Horizon Depth:</i> 0.56 – 1.00	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, moderately well-drained <i>Depth:</i> 0.60, 0.90 <i>Field pH:</i> 6.5, 7.0 <i>Meter pH/EC:</i> 6.8 / 0.25 7.2 / 0.36	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, <10 mm peds, sub-angular <i>Strength:</i> Firm	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

Table 37: Soil Chemistry Results for Representative Site 106

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.20-0.30	0.40-0.50	0.60-0.70	0.90-1.00
Soil pH	6.3	6.5	6.2	7	7.9
Soil EC (dS/m)	0.01	0.02	0.06	0.31	0.41
Soil Cl (mg/kg)	18	18	90	398	537
P (Olsen) (mg/kg)	10	---- ¹	----	----	----
Exch.Ca (meq/100g)	3.21	3.01	3.23	7.38	6.75
Exch. Mg (meq/100g)	1.67	0.86	2.42	6.1	5.65
Exch. Na (meq/100g)	<0.08	<0.08	0.57	2.22	2.6
Exch.K (meq/100g)	0.27	0.25	0.21	0.46	0.44
CEC (meq/100g)	5.2	4.2	6.5	16.2	15.5
Ca/Mg	1.9	3.5	1.3	1.2	1.2
ESP (%)	<1	1	9	14	17
Total N (mg/kg)	0.09	----	----	----	----
Nitrate N (mg/kg)	<1	----	----	----	----
Organic Matter (%)	2.2	----	----	----	----
Ammonia (mg/kg)	<20	----	----	----	----
PSA-Clay (%)	39	----	----	----	----
PSA-Fine Silt (%)	32	----	----	----	----
PSA-Silt (%)	13	----	----	----	----
PSA-Gravel (%)	16	----	----	----	----
Disp Ratio (%)	0.72	----	----	----	----
ADMC (%)	1.1	0.6	1.3	2.8	2.3
Total S	0.02	----	----	----	----
Sulfate-S (%)	2	----	----	----	----
Manganese (mg/kg)	24.7	----	----	----	----
Boron (mg/kg)	<0.1	----	----	----	----
Copper (mg/kg)	0.5	----	----	----	----
Iron (mg/kg)	28	----	----	----	----
Zinc (mg/kg)	0.9	----	----	----	----
Aluminium (meq/100g)	0.02	0.02	0.02	0.02	0.02

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

4.1.11 Soils of recent alluvial floodplains and active drainage channels: Soil Mapping Unit A1

Overview

This SMU is associated with the active drainage channel located within the Olive Downs South domain, transecting west to south east. Landforms are a drainage channel with soils that are very dark greyish brown sands to dark brown loamy sandy loams with a firm surface. Soils throughout profile area are massive near apedal with rapid drainage within the first metre.

Soil Characteristics and Chemistry

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

- Loam to sandy loam texture to 1.0 m depth;
- pH is neutral throughout profile;
- EC is very low;
- low CEC;
- non-sodic profile;
- very high Ca to Mg ratios throughout;
- low dispersive profile; and
- overall fertility is low.

Representative Site

Site 62 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 38, and a soil profile morphology summary is presented in Table 39. The soil chemistry results for this site are presented in Table 40.

Table 38: Land Summary for Representative Site 62

Representative site number	A1	Representative Site Number	Site 62
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, Moreton Bay Ash, Paperbark and various Eucalypts.
Location (GDA94)	641685 mE 7533763 mN	Disturbance	Gully erosion
Landform pattern/element	Drainage line	Micro relief	Nil
		Permeability	Highly permeable
Slope (%)	<1.0	Drainage	Rapid
Surface coarse fragments	<1 % 1-3 mm coarse fragments	Surface condition	Surface is firm and dry
ASC Order (s)	Haplic Grey Kandosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Davy	Principal Profile Form (Northcote 1974)	Uc5.11
Land suitability summary	Effective rooting depth: 1.00 mbgl Estimated soil water storage: PAWC 100-125 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of native pastures class: 4 Agricultural Land Class: C3		

Erosion potential	An open depression area with loam surface predisposes a moderate to high water erosion hazard in situ. Laboratory results indicated: - Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile. - ESP (sodicity) rating indicates that the soil profile is non-sodic. - Very high Ca/Mg ratio results throughout indicate favourable conditions with aggregation of clay particles. Erosion potential through dispersion is considered low however, appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.40 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.40–1.00 mbgl <u>Recommended subsoil use:</u> Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
ASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	124

Table 39: Soil Profile Morphology for Representative Site 62

Site 62	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots.
	<i>Horizon:</i> A1 <i>Horizon Depth:</i> 0 – 0.55 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR3/2 <i>Very dark greyish brown</i> <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.1, 0.4 <i>Field pH:</i> 6.5, 6.5 <i>Meter pH/EC:</i> 6.9 / 0.01	<i>Texture:</i> Loam <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Fine, few roots
	<i>Horizon:</i> B2 <i>Horizon Depth:</i> 0.55 – 1.00	<i>Colour:</i> 10YR3/3 <i>Dark brown</i> <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.6, 0.9 <i>Field pH:</i> 6.5, 6.5 <i>Meter pH/EC:</i> 7.0 / 0.01	<i>Texture:</i> Sandy loam <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Fine, few roots

Table 40: Soil Chemistry Results for Representative Site 62

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.3-0.4	0.6-0.7	0.9-1.0
Soil pH	7.2	7.5	7.3	7.5
Soil EC (dS/m)	0.03	0.03	0.02	0.03
Soil Cl (mg/kg)	11	32	34	26
P (Olsen) (mg/kg)	3	---- ¹	----	----
Exch.Ca (meq/100g)	5.5	3.29	4.85	4.64
Exch. Mg (meq/100g)	1.85	1.64	1.86	1.97
Exch. Na (meq/100g)	<0.08	0.14	0.19	0.13
Exch.K (meq/100g)	0.29	0.23	0.25	0.29
CEC (meq/100g)	7.7	5.4	7.2	7.1
Ca/Mg	3.0	2.0	2.6	2.4
ESP (%)	1	3	3	2
Total N (mg/kg)	0.099	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	2.8	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	67	----	----	----
PSA-Fine Silt (%)	16	----	----	----
PSA-Silt (%)	9	----	----	----
PSA-Gravel (%)	9	----	----	----
Disp Ratio (%)	0.62	----	----	----
ADMC (%)	1.2	0.9	1.3	1.1
Total S	0.02	----	----	----
Sulfate-S (%)	3	----	----	----
Manganese (mg/kg)	14.9	----	----	----
Boron (mg/kg)	0.4	----	----	----
Copper (mg/kg)	0.5	----	----	----
Iron (mg/kg)	19	----	----	----
Zinc (mg/kg)	0.5	----	----	----
Aluminium (meq/100g)	0.03	0.1	0.04	0.07

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

4.1.12 Soils of recent alluvial floodplains and active drainage channels: Soil Mapping Unit A2

Overview

This SMU is associated with the active drainage channels and floodplains located within both the Olive Downs South domain and the Willunga domain. Landforms include a drainage channel and numerous open depressions/floodplains within gently undulating plains. Soils are weak to moderate, very dark grey sands to brown mottled light medium clays with rapid to imperfect drainage.

Soil Characteristics and Chemistry

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

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic increasing to strongly alkaline with subsoil depth;
- EC is very low;
- very low CEC increasing to low within subsoils;
- non-sodic topsoil profile increasing significantly to extremely sodic within subsoils;
- very high decreasing to high Ca to Mg ratios with subsoil depth;
- low dispersive topsoil increasing in subsoils; and
- overall fertility is low.

Representative Site

Site 96 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 41, and a soil profile morphology summary is presented in Table 42. The soil chemistry results for this site are presented in Table 43.

Table 41: Land Summary for Representative Site 96

Representative site number	A2	Representative Site Number	Site 96
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, Moreton Bay Ash and various Eucalypts.
Location (GDA94)	644069 mE 7534469 mN	Disturbance	Gully erosion
Landform pattern/element	Gently undulating plain, open depression	Micro relief	Nil
		Permeability	Highly permeable
Slope (%)	<2.0	Drainage	Rapid to imperfect
Surface coarse fragments	No coarse fragments	Surface condition	Surface is soft and moist
ASC Order (s)	Subnatuc Grey Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting depth: 0.25 mbgl Estimated soil water storage: PAWC 50-75 mm (Table 2.3 Surrogate field properties for estimating plant available water capacity, LSAT, January 1995). Rain fed Cropping class: 5 Beef Cattle Grazing of native pastures class: 4 Agricultural Land Class: C3		

Erosion potential	Gently undulating areas with sandy surface predisposes a high water erosion hazard in situ. Laboratory results indicated: • Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile. • ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as extremely sodic. • Very high Ca/Mg ratio within topsoil indicates aggregation of clay particles. Moderate to high levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate to high with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine rehabilitation	<u>Recommended topsoil strip depth:</u> 0.00-0.15 mbgl <u>Recommended topsoil use:</u> Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. <u>Recommended subsoil strip depth:</u> 0.15–1.00 mbgl <u>Recommended subsoil use:</u> Capping material over waste rock.
AASS/PASS Field Assessment	Very low field indication of PASS. No field indicators of AASS.
Land condition	Good condition
Total area (ha)	801

Table 42: Soil Profile Morphology for Representative Site 96

Site 96	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	<i>Horizon:</i> A1 <i>Horizon Depth:</i> 0.0 – 0.04 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/1 <i>Dark grey</i> <i>Mottle:</i> No mottles <i>Bleaching:</i> No <i>Bleaching</i>	<i>Moisture:</i> Moderately moist, rapid <i>Depth:</i> 0.02 <i>Field pH:</i> 6.5 <i>Meter pH/EC:</i> 6.6 / 0.01	<i>Texture:</i> Clayey sand <i>Structure:</i> Weak sub- angular, <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few roots
	<i>Horizon:</i> A2 <i>Horizon Depth:</i> 0.04 – 0.25 <i>Boundary:</i> Abrupt	<i>Colour:</i> 10YR4/4 <i>Dark</i> <i>yellowish</i> <i>brown</i> <i>Mottle:</i> No mottles <i>Bleaching:</i> No <i>Bleaching</i>	<i>Moisture:</i> Moderately moist, rapid	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak sub- angular <i>Strength:</i> Weak	<i>Coarse Fragments:</i> 10% coarse fragments 2-4 mm <i>Roots:</i> Very fine, very few roots
	<i>Horizon:</i> B2 <i>Horizon Depth:</i> 0.25 – 1.00	<i>Colour:</i> 10YR4/3 <i>Brown</i> <i>Mottle:</i> Mottles 5% 10YR54 <i>Yellowish</i> <i>brown</i> <i>Bleaching:</i> No <i>Bleaching</i>	<i>Moisture:</i> Moist, imperfect <i>Depth:</i> 0.3, 0.6, 0.9 <i>Field pH:</i> 6.5, 6.5, 6.5 <i>Meter pH/EC:</i> 7.7 / 0.24 8.6 / 0.63 8.8 / 0.66	<i>Texture:</i> Light medium clay <i>Structure:</i> Moderate, sub- angular 30-60 mm <i>Strength:</i> Firm	<i>Coarse Fragments:</i> 10% coarse fragments 2-4 mm <i>Roots:</i> No roots observed

Table 43: Soil Chemistry Results for Representative Site 96

	Sample Depth (m)			
Analysis (Unit)	0.00-0.04 ¹	0.15-0.25	0.40-0.50	0.90-1.00
Soil pH	6.2	6.6	7.3	7.3
Soil EC (dS/m)	0.03	<0.01	0.03	0.07
Soil Cl (mg/kg)	23	24	175	82
P (Olsen) (mg/kg)	6	---- ¹	----	----
Exch.Ca (meq/100g)	1.61	0.41	2.65	1.67
Exch. Mg (meq/100g)	0.49	0.21	4	2.66
Exch. Na (meq/100g)	<0.08	<0.08	1.24	1.17
Exch.K (meq/100g)	0.24	0.09	0.64	0.3
CEC (meq/100g)	2.4	0.7	8.7	5.9
Ca/Mg	3.3	2.0	0.7	0.6
ESP (%)	1	3	14	20
Total N (mg/kg)	0.101	----	----	----
Nitrate N (mg/kg)	<1	----	----	----
Organic Matter (%)	3.2	----	----	----
Ammonia (mg/kg)	<20	----	----	----
PSA-Clay (%)	52	----	----	----
PSA-Fine Silt (%)	19	----	----	----
PSA-Silt (%)	20	----	----	----
PSA-Gravel (%)	11	----	----	----
Disp Ratio (%)	0.61	----	----	----
ADMC (%)	0.8	0.3	2.2	1.4
Total S	<.02	----	----	----
Sulfate-S (%)	4	----	----	----
Manganese (mg/kg)	17.4	----	----	----
Boron (mg/kg)	0.4	----	----	----
Copper (mg/kg)	0.5	----	----	----
Iron (mg/kg)	144	----	----	----
Zinc (mg/kg)	0.6	----	----	----
Aluminium (meq/100g)	0.02	0.02	0.18	0.07

1 Laboratory sample is for 0.00 to 0.04, not 0.00 to 0.4 as listed within the laboratory certificates.

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

5 LAND SUITABILITY AND AGRICULTURAL LAND ASSESSMENT

Determination of land suitability at the Project has been conducted in accordance with Bruce et al. (1982, 1984), Gunn et al. (1988), DME (1995) with reference to *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) and *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013).

The land suitability assessment produced in the following section follows LSAT (DME 1995) for assessment of SMUs. This included the review of existing land suitability information available.

5.1 Previous Soils Report, Land Suitability and Limitations Review

Previous land use suitability assessments for the Project site and surrounding SMUs have been completed. This includes the major assessment, Land of Isaac Comet (Gunn et al. 1967) and Windeyers Hill Area, Burgess (2003).

5.1.1 Land Suitability and Limitations (Burgess 2003)

Burgess (2003) assessed the land use suitability of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments in Central Queensland. A set of land use requirements for plant growth, machinery use, land preparation irrigation and prevention of land degradation has been defined for agricultural land use in Queensland. Methods and terminology are consistent with the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) (Land Resources Branch Staff [1990], McDonald et al. [1990] and Isbell [2002]).

Volume 2, Appendix 9 of Burgess (2003) details the methods of assessment and *Appendix 10* of Burgess (2003) details results. Where appropriate, information was reviewed against the Project site SMUs.

5.1.2 Lands of Isaac-Comet Area, Queensland (Gunn et al. 1967)

Gunn et al. (1967) addresses the land capability of the Lands of Isaac-Comet area. Land capability is an eight class system from broad scale mapping.

The present land use over the greater part is grazing of natural pastures for the production of beef cattle. An attempt is made to interpret some of the data within the report in terms of potential land use. Limitations including erosion, fertility, salinity and other aspects are discussed. Figure 14 within Gunn et al. (1967) presents the estimated potential land use. The Project site is assessed as Class IV - Limited cultivation and/or improved pastures.

5.2 Land Suitability Classes

Land suitability for the Project site is primarily based upon classifications provided within the LSAT Guidelines within the DME's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

The *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) were utilised to assess land suitability classes and ALCs. The *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) and *Regional Land Suitability Frameworks* (DSITI and DNRM 2013) for various regions of Queensland could give specific information for appropriate land uses and their associated limitations.

The land suitability classes as outlined in *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) are in Table 44.

Table 44: 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 *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015).

The review of the *Regional Land Suitability Frameworks*. (DSITI and DNRM 2013) was undertaken in conjunction with *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015). Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) for the Inland Fitzroy and Southern Burdekin area was undertaken once the DME (1995) broadacre rainfed cropping and beef cattle grazing limitations assessment and ALCs were established.

The LSAT Guidelines also provide general criteria and threshold values for assessment of a range of soil limitations to rainfed broadacre cropping and beef cattle grazing land use. Only major limiting factors have been considered, including:

- plant available water capacity (PAWC) (m);
- nutrient deficiency (n);
- soil physical factors (p);
- salinity (s);
- rockiness (r);
- microrelief (g);

- topography (t);
- susceptibility to water erosion (e); and
- flooding (f).

Grazing suitability used the same approach as cropping but with varied interpretation of the severity of limiting factors.

Field and laboratory data collected was used to assess the severity of any limitations and the land suitability class of each soil unit against the LSAT Guidelines. Methods from Burgess (2003) and Shields and Williams (1991) have been used to support the land suitability classification of soils mapped at the Project site.

5.3 Land Suitability Limitations Assessment

The land suitability assessment includes the SMU identified characteristics, chemistry and suitability classes of the LSAT Guidelines.

5.3.1 Rainfed Broadacre Cropping

Plant Available Water Capacity (m)

PAWC is a significant soil property in this locality as cropping is based on fallow storage of moisture in the soil profile. Effective rooting depth is defined as the depth to which approximately 90% of plant roots will extract water. It is normally limited either by the presence of underlying rock or other hard materials or by chemical or physical attributes within the subsoil that restrict root growth (Department of Primary Industries Land Resources Branch 1990).

Field morphology observations and chemical data used included soil texture and barriers to root growth such as high sodium, bedrock, poor soil structure, high electrical conductivity and chloride. PAWC is classically defined as the moisture present between field capacity and permanent wilting point (15 bars). Additionally, field assessments of effective soil depth, and subsequently soil water storage, were undertaken which followed the method used by Burgess (2003). This involved estimates of field texture combined with field pH, EC and depths to hard soil horizons.

Table 45 shows the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in the Kilcummin area which was reviewed alongside PAWC and effective rooting depth. Table 46 shows PAWC limitation severity for each SMU.

Table 45: Criteria for PAWC limitations for cropping (Shields and Williams 1991)

Limitation Level	PAWC (mm)	Effective Rooting Depth (mm)	Predicted Cropping Success (%)
2	>130	900	70-75
3	100-130	600	40-70
4	75-100	400	<40
5	<75	<400	<30

Table 46: PAWC limitation levels for SMUs

Soil Unit	Concept	Estimated ERD (m)	PAWC (mm) ¹	Dryland cropping Limitation level	Grazing limitation level
C1	Brown light clays with melon hole microrelief	0.40	75-100	4	3
C2	Grey to brown light to medium clay with normal gilgai microrelief	<0.30	50-75	5	4
S1	Brown shallow to deep duplex loamy sands to clay loam sandy earths	0.40	50-75	4	4
S2	Brown gradational sands, loamy to clayey sands	0.60	75-100	4	3
R1	Light red loamy sands to reddish loamy/clayey sands	0.80	75-100	4	3
R2	Brown to reddish brown loamy sands to sandy clay loams	0.60	75-100	4	3
L1	Shallow (0.20m) loamy sands to deep light clay	0.20	50-75	5	4
L2	Deeper (0.40-0.60m) loamy sands to light clay	0.30	50-75	5	4
B1	Black, to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams	0.60	75-100	4	3
B2	Brown silty loams to light clays with cracking surface on lower flat plains	0.40	50-75	5	4
A1	Loam to loamy sands within active channels	1.00	100-125	3	2
A2	Clayey sands to light medium clay within alluvial depression	0.25	50-75	5	4

1- Water availability values obtained from Table 2.3 Surrogate field properties for estimating plant available water capacity (PAWC), Land Suitability Assessment Techniques, January 1995 have been assessed.

The effective rooting depth (ERD) and PAWC for SMUs C1 and C2 were also assessed against Burgess (2003) Indicus melonhole phase (IdMp) and Pomegranate melonhole phase (PgMp) as their attributes were representative of the vertosol soils encountered.

SMU C1 exhibits attributes similar to IdMp including high salinity (chloride) levels in mounds (611 mg/kg at 0.60 m) and reduced levels at depth for depressions (275 mg/kg at 0.90 m). Review of the SMU C1 with respect to IdMp, salinity and sodic levels between the representative sites mound and depression, GTE assess the ERD at 0.40 m with a PAWC to be 75-100 mm.

SMU C2 exhibits attributes similar to PgMp with high salinity levels in mounds (<0.30 m) and in depressions (<0.60 m). Burgess states that regular seasonal ponding in depressions results in leaching and downward movement of the salt bulge, as seen at SMU C2. Burgess (2003) continues to state *'Even where deeper mound profiles occur (ERD >0.25 m) maximum PAWC levels (70-100 mm) are rarely achieved on a regular basis because of restricted infiltration (hard setting, fine sandy, clay surface, surface sealing and dispersive behaviour).'*

Review of the SMU C2 with respect to PgMp, salinity and sodic levels between the representative sites mound and depression, GTE assess the ERD at <0.30 m with a PAWC to be 50-75 mm. SMU C2 exhibits higher EC and chloride levels than PgMp at these mound and depression depths.

Nutrient deficiency (n)

Laboratory data shows slight variations in some nutrient attributes, particularly phosphorus (P) and exchangeable potassium (K) and calcium (Ca). According to DME (1995), levels of nutrient deficiency reported range between favourable in clay SMU profiles to not favourable for agricultural activities with most sandy earths, excluding SMU S1.

SMUs C2 and S2 reported the highest level of Bicarbonate P at 17 and 11 mg/kg for cropping and grazing with classes of 1/1 and 1/2.

SMUs R1, R2, and A1 reported the least favourable levels of nutrient deficiency with LSAT classes of 4 for rainfed cropping and class 4 grazing.

Soil Physical Factors (p)

This limitation deals with conditions which determine sufficient seed contact with moist soil to prevent desiccation prior to germination and establishment. It was found that nine SMUs C1, C2, S2, R1, R2, B1, B2, A1 and A2 had favourable factors due to consisting of rigid soils with a loose soft or firm surface when dry.

Three SMUs, S1, L1 and L2 presented hard setting surfaces as a limiting factor.

Salinity (s)

This refers to the reduction in dry matter yield as a result of soluble salt in the soil profile. It also contributes to reduced water availability limitation.

Salinity (chloride) levels for SMU C2 were assessed at 1654 mg/kg within 0.30-0.40 m of the mound and 1330 mg/kg within 0.60-0.70 m of the depression. With reference to Burgess (2003), in determining the mean average, the two salinity results were averaged at 964 mg/kg.

The topsoil profile for the depression (0.00-0.10 m – 21 mg/kg, 0.30-0.40 m – 274 mg/kg) and mound (0.00-0.10 – 19 mg/kg) depths show very low salinity levels. Taking into account the average salinity level and the rootzone (based upon the profile and ERD), SMU C2 is assessed to have a land suitability class 4 (rootzone CL 900-1500).

Salinity levels across the remaining eleven SMUs were low with LSAT Class 1 for rainfed cropping and grazing. SMU L1 did exhibit increased chloride levels within 0.50 m of the surface, however, these levels were not considered within the rootzone of the soil profile.

Rockiness (r)

This refers to the amount of coarse fragments located on the surface of the soil profile, the size and percentage. All twelve SMUs did not exhibit surface coarse gravel equal to or greater than 10% or any rocky outcrops.

Microrelief (g)

Microrelief (commonly referred to as gilgai or melon holes) refers to localised depressions along the land surface (McDonald et al. 1990).

Two SMUs, C1 and C2 reported normal gilgai and melon holes. SMU C1 consists of melon holes approximately 4.0 m diameter, 0.4 m deep at 50% coverage. The LSAT classes for SMU C1 are 3/3.

SMU C2 consists of shallow to normal gilgai, approximately 3.0 m diameter, 0.3 m at their deepest at 20-30% coverage. The LSAT classes for SMU C2 are 3/2.

Gilgai and melon holes were not recorded at the remaining SMUs.

Topography (t)

Topography is assessed in terms of slope and micro-relief. Slope may limit the effective and safe use of machinery and contribute to erosion hazard.

Topography limitations were only evident in the alluvial areas of SMU A1 and A2 where abundant deep gullies would prevent any practical cultivation. The rainfed and grazing classes for SMU A1 and A2 were 4/4 and 2/4.

Susceptibility to Water erosion (e)

The risk of soil loss from water erosion magnifies with increased water velocity when land is devoid of vegetation for cropping. Such effects are directly proportional to slope gradient.

SMUs S1, L2, B1 and A2 report the highest LSAT classes for water erosion. SMUs S1, L2 and A2 reported slopes under 2% on sodic rigid soils and SMU B1 reported slopes under 3% on non-sodic rigid soils. LSAT classes for the SMUs were 3/1 for cropping and grazing. If subsoils of S1, L2, B1 and A2 are exposed they pose an erosion threat due to sodicity and dispersion tendency.

SMUs R1 and R2 reported LSAT classes of 2/1 for cropping and grazing with slopes less than 2% on non-sodic rigid soils.

The remaining SMUs C1, C2, S2, L1, S2 and A1 reported flat plains to slopes with a gradient of less than 1.0% for LSAT classes of 1.

Flooding (f)

Flooding only influenced SMUs A1 and A2 as these are located within active drainage lines. Areas were observed where rare flooding may occur across the Project site including the variant of B2, B2DV, however these areas were considered a small percentage compared to the dominant SMUs.

5.3.2 Grazing

Grazing land limitations in general, are one class lower than the rainfed cropping limitation classes. Major observations of the limitations for grazing are present below.

Plant Available Water Capacity (m)

SMUs S1, L1, L2 and A2 will be the least productive due to some limitations with the soil profile texture reducing soil water availability.

Nutrient deficiency (n)

Nutrient deficiency impacts across all SMUs with limitation levels of 3 and 4 with SMUs R1, R2, B1 and A1 reporting the least favourable attributes.

Salinity (s)

SMU C2, salinity was assessed at rootzone CL 900-1500, for a land suitability class of 4.

Topography (t)

Topography limitations of alluvial areas and drainage lines of SMUs A1 and A2 prevent adequate management of grazing stock.

5.3.3 Land Suitability Limitations Summary

The suitability assessment of each SMU for rainfed cropping and beef cattle grazing have been assessed and presented in Table 47.

Table 47: Suitability classes for rainfed broadacre crops and grazing for SMUs

SMU	LSAT Criteria: Rainfed / Grazing								
	Limiting factors (refer 5.3.1 & 5.3.2)								
	m ¹	n	p	s	r	g	t ²	e	f
C1	4/3	2/3	2/2	1/1	1/1	3/3	1/-	1/1	1/1
C2	5/4	1/1	2/2	4/4	1/1	3/2	1/-	1/1	1/1
S1	4/4	3/3	3/2	1/1	1/1	1/1	1/-	3/1	1/1
S2	4/3	1/2	1/1	1/1	1/1	1/1	1/-	1/1	1/1
R1	4/3	4/4	1/1	1/1	1/1	1/1	1/-	2/1	1/1
R2	4/3	4/4	1/1	1/1	1/1	1/1	1/-	2/1	1/1
L1	5/4	2/3	3/2	1/1	1/1	1/1	1/-	1/1	1/1
L2	5/4	3/3	3/2	1/1	1/1	1/1	1/-	3/1	1/1
B1	4/3	3/4	1/2	1/1	1/1	1/1	1/-	3/1	1/1
B2	5/4	3/3	2/2	1/1	1/1	1/1	1/-	1/1	1/1
A1	3/2	4/4	1/1	1/1	1/1	1/1	4/4	1/1	5/2
A2	5/4	2/3	1/1	1/1	1/1	1/1	2/4	3/1	4/2

1 Water availability values obtained from Table 2.3 Surrogate field properties for estimating plant available water capacity (PAWC), Land Suitability Assessment Techniques, January 1995 and Burgess (2003).

2 '-' No suitable limitation factor available.

5.4 Review and Summary of Pre-Mine Land Suitability Areas

Review of the SMUs indicates that overall, they are marginal to unsuitable for broadacre rainfed cropping. In general, this is due to limitations in PAWC and nutrients, with some SMU specific limitations including salinity, topography and flooding,

Beef cattle grazing is assessed as marginally to suitable land with moderate limitations. Limitations such as moisture, nutrients and salinity may be considered to have less impact on maintaining native pastures compared with establishing cropping lands. Observations of the Project site vegetation and current agricultural land use displayed successful beef cattle grazing activities already established onsite.

The Department of Environment and Science (formerly known as EHP) consider that nutrients limitation may be viewed as readily rectified with fertiliser and pasture management. Limitation levels may be viewed as marginal when assessing as between unsuitable and suitable for a land use.

As the overall suitability class is usually determined by the most severe suitability subclass that applies in a particular SMU, moisture, nutrients and salinity limitations for SMUs C2, S1, R1, R2, L1, L2, B1 and B2 of grazing class four will be re-reviewed as marginal compared with other favourable attributes.

This will increase the grazing class to three, which reflects the SMUs beef cattle grazing potential in line with the definition in Table 44.

Table 48 shows the land suitability class for each SMUs and their area (ha). These classes are based upon the most significant limitation presented in Table 47. Figures 5.1-5.4 and 6.1-6.4 present the pre-mine land suitability across the Project site.

Table 48: SMUs Suitability Assessment and Areas (ha) for classes of cropping and grazing

Land Suitability – Cropping			Land Suitability – Grazing		
Class	SMU	Area (Ha)	Class	SMU	Area (Ha)
1	-	-	1	-	-
2	-	-	2	-	-
3	-	-	3	C1, S2, C2, S1, R1, R2, L1, L2, B1, B2	15,796
4	C1, S1, S2, R1, R2, B1	8,985	4	A1, A2	471
5	C2 L1, L2, B2, A1, A2	7,283	5	-	-

5.5 Agricultural Land Classes

ALCs 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.

ALCs for the Project site are defined as part of the Isaac Region Shire Planning Scheme, due for completion in 2018 based upon the existing Belyando, Broadsound and Nebo Planning Schemes. ALCs assessment guidelines are shown below in Table 49.

Table 49: Agricultural Land Classes

Agricultural Land Class	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	Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
C3	4-5	4	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.
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 Guidelines for agricultural land evaluation in Queensland (DSITI and DNRM 2015).

² Land suitability classes are a guide to assess ALC. Class 3/4 and 4/5 thresholds may be reviewed as either crisp (clear or distinct) boundaries or if results are marginal and show gradational characteristics, attributes are assessed as such.

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.

5.5.1 Agricultural Land Classes Assessment

The factors used to assess agricultural land suitability are soil results including the LSC assessment, field observations, topographic and professional experience. The revised marginal limitations as discussed within Section 5.4, would be taken into account to assess the suitable pasture land ALC for each SMU.

The summary assessment and results for each class is below and presented in Table 50. These ALCs are presented in Figures 7.1-7.4.

Table 50: SMUs Suitability Assessment and Areas (ha) for Agricultural Land

Agricultural Land Assessment		
Class	SMU	Area (Ha)
A	-	-
B	C1, S2	6,114
C1	-	-
C2	C2, S1, R1, R2, L1, L2, B1, B2	9,680
C3	A1, A2	472

Class A (A1, A2) - Crop Land

- No SMUs were assessed within this class.

Class B - Limited Crop Land

- SMU C1 increasing sodic attributes and microrelief may be considered least favourable for wide range of cropping activities, however favourable attribute such as nutrients and salinity promote highly suitable conditions for pasture grazing and narrow range of potential cropping.
- SMU S2 reported more favourable conditions with attributes remaining consistent throughout the profile. It is highly suitable for grazing and a narrow range of cropping.

Engineering and/or agronomic improvements would be required for potential limited cropping for either SMU. These SMUs have been re-assessed against the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) in Section 5.5.2.

Class C – Pasture Land C1

- No SMUs were assessed within this class.

Class C – Pasture Land C2

- SMU C2 presented favourable attributes such as high fertility soils; however reduced PAWC and salinity limitations reduce the recommended class of the SMU as a Class C2.

- SMU S1 main limitations were PAWC, sodicity and soil physical attributes within subsoils. All remaining attributes remained favourable to grazing of native pastures with no ground disturbance to establish pastures.
- SMUs R1 and R2 had favourable attributes with classes of rainfed and grazing classes of 4 and 3, however review of low fertility nutrient values are marginal to prevent recommendation of limited cropping land and sown pastures. The SMUs are assessed as Class C2.
- SMU L1 reported PAWC limitations with favourable LSAT criteria throughout. Review of the laboratory data, specifically physical attributes and sodicity levels, it is recommended the SMU be assessed as suitable for grazing while not suitable for ground disturbance to establish pastures.
- SMU L2, like SMU L1 reported PAWC limitations with favourable LSAT criteria throughout. The SMU has a deeper, non-sodic A horizon than L1, however nutrient levels are less favourable. It is recommended the SMU be assessed as suitable Class C2 rather than Class C1 due to this limitation.
- SMU B1 and B2 have favourable attributes for grazing, however are not considered to have high fertility soils for limited cropping or sown pastures. They are assessed as Class C2 due to this limitation.

Class C – Pasture Land C3

- SMUs A1 and A2 are located within active drainage lines and alluvial floodplains, which is considered an accessibility limitation. The SMUs are considered suitable only for light grazing of native pastures.

Class D – Non-agricultural Land

- No SMUs were assessed within this class.

5.5.2 Regional Frameworks Assessment

The land suitability assessment has determined the final suitability for each SMU and agricultural land use. Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) for the Inland Fitzroy and Southern Burdekin area indicates limitations relating to cropping land activities. As assessed within the LSAT guidelines, two SMUs C1 and S2 may be considered for limited crop land. All other SMUs identified are considered for beef cattle grazing activities, and therefore not considered for review.

The limitations covered for dryland and irrigated cropping land uses include;

- Erosion (E);
- Soil Water availability (M);
- Narrow moisture range (Pm);
- Surface Condition (Ps);
- Rockiness (R);

- Microrelief (Tm); and
- Wetness (W).

Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) indicates the following suitable subclasses for various land management options for the two SMUs summarised in Table 51 and 52.

Table 51: Regional Frameworks Assessment – SMU C1

SMU	Limitation Categories	Limitation Value and Suitability Subclasses for different land uses		
		Group A	Group B	Group C
C1	Erosion (E, Es)	2	– ¹	-
	Soil Water Availability (M)	3	4	5
	Narrow Moisture Range (Pm)	3	-	-
	Surface Condition (Ps)	3	-	-
	Rockiness (R)	1	1	-
	Microrelief (Tm)	3	-	-
	Wetness (W)	4	4	4
Overall Suitability Class		4	4	5

1. No suitability subclass for the land management option.

Table 52: Regional Frameworks Assessment – SMU S2

SMU	Limitation Categories	Limitation Value and Suitability Subclasses for different land uses		
		Group A	Group B	Group C
S2	Erosion (E, Es)	2	– ¹	-
	Soil Water Availability (M)	3	4	5
	Narrow Moisture Range (Pm)	1	-	-
	Surface Condition (Ps)	2	-	-
	Rockiness (R)	1	1	-
	Microrelief (Tm)	1	-	-
	Wetness (W)	1	1	1
Overall Suitability Class		3	4	5

1 No suitability subclass for the land management option.

Land management options for SMU C1 is assessed as currently marginally to unsuitable for land uses outlined within the regional frameworks for the Project site with limitation wetness being the most severe. This limitation was based upon the SMU depression attributes with mound attributes indicating slightly better conditions. Marginal cropping land uses may include Maize, Millet, Oat, Sorghum, Triticale and Wheat. As discussed within Section 5.5.1, through the use of additional engineering and/or agronomic improvements, potential limited broadacre and horticultural cropping may be considered improved.

Land management options for SMU S2 is assessed as currently suitable with moderate limitations for Group A land uses outlined within the regional frameworks for the Project site with limitation soil water availability being the most severe. Group B and C are considered unsuitable without the use of engineering and/or agronomic improvements, potential limited broadacre and horticultural cropping may be considered viable. Dryland cropping land uses may include Barley, chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.

6 TOPSOIL, SUBSOIL REVIEW, RECOMMENDATIONS AND STRIPPING DEPTH

6.1.1 Topsoil and Subsoil Management

Areas to be disturbed as a result of open cut mining activities, construction of a rail spur connection, water pipeline, ETL, access roads and associated infrastructure will require stripping of the topsoil and possibly subsoil for reuse in rehabilitation programs.

Therefore, all soils within the Project site have been assessed to determine their suitability for stripping and reuse for rehabilitation purposes.

6.1.2 Specific Soil Mapping Unit Recommendations

The Project site contains soils from uniform to gradational sandy earths to duplex clay soils. The sections below give specific recommendations for each of the soils identified. A summary of the topsoil and subsoil recommendations is provided below in Table 53.

Table 53: Topsoil and Subsoil Recommendations Summary

Soil	ASC Soil Type	Topsoil Recommended Rehabilitation Use	Subsoil Recommended Rehabilitation Use
C1	Endohypersodic Brown Vertosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope).	Buried supporting subsoils for topsoil.
C2	Brown Vertosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope).	Capping material over waste rock.
S1	Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Buried supporting subsoils for topsoil.
S2	Haplic Brown Dermosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
R1	Red Rudosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
R2	Haplic Red Chromosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
L1	Mesonatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Buried supporting subsoils for topsoil. <u>Subsoils 0.35-1.00 mbgl</u> Soils below 0.35m are not recommended to be reused however may be marginally suitable with possible use as capping material over waste rock.
L2	Mesonatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are	Capping material over waste rock.

Soil	ASC Soil Type	Topsoil Recommended Rehabilitation Use	Subsoil Recommended Rehabilitation Use
		relatively flat to sloped areas such as backfill batters.	
B1	Subnatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves for level plains Buried supporting subsoils for topsoil.
B2	Mesonatric Grey Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. <u>Subsoils 0.50-1.00 mbgl</u> Subsoil below 0.5 m would not be favourable for supporting native vegetation growth due to poorly structured, poor water holding and fertility attributes. It would be recommended as buried supporting soils for SMUs within this category.
A1	Haplic Grey Kandosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
A2	Subnatric Grey Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Capping material over waste rock.

Flat to gently undulating plains dominated by uniform and gradational clays (C1, C2)

This SMU includes uniform to gradational cracking clays.

- These soils are moderate (C1) to high (C2) in fertility status and low dispersive qualities. Topsoil stripping depths are shallow due to the sodic conditions within subsoils of 0.00-0.10 mbgl (C1) and 0.00-0.20 mbgl (C2).

This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope) due to potential compaction of clay texture and firm setting tendencies.

These depths allow the maximum retention of suitable quality clay soils across the two SMUs. Double stripping of topsoil for SMU C1 may be considered for an additional 0.10mbgl if suitable topsoil volumes are not assessed as sufficient. This would allow additional lower fertility clay soils to be stockpiled with minimum risk of including sodic clays deeper within the B horizon.

Subsoils within both SMUs are prone to dispersion due to sodicity (C1) and salinity (C2) depth. SMU C2 although the least favorable with these two attributes, stripping depths have been recommended at the depths of 0.10 mbgl and 0.20 mbgl to retain the higher topsoil fertility soils.

SMU C1 subsoils are recommended for rehabilitation use as buried soils for clay topsoils. SMU C2 subsoils are not recommended for rehabilitation use due to the elevated salinity limitations however may be suitable with possible use as capping material over waste rock.

Gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2)

These SMUs include brown, reddish brown to light red sands of gradational sands and duplex clay soils.

- SMU S1 topsoil is acidic, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include an increase in pH to alkaline levels, low fertility status, strongly sodic conditions and moderate dispersive qualities and a stripping depth to 1.00 mbgl. It would be recommended as buried supporting soils for SMUs.

- SMU S2 topsoil is neutral, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.50 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It would be recommended for natural vegetation growth assistance with additional soil fertility conditioning and could potentially increase topsoil reserves and supporting subsoils.

- SMU R1 topsoil is slightly acidic pH, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.35 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It is recommended for natural vegetation growth assistance with additional soil fertility conditioning and could potentially increase topsoil reserves and supporting subsoils.

- SMU R2 topsoil is slightly acidic pH, very low in fertility status, has non-sodic conditions, very low dispersive qualities and a stripping depth to 0.50 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with neutral pH, very slight increase in dispersive qualities, and a stripping depth to 1.00 mbgl. It is recommended for natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves and supporting subsoils.

- SMU L1 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.10 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include high clay content, an increase in pH to strongly alkaline levels, low fertility status, strongly sodicity conditions and dispersive qualities with a stripping depth to 0.35 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.35 mbgl are not recommended for rehabilitation use however may be suitable with possible use as capping material over waste rock.

- SMU L2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include high clay content, an increase in pH to strongly alkaline levels, low fertility status, strongly sodic conditions and dispersive qualities with a stripping depth to 1.00 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.30 mbgl are not recommended for rehabilitation use however may be suitable for use as capping material over waste rock.

Relic alluvial plains and low-lying plains (B1 and B2)

These SMUs include brown loamy sand and silty loams to duplex clay soils.

- SMU B1 topsoil is neutral, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include an increase in clay content, sodic conditions, slightly increased dispersive qualities with a stripping depth to 1.00 mbgl.

The subsoil may be recommended as supportive additional natural vegetation growth assistance as per the topsoil with additional soil fertility and soil conditioning on level plains due to its increased dispersive qualities and supporting subsoils.

- SMU B2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.20 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include an increase in clay content, neutral pH, sodic conditions, and moderate dispersive qualities with a stripping depth to 0.50 mbgl. It would be recommended as supporting subsoils for SMU topsoils within this category. Subsoils below 0.50 mbgl are recommended not for rehabilitation use due to poorly structured, poor water holding and fertility attributes.

Subsoils would be recommended as buried supporting soils for SMUs within this category.

SMU variant, B2DV presents the soil profile without the topsoil. Therefore, topsoil stripping is not considered with subsoils below 0.5 mbgl remaining. The subsoil recommendations for SMU B2 apply.

Recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2)

These SMUs include brown loamy sand and silty loams to duplex clay soils.

- SMU A1 topsoil is neutral, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.40 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It would be recommended as additional natural vegetation growth as per the topsoil with additional soil fertility conditioning and potentially increase topsoil reserves and supporting subsoils.

- SMU A2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.15 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters

Subsoil attributes include an increase in clay content, alkaline pH, extremely strongly sodic conditions, and dispersive qualities with a stripping depth to 1.00 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.15 mbgl are not recommended for rehabilitation use however may be suitable with possible use as capping material over waste rock.

6.1.3 Summary of Recommended Soil Stripping Depths and Volumes Available

Table 54 provides the recommended stripping depths for each SMU and total estimated available topsoil and subsoil reserves within the proposed Project site. These stripping depths are shown in Figures 4.1 to 4.4.

Table 54: Recommended Stripping Depths and Volumes Available

SMU	Recommended Topsoil Stripping Depth (mbgl)	Recommended Subsoil Stripping Depth (mbgl)	Soil Mapping Unit Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³) Rehabilitation Use and Supporting Buried Soils	Approximate Subsoil Volume (m ³) Only Supporting Buried Soils	Approximate Subsoil Volume (m ³) Capping over Waste Rock
C1	0.00-0.10	0.10-1.00	4,540.3	4,540,300	-	40,862,700	-
C2	0.00-0.20	0.20-1.00	3,081.1	6,162,260	-	-	24,649,040
S1	0.00-0.30	0.30-1.00	2,888.7	8,665,950	-	20,220,550	-
S2	0.00-0.50	0.50-1.00	1,572.0	7,859,900	7,859,900	-	-
R1	0.00-0.35	0.35-1.00	892.0	3,121,825	5,797,675	-	-
R2	0.00-0.50	0.50-1.00	783.1	3,915,550	3,915,550	-	-
L1	0.00-0.10	0.10-0.35	178.3	178,280	-	445,700	-
L2	0.00-0.30	0.30-1.00	272.0	815,910	-	-	1,903,790
B1	0.00-0.30	0.30-1.00	1,178.6	3,535,650	8,249,850	-	-
B2	0.00-0.20	0.20-0.50	469.7	939,440	1,409,160	-	-
B2-DV ²	0.00-0.00	0.20-0.50	30.1	0	90,300	-	-
A1	0.00-0.40	0.40-1.00	92.1	368,320	552,480	-	-
A2	0.00-0.15	0.15-1.00	379.7	569,550	-	-	3,227,450
TOTAL FOR PROJECT SITE			16,358	40,672,935	27,874,915	61,528,950	29,780,280

¹Area shown in Table 54 for B2 for purposes of topsoil stripping does not include B2-DV

²Variant of B2, B2DV topsoil resource isn't available due to stream bank erosion, therefore topsoil volume for this 30 ha area is not included.

6.1.4 Double Stripping Depths for Increased Topsoil Volumes

As discussed above in Section 6.1.2, double stripping of SMU C1 to 0.20mbgl may be an option if current proposed topsoil stripping depths are calculated as insufficient. This would allow additional lower fertility clay soils to be stockpiled with minimum risk of including sodic clays deeper within the B horizon.

As a result, subsoils volume for the SMU would be reduced. The revised volumes are summarised below in Table 55.

Table 55: Recommended Double Stripping Depths and Volumes

SMU	Double Stripping Topsoil Depth (mbgl)	Double Stripping Subsoil Depth (mbgl)	Soil Mapping Unit Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³)
C1	0.00-0.20	0.20-1.00	4,540.86	9,080,600	45,408,600

6.1.5 Recommended Topsoil Application Depths for Rehabilitation

It is recommended that the minimum placement depth of topsoil be 0.2m with a preferred placement depth of 0.30m.

If topsoil volumes are insufficient to meet the recommended placement depths, placing suitable subsoils of up to 0.50m may be suitable to cap with 0.20m topsoil. Providing subsoils selected are suitable, another recommendation may be mixing of suitable subsoils with quality topsoils to create slightly reduced quality topsoil.

It is recommended a waste rock characterisation database is maintained to assist with the management of rehabilitation planning.

7 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 PLAs, PAAs, SEAs and SCL. The Project site was assessed against SCL and PAA requirements.

7.1 Assessment of Strategic Cropping Land

The RPI Act repealed the *Strategic Cropping Land Act 2011*. The repealed policies were migrated into the new legislation through the declaration of the SCL as an area of regional interest.

Identification of SCL was undertaken for the Project site. Desktop review of the Project site was compared to the SCL Trigger Map (Figure 8). SCL was not identified within the Project site and was located to the south, approximately 150m at its closest point. It was assessed that no further assessment would be required, however identified SMU field and laboratory observations were also compared to the SCL criteria.

The RPI Act Guideline 08/14 (Queensland Government 2017) *How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land* was used as a guide. The Project site was assessed against the Western Cropping Zone criteria for the twelve SMUs, based on field and laboratory information.

The criteria for the Western Cropping zone included;

- Slope (Sl) - Equal to or less than 3%;
- Rockiness (Rk) - Equal to or less than 20% for rocks greater than 60 mm in dia;
- Gilgai (G) - Less than 50% of land surface being gilgai of greater than 500 mm in depth;
- Soil Depth (Sd) – Equal to or greater than 600 mm;
- Soil Wetness (Sw) – Has favourable drainage;
- Soil pH (Sp) - Rigid Soils – 0.30-0.60, pH within 5.1-8.9 and Non-rigid Soils – 0.30-0.60, pH greater than 5.0;
- Salinity (SI) - Chloride is less than 800 mg/kg at 0.6 m depth; and
- Soil Water Storage (Sws) - Equal to or greater than 100 mm to a soil depth or soil physio-chemical limitation of equal to or less than 1000 mm.

The SCL assessment of the twelve SMUs is summarised below in Table 56.

Table 56: SCL Assessment of Project Site SMUs

SMU	Western Cropping Zone							
	Pass/Fail Threshold							
	SI	Rk	G	Sd	Sw	Sp	SI	Sws
C1	P	P	F	-	-	-	-	-
C2	P	P	P	P	P	P	F	-
S1	P	P	P	P	F	-	-	-
S2	P	P	P	P	P	P	P	F
R1	P	P	P	P	P	P	P	F
R2	P	P	P	P	P	P	P	F
L1	P	P	P	P	P	F	-	-
L2	P	P	P	P	P	P	P	F
B1	P	P	P	P	F	-	-	-
B2	P	P	P	P	P	P	P	F
A1	P	P	P	P	P	P	P	F
A2	P	P	P	P	F	-	-	-

The SMUs were assessed against the Western Cropping Zone criteria with all SMUs failing on criteria such as gilgai, soil wetness, soil pH and soil water storage. Based upon this assessment for the Project site, no SMU could be demonstrated to meet the requirements for SCL.

It is noted that the assessment of SCL requires a comprehensive survey to be completed as per the RPI Act requirements. This includes additional field observations and additional laboratory results per SMU mapping polygon unit than what is acceptable for this soils and land suitability assessment.

7.2 Assessment of Priority Agricultural Areas

PAA 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 Project site. Desktop review of the Project site compared to Queensland Government Development Assessment Mapping System confirmed that no PAA was located within the Project site, and the nearest areas were situated approximately 100 km to the south.

8 ACID SULFATE SOILS ASSESSMENT

As stated in Section 3.5, a review of the ASRIS including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken. It was identified that the majority of the Project site is shown as 'No Known Occurrence'.

The north-west portions of the Iffley property, Vermont Park properties and the western portion of the water pipeline include low probability areas of Acid Sulfate Soils occurring in mapping units of the Project site (Fitzpatrick et al. 2008).

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*.

8.1 Assessment of Actual and Potential Acid Sulfate Soils

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

- Field pH;
 - AASS, field $pH_F \leq 4$, when field $pH_F > 4$ but < 5 may indicate some existing acidity;
 - PASS, 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 indicator 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 57.

Table 57: Assessment of Field Indicators for AASS/PASS

SMU	AASS / PASS Assessment	Overall Assessment
C1	pH is alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	No field indication of AASS/PASS.
C2	pH is alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	No field indication of AASS/PASS.
S1	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
S2	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
R1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
R2	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
L1	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
L2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
B1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
B2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
A1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.
A2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell. Soil profile is moderately moist but not observed as water logged.	Very low field indication of PASS. No field indicators of AASS.

Ten of the twelve SMUs, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2 reported neutral or neutral to alkaline pH and the remaining indicators (corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils) were not observed at any SMUs. Therefore the 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. SMUs C1 and C2 (with alkaline pH) had no field indications of AASS and/or PASS.

This result (i.e. very low to no field indicators) is consistent with the desktop review against the Atlas of Australian Acid Sulfate Soils mapping which showed the Project site as “No Known Occurrence”. It is assessed as highly unlikely the Project site includes AASS and/or PASS, however environmental management plans should include procedures to monitor and identify ASS during the Project’s lifespan.

9 LAND USE IMPACTS AND FINAL LAND USE

9.1 Disturbance Types Requiring Rehabilitation

The Project will require mine rehabilitation programs for areas which are disturbed by mining and related activity. As an open cut operation is being planned, surface disturbance requiring rehabilitation will form a significant proportion of the overall Project site. Current mine planning indicates that changes in pre-mining land use and suitability will involve approximately 10,500 ha of the Project site.

Key activities at the Project site that will require significant rehabilitation works as a result of direct surface disturbance will include (Figure 2):

- Open cut mine areas;
- Coal handling and preparation plant (CHPP);
- Rail spur connection;
- Water pipeline;
- Waste dump area;
- Access roads; and
- Associated infrastructure including mine offices, crib facilities, bathhouse, warehouse, workshops and re-fueling facilities.

The remainder of the Project site (15,500 ha) will either not be disturbed or will have altered local topography from local impacts such as access roads or other minor infrastructure.

9.2 Post Mining Land Use Suitability

Post mine 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 land form and suitability for land use activities.

Land disturbed by open cut mining may be able to be restored to its previous pre-mining land suitability or reduced to limited grazing based upon available waste rock relocation volumes and final landform design. However, disturbed areas such as CHPP, workshops, waste dump areas and sediment dams will require more intensive rehabilitation to retain the initial LSAT class.

It is expected that only higher risk areas and permanent infrastructure such as final voids and railway lines will not revert to a grazing suitability potential due to the slope of land and unusable linear features.

It is therefore expected that the majority of the Project site will revert to the pre-mining land suitability class. Rehabilitation methods and post mining land suitability shall be refined in an Environmental Management Plan for the Project site, however overall concepts envisaged for specific disturbance types are summarised in Table 58.

Table 58: Rehabilitation Methods and Post Mine Land Use for Specific Disturbance Types

Disturbance Type	Specific Facilities	Proposed Rehabilitation Strategy Recommendations	Proposed Post Mining Land Suitability Class
Open Cut Mining Waste Dump Area / ILF Cells	- Open cut mining pits - Access tracks - Dry/Wet storage area	Open cut mining areas will be backfilled with suitable waste rock including subsoil and topsoil rehabilitation reserves. Final landform design will be developed in consideration of suitable soil attributes, depths and slopes. Open cut mining areas would be backfilled up to the pre-mining surface level or higher with batters to be graded to 15%/8° slope on highwall and battered down. No areas will 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%; will have reduced grazing land suitability potential. Implementation of practical drainage designs will ensure that any area affected by settling will 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 will be topsoiled and seeded with native grasses. Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas Coal rejects will be capped/buried within the open cut mine pits, with at least or equal to 15.0 m of benign waste rock encapsulating the material from the surface and walls. Coal rejects will be capped with inert material and topsoil with vegetation will be established. The coal rejects capping will be constructed such that water does not infiltrate and will be shed while ensuring surface stability. An ongoing, post mining management plan will be documented.	Slope >70% of the land is <10% slope of land surface Class 3 – Grazing Class 5 – Cropping Slope >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
Elevated waste dump areas	- Areas of waste rock or other materials from open pit excavation, access tracks or other sources	No areas will 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%; will have reduced grazing land suitability potential. Rehabilitated areas will be topsoiled and seeded with native grasses. Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas.	Slope >70% of the land is <10% slope of land surface Class 3 – Grazing Class 5 – Cropping Slope >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

Disturbance Type	Specific Facilities	Proposed Rehabilitation Strategy Recommendations	Proposed Post Mining Land Suitability Class
Final Voids	- Areas remaining after final backfilling has occurred of open voids below the existing ground surface	Highwall and low-wall slopes will be seeded. Area will be fenced off on highwall sides to prevent access by fauna. 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 will be fully fenced off.	Class 5 – Cropping/Grazing
General infrastructure including potentially contaminated areas	General infrastructure: - Mine offices; - Crib facilities; - Bath house; - Warehouse; - Accommodation camp; - Conveyors; - Electrical substations; and - Power lines. Potentially contaminated areas: - Coal Preparation plant; - Workshops; - Vehicle servicing and -wash-down; and - Rail spur and rail-loadout facility.	Infrastructure will be assessed on an individual basis for possible removal or whether it can be retained for future land owners. Infrastructure will be removed, and areas prepared and re-seeded if necessary. Location of all such areas will be recorded on the mine Disturbance Plan. Potentially contaminated areas will undergo Stage 1 and 2 Contaminated land assessments. A Remediation Plan for potentially contaminated areas will be prepared. Remediation works to remove contaminated material or rip, cap and topsoil inert areas. Areas will be seeded with native grasses. Aim is to assess and remediate any residual contamination in a manner described for potentially low risk contaminated areas. Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas.	Same classes as pre-mining
Coal material Laydown areas	- ROM and product coal stockpiles. - Surface conveyors.	Coal material and stockpile base will be removed. Areas will be capped and topsoiled, ripped and seeded with pasture grasses. It is anticipated that these areas will return to grazing lands similar to pre-mining suitability.	Same classes as pre-mining
Water management structures	- Sediment, raw and mine water dams	Water management structures will 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 will be dewatered, capped and rehabilitated using topsoil and pasture grasses.	Same classes as pre-mining
Creek Diversions	- Existing and new creek and drainage lines	Areas will be graded to design and rehabilitated using topsoil reserves and pasture grasses.	Same classes as pre-mining
Linear Infrastructure	- Water pipeline - Railway line - ETL - Access Road	Areas will be assessed, and if rehabilitation is required, the infrastructure will be decommissioned, and the area will be rehabilitated to previous land forms. The railway may be considered a permanent feature and therefore not suitable for any other use. It has been assessed as such.	Pipeline and Access Road Same classes as pre-mining Railway Class 5 – Cropping/Grazing

9.2.1 Significantly Disturbed Areas

The major objective of significantly disturbed areas is their rehabilitation to a stable and self-sustaining vegetation community using appropriate native tree, shrub and grass species. These areas form a major proportion of the overall Project. A review and downgrading from pre-mining land suitability may be needed in some areas to ensure that long term stability is ensured, and risks of potential downstream impact are minimal. The proposed disturbed areas will be assessed on the impact of the disturbance type and proposed rehabilitation strategies for those areas.

9.2.2 Areas with No or Minor Disturbance

This type of disturbance makes up approximately 35% of the area within the Project MLAs. The rehabilitation objective is to return all such areas to its pre-disturbance land suitability potential.

Table 58 summarises rehabilitation methods for disturbed and minor disturbed areas and presented on Figures 9.1-9.4 and 10.1-10.4.

9.2.3 General Rehabilitation Strategy

All disturbances will be recorded on mine plans and updated on a regular basis. The rehabilitation objective is to return all disturbed areas to their pre-disturbance land suitability potential or to an acceptable level as per the Environmental Management Plan for the Project site.

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

The stability of the post-mine landform will be achieved by applying sound rehabilitation practices based on industry knowledge and science.

The disturbed land will be rehabilitated to a condition that is self-sustaining or to a condition where the maintenance requirements are consistent with the post mining land use.

Rehabilitation strategies for the Project will include all areas of disturbance and will be reviewed on a regular basis in order to take into account 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). In particular, the following guidelines will 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 on Project sites so as to reduce the amount of contaminated water that may need to be handled;
- Water Discharge Management – which addresses the management of water discharged from Project sites to ensure compliance with statutory requirements and protection of downstream uses;
- Progressive rehabilitation of disturbed areas, using rehabilitation procedures for 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.

Table 59 summarises the expected changes in agricultural land suitability following mining and Figures 9.1-9.4 and 10.1-10.4 show the distribution of post-mining land suitability classes.

Table 59: Post Mine Land Suitability Changes

Land Suitability – Cropping			Land Suitability – Grazing		
Class	Pre-mining (ha)	Post mining (ha)	Class	Pre-mining (ha)	Post mining (ha)
1	-	-	1	-	-
2	-	-	2	-	-
3	-	-	3	15,755	14,635
4	8,983	2,571	4	472	472
5	7,244	12,638	5	-	102
Total	16,227	15,209	-	16,227	15,209

Note: Mapping did not include the ETL corridor.

10 CONCLUSION

The following conclusions have been made:

- Twelve SMUs are present within the Project site, C1, C2, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2.
- The Project site includes areas of flat to gently undulating plains dominated by uniform and gradational clays (C1 and C2), gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2), relic alluvial plains and low-lying plains (B1 and B2) and recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2).
- Land use suitability assessment of the twelve SMUs reported for rainfed cropping, Class 4: C1, S1, S2, R1, R2 and B1, and Class 5: C2, S1, L1, L2, B2, A1 and A2. Assessment of beef cattle grazing reported Class 3: C1 and S2 and Class 4: C2, S1, R1, R2, L1, L2, B1, B2, A1 and A2. Review of Regional Frameworks for the Inland Fitzroy and Southern Burdekin area assessed SMU C1 having marginal cropping potential for dryland cropping and SMU S2 moderately suitable for dryland cropping with Barley, Chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.
- The majority of topsoil from the loamy sand and clayey sand SMUs (S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2) would be suitable for rehabilitation use in supporting native vegetation and grasses with application preferred on level surface to sloped backfill batters. Topsoils consisting of clay (C1 and C2) would be preferable on level to very gently undulating areas <1%.
- Six SMUs (S2, R1, R2, B1, B2 (0.20-0.50 mbgl and A1) may be suitable for rehabilitation situations and limited natural vegetation growth with additional soil fertility conditioning on level surface to sloped backfill batters. Five SMUs (C1, S1, L1, L2 and A2) were suitable for buried supporting subsoils for topsoil. The remaining SMU (C2) is recommended as capping material over waste rock.
- The Project site is not located within Regional Planning Interests Areas of SCL or PAAs.
- The majority of the Project site is shown as 'No Known Occurrence' with respect to ASS. Field observations reported very low indicators in ten SMUs of neutral and neutral to alkaline pH. It is assessed as highly unlikely the SMUs contain soils impacted by AASS and PASS however, environmental management plans should include procedures to monitor and identify ASS during the Project's lifespan.
- The proposed post mine final land use for the majority of the Project site will be beef cattle grazing activities. Final void areas have been assessed as unsuitable and will be fenced off as required to prevent fauna access. Existing infrastructure that is not planned to be decommissioned such as railway lines will be rated as unsuitable for cropping and grazing land uses. It is expected that undisturbed areas of the Project will 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.

ASC. Australian soil class

Alluvial. Describes material deposited by, or in transit in, flowing water.

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

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 other than Hydrosols with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acid. Soils with strongly subplastic upper B2 horizons are also included even if they are sodic.

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.

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

Dia. Diameter.

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.

Effective Soil Depth. The depths of which vegetation roots may readily penetrate the soil profile and have access to water and nutrients.

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.

EIS. Environmental Impact Statement.

Endohypersodic. Other soils in which some sub horizon of the solum below 0.5m has an ESP pf 15 or greater.

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 cation exchange capacity (CEC), multiplied by 100. ESP values greater than 6% are considered sodic, with values greater than 15% considered very sodic. $ESP = (\text{Exchangeable sodium (meq/100g)} / \text{Cation exchange capacity (meq/100g)}) \times 100$

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.

Gully erosion. The displacement of soil by running water that forms clearly defined, narrow channels that generally carry water only during or after heavy rain.

Haplic. Other soils in which the major part of the B2 horizon is whole coloured.

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

Kandosols. Soils that have well-developed B2 horizons in which the major part is massive or has only a weak grade of structure (compare with tenic B horizon and cemented pans) and have a maximum clay content in some part of the B2 horizon which exceeds 15% (i.e heavy sand loam, SL+).

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.

Mbgl. Metre below ground level.

Mesonatric. Other soils in which the major part of the upper 0.2m of the B2 horizon has an ESP of between 15 and 25.

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

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

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

Pedal. Describes a soil in which some or all of 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.

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.

Rudosol. Soil with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an A1 horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

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

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.

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

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.

Subnatric. Other soils in which the major part of the upper 0.2m of the B2 horizon has an ESP pf between 6 and <15.

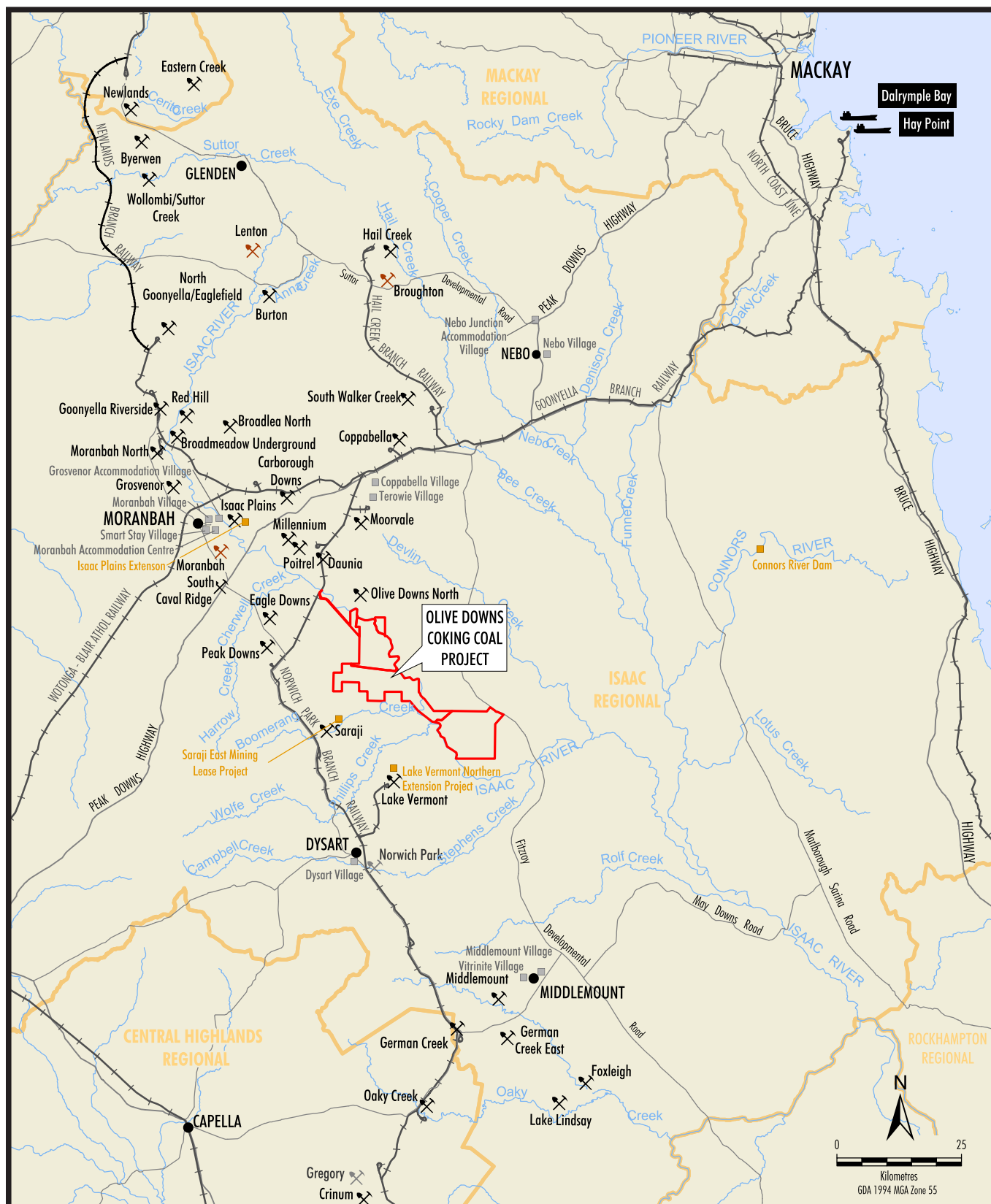
Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

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.

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

Figure 1	Project Location
Figure 2	Project Layout
Figure 3	Soil Mapping Units
Figure 4	Topsoil Stripping Depths
Figure 5	Pre Mine - Rainfed Broadacre Cropping
Figure 6	Pre Mine - Beef Cattle Grazing
Figure 7	Agricultural Land Classes
Figure 8	SCL Trigger Map
Figure 9	Post Mine – Rainfed Broadacre Cropping
Figure 10	Post Mine – Beef Cattle Grazing



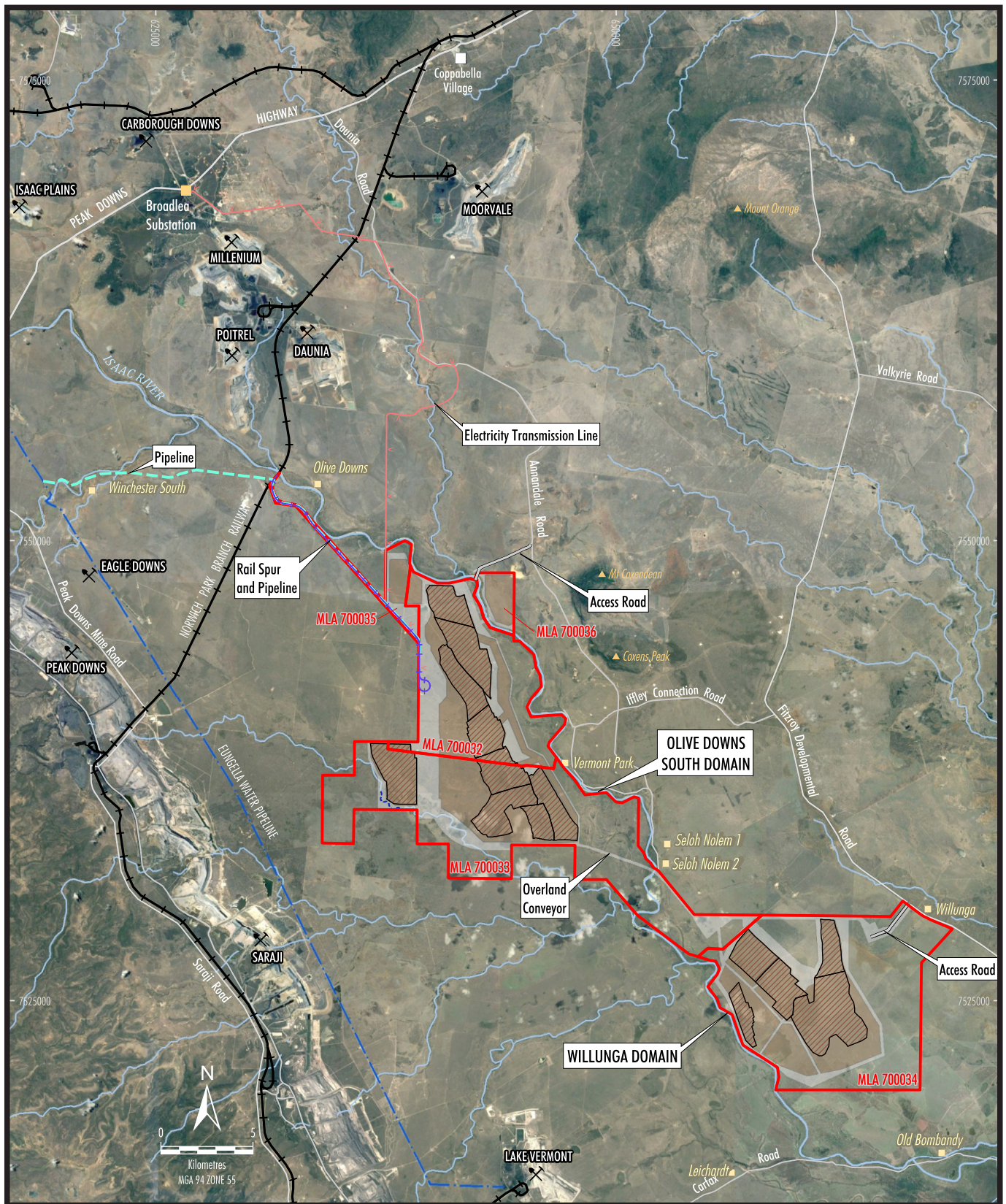
Source: Geoscience Australia - Topographical Data 250K (2006)

Figure 1: Project Location

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Source: Geoscience Australia - Topographical Data 250K (2006)
 Department of Natural Resources and Mines (2016)
 Orthophotography: Google Image (2016)

Figure 2: Project Layout

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Soils and Land Suitability Assessment
 OLIVE DOWNS COKING COAL PROJECT



Legend

- Olive Downs Mining Lease Application Boundary
- Approved/Operating Coal Mine
- Eungella Pipeline Network
- Railway
- Nearby Dwelling
- Open Cut Extent (including In-pit Waste Rock Emplacement)
- Out-of Pit Waste Rock Emplacement
- Infrastructure
- Proposed Access Road
- Proposed Electricity Transmission Line
- Proposed Rail
- Proposed Water Pipeline
- Proposed Creek Diversion

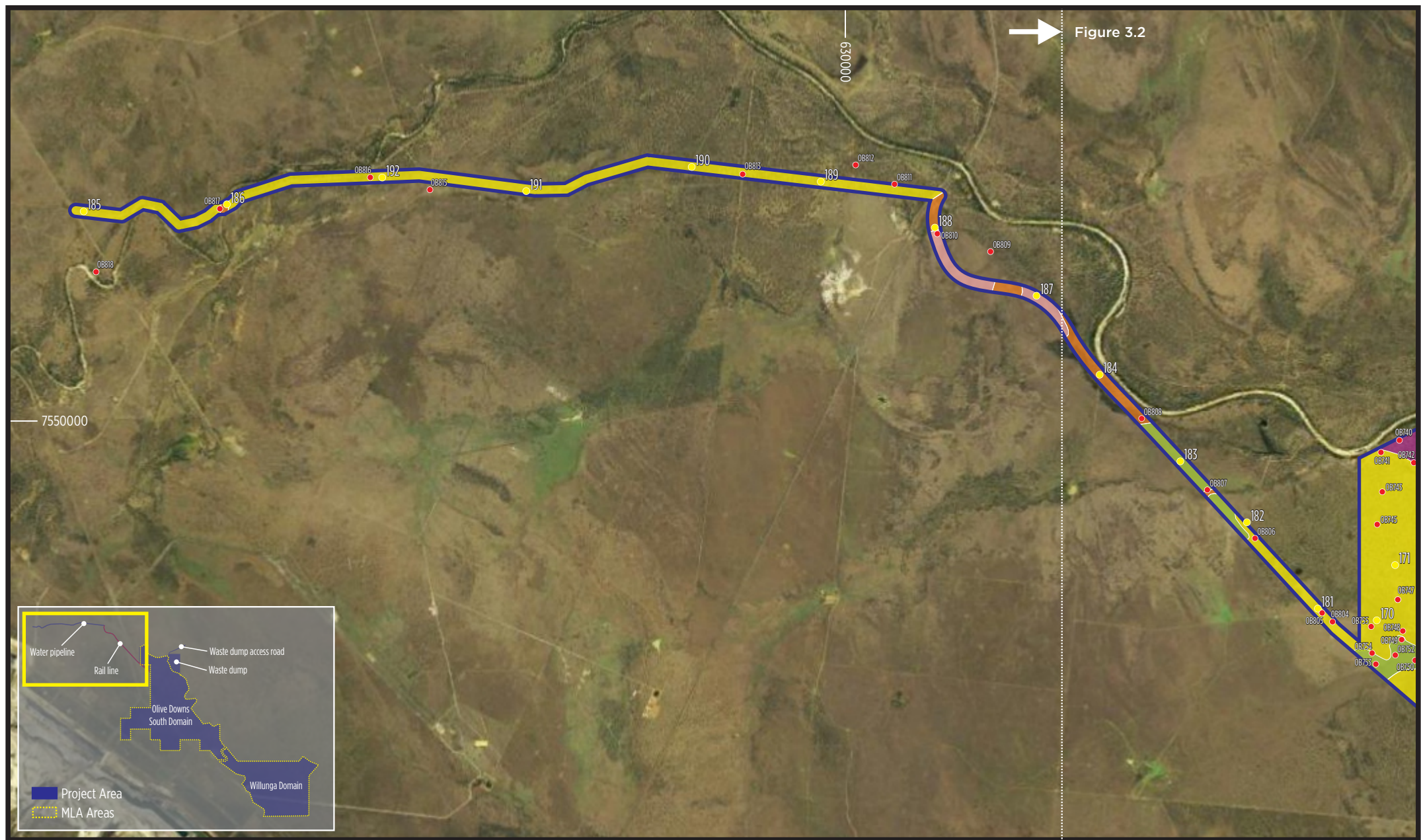


Figure 3.1: Soil Mapping Units

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Legend

- Project Area
- Detailed Site
- Observation Site

- C1 Brown light clays with melon hole microrelief
- C2 Grey to brown light to medium clay with normal gilgai microrelief
- S1 Brown shallow to deep duplex loamy sands to clay loam sandy earths
- S2 Brown gradational sands, loamy to clayey sands
- R1 Light red loamy sands to reddish loamy/clayey sands
- R2 Brown to reddish brown loamy sands to sandy clay loams
- L1 Shallow (0.20m) loamy sands to deep light clay

- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
- A1 Loam to loamy sands within active channels
- A2 Clayey sands to light medium clay within alluvial depression



Green environmental

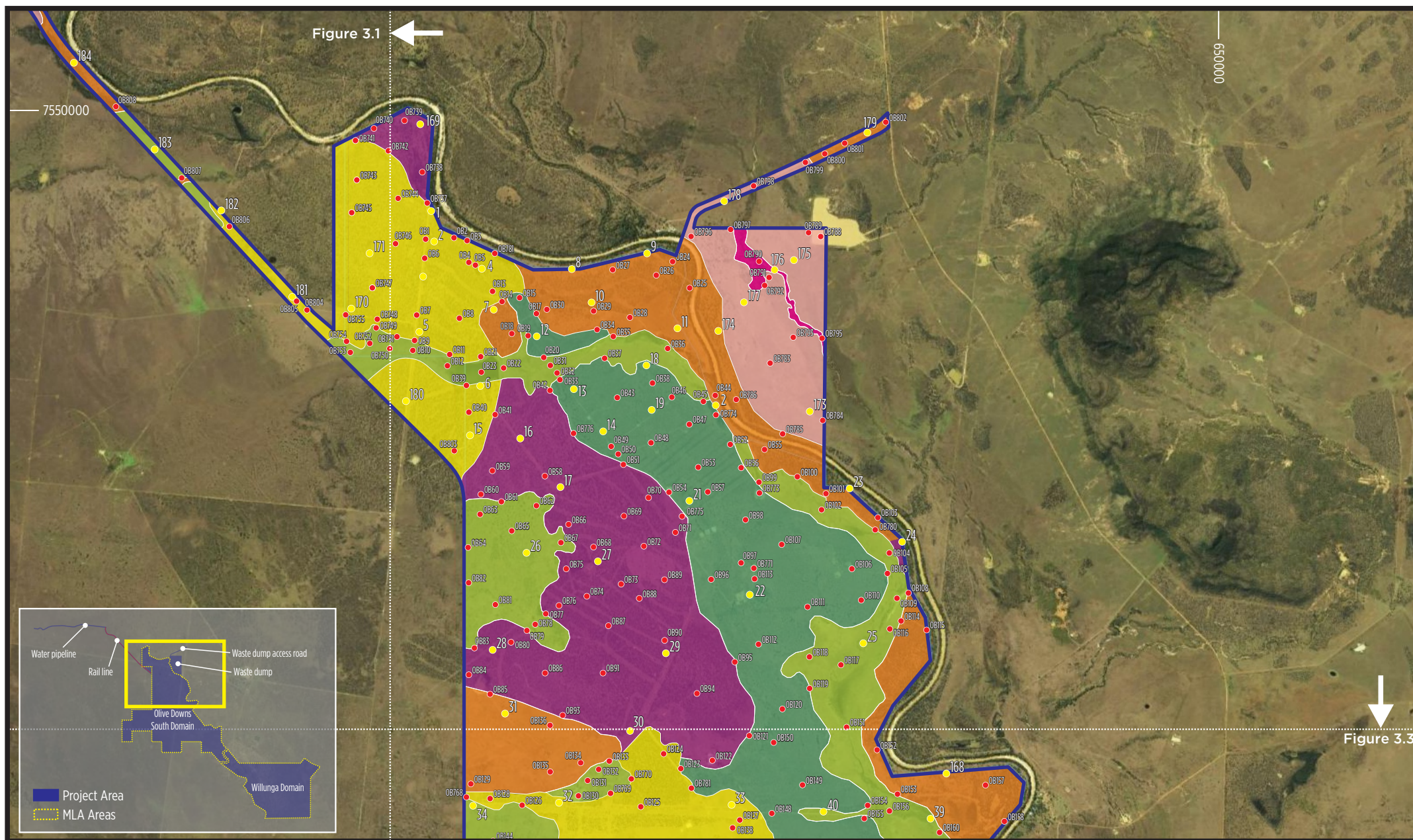
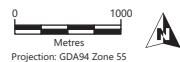


Figure 3.2: Soil Mapping Units

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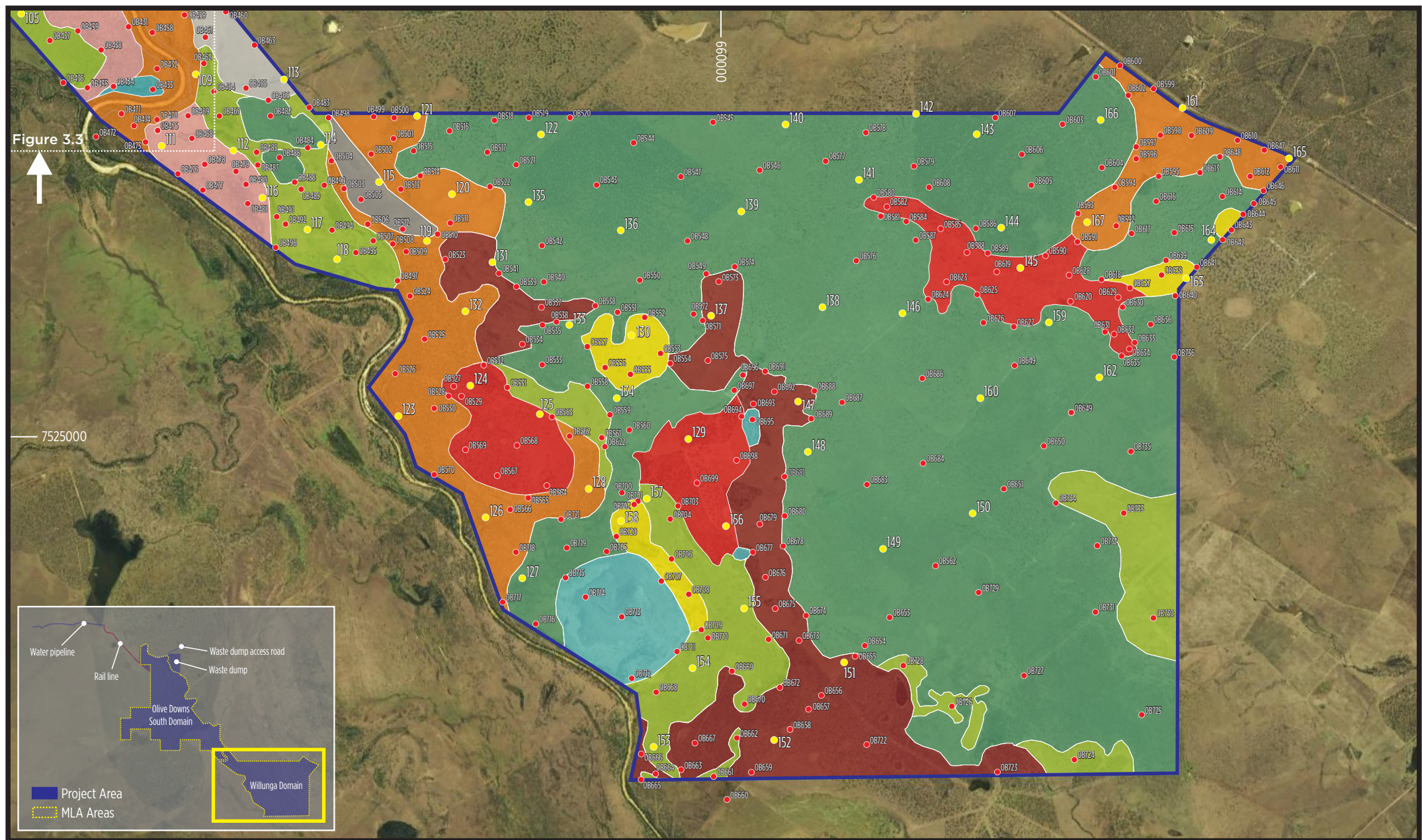
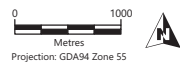


Figure 3.4: Soil Mapping Units

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Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Detailed Site
- Observation Site

- C1 Brown light clays with melon hole microrelief
- C2 Grey to brown light to medium clay with normal gilgai microrelief
- S1 Brown shallow to deep duplex loamy sands to clay loam sandy earths
- S2 Brown gradational sands, loamy to clayey sands
- R1 Light red loamy sands to reddish loamy/clayey sands
- R2 Brown to reddish brown loamy sands to sandy clay loams
- L1 Shallow (0.20m) loamy sands to deep light clay

- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
- A1 Loam to loamy sands within active channels
- A2 Clayey sands to light medium clay within alluvial depression



Figure 4.1: Topsoil Stripping Depths

Legend

 	Project Area		0.30 metres
	0.10 metres		0.35 metres
	0.15 metres		0.40 metres
	0.20 metres		0.50 metres

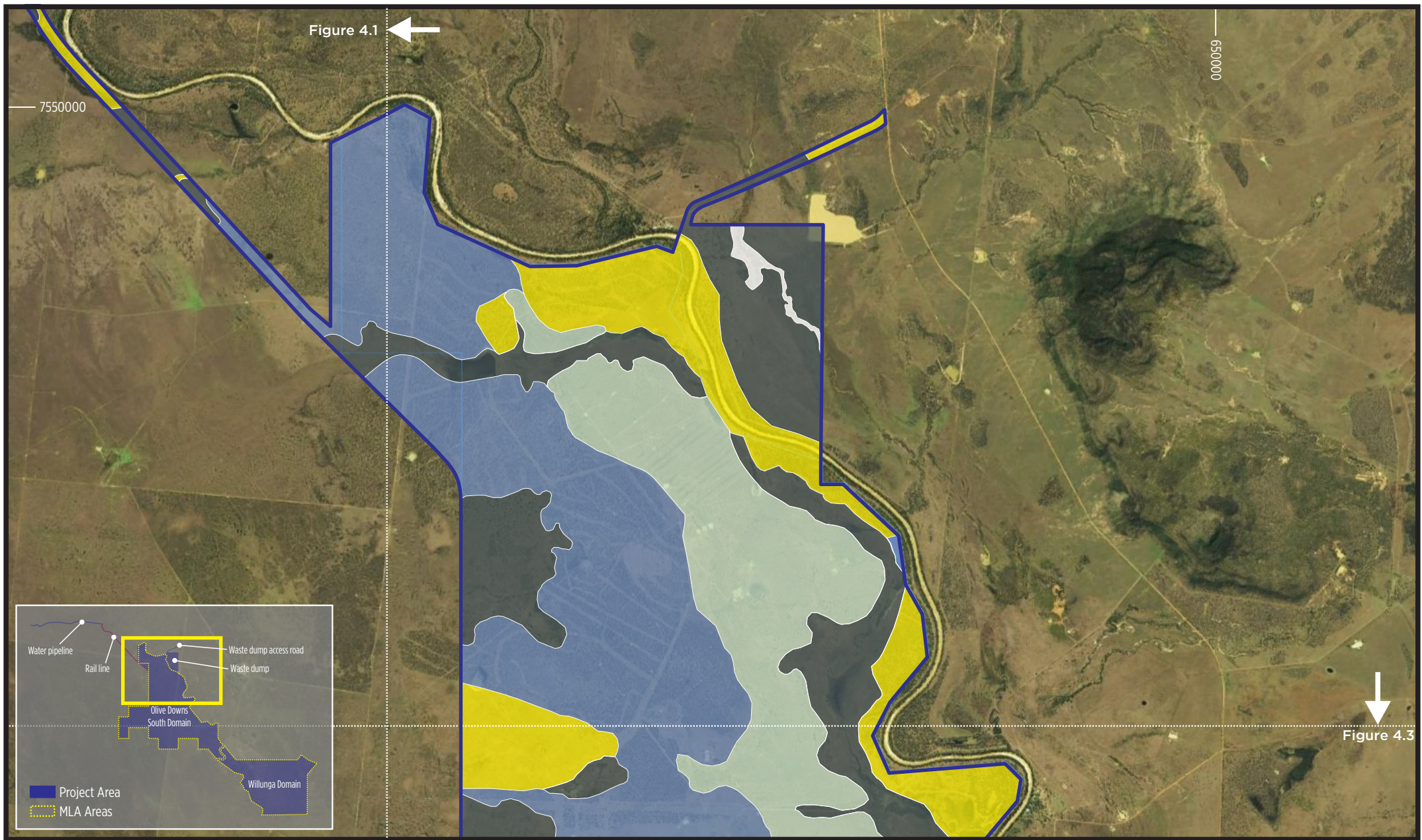
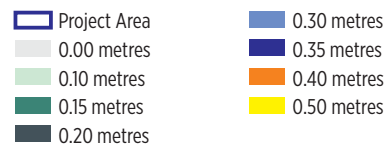


Figure 4.2: Topsoil Stripping Depths

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Soils and Land Suitability Assessment
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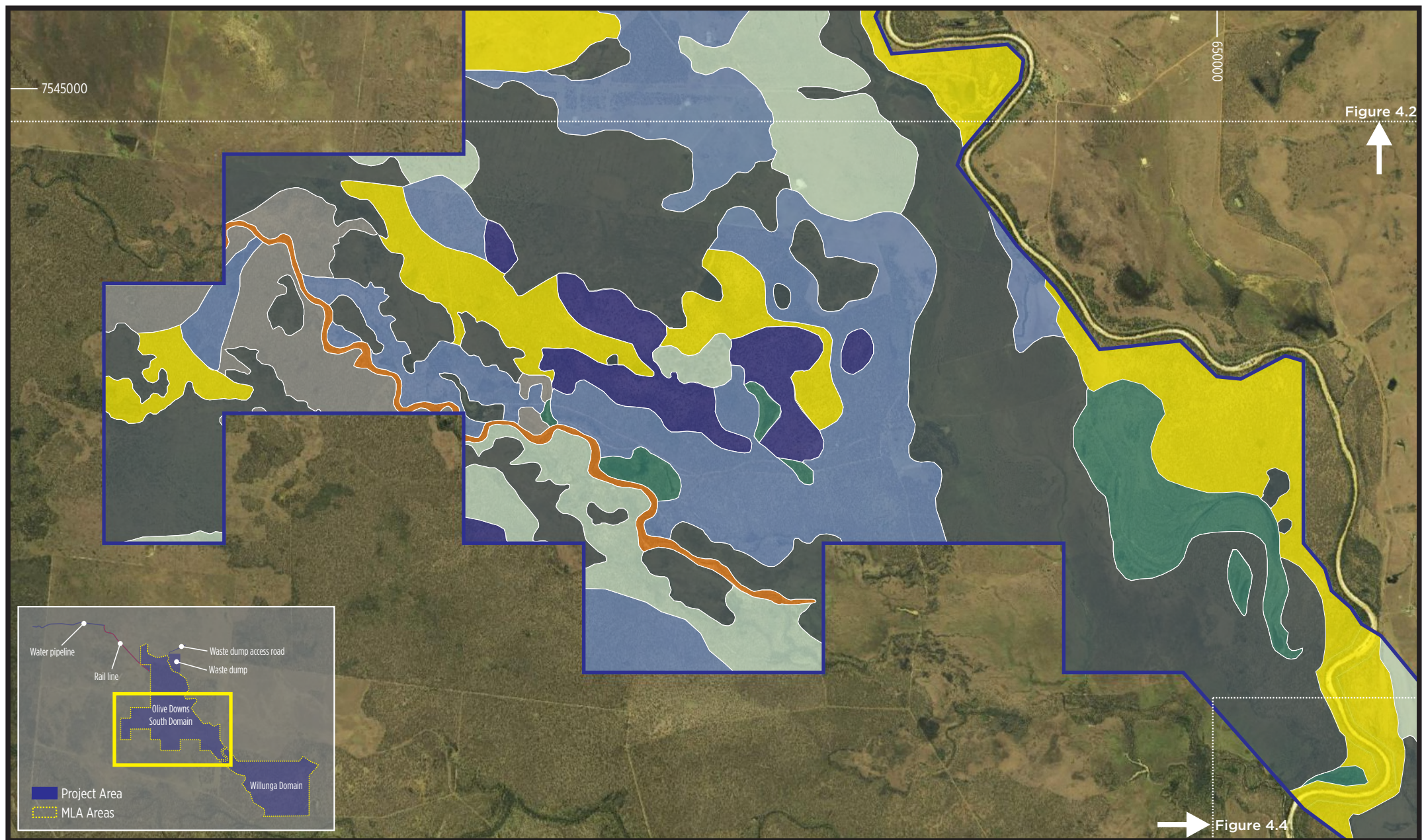


Figure 4.3: Topsoil Stripping Depths

Legend

- | | |
|--|--|
| Project Area | 0.30 metres |
| 0.10 metres | 0.35 metres |
| 0.15 metres | 0.40 metres |
| 0.20 metres | 0.50 metres |

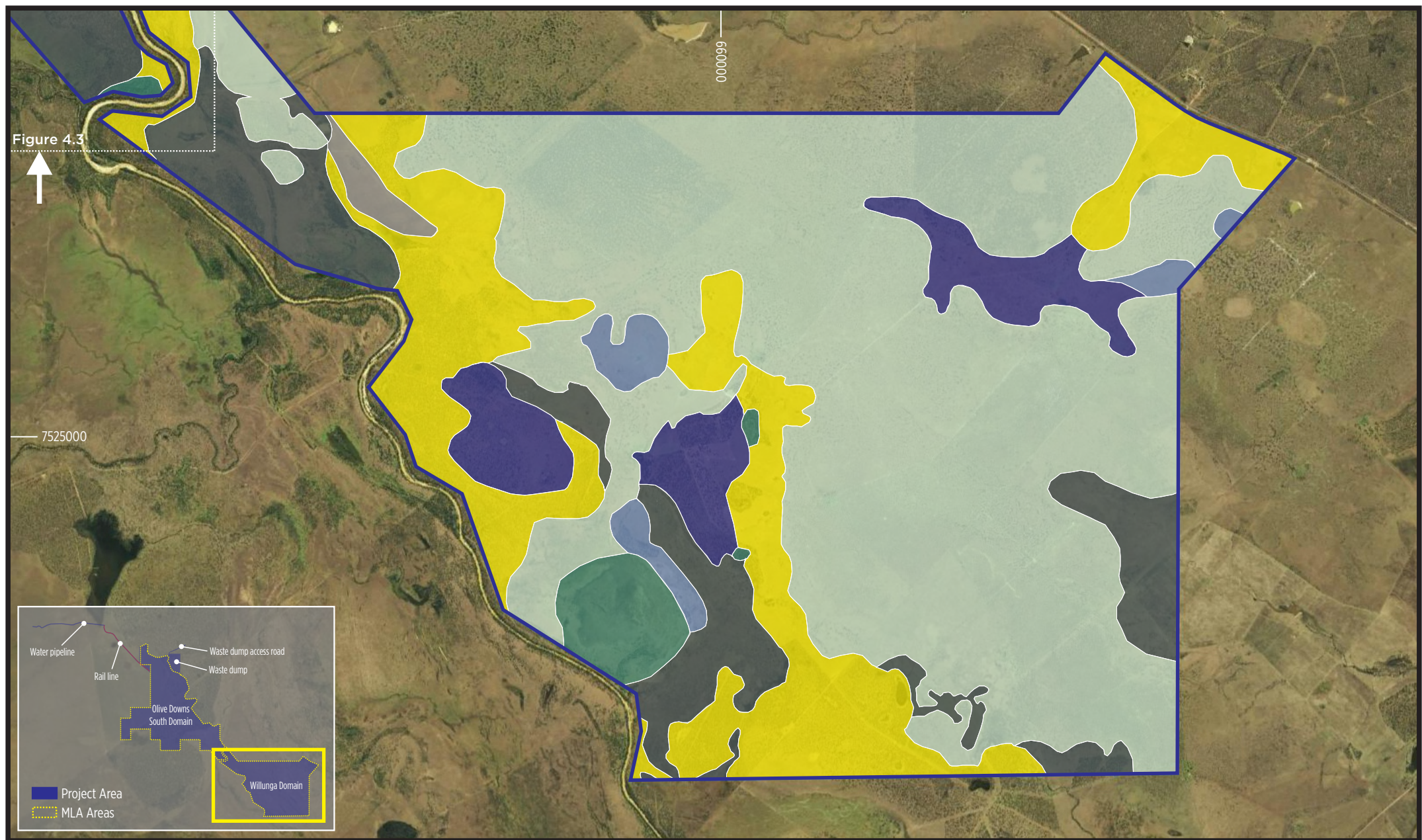
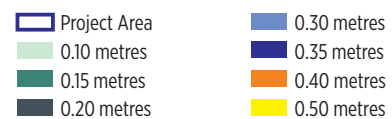


Figure 4.4: Topsoil Stripping Depths

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Soils and Land Suitability Assessment
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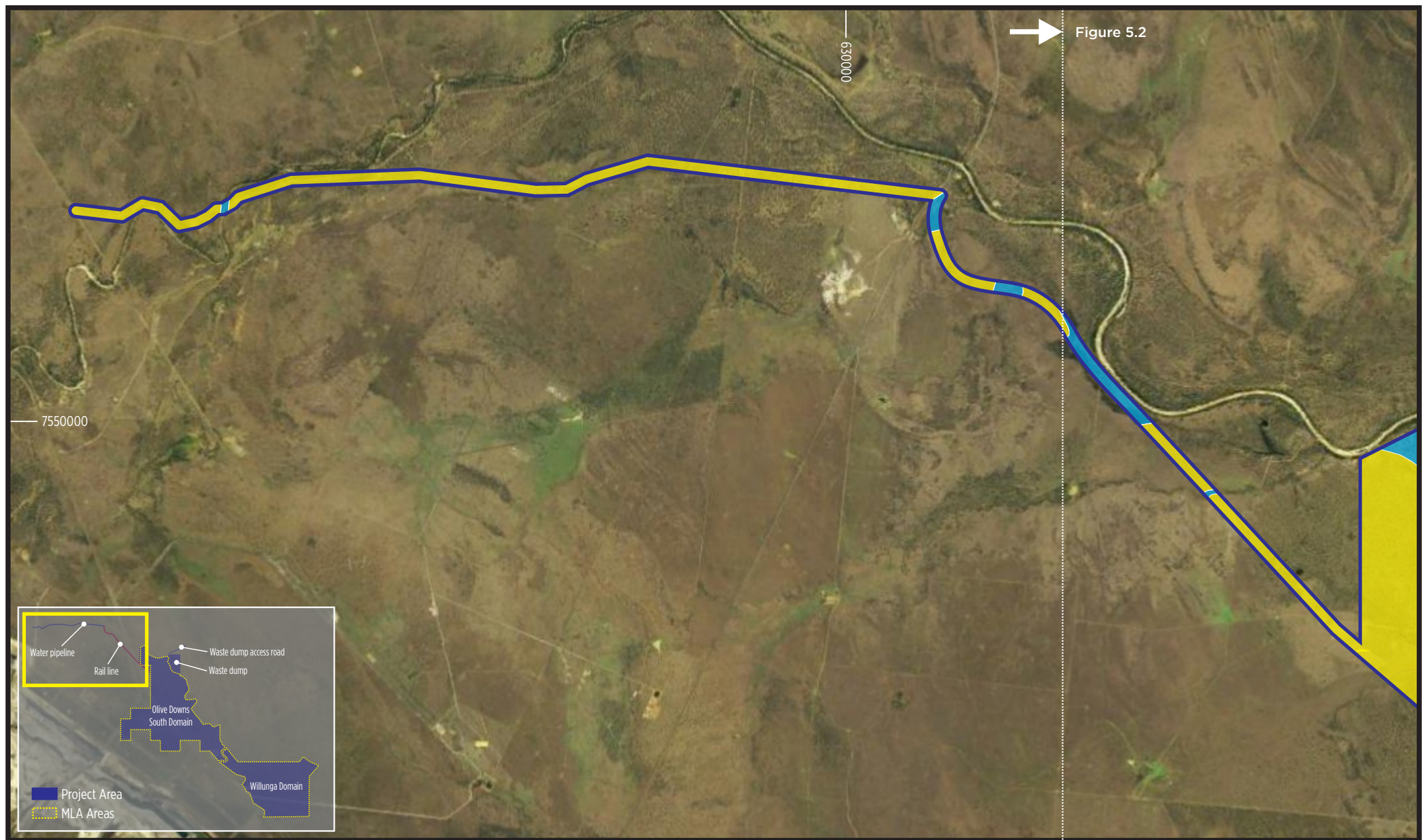
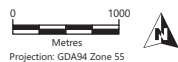


Figure 5.1: Pre Mine - Rainfed Broadacre Cropping

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Soils and Land Suitability Assessment
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Legend

- Project Area
- Class 4
- Class 5

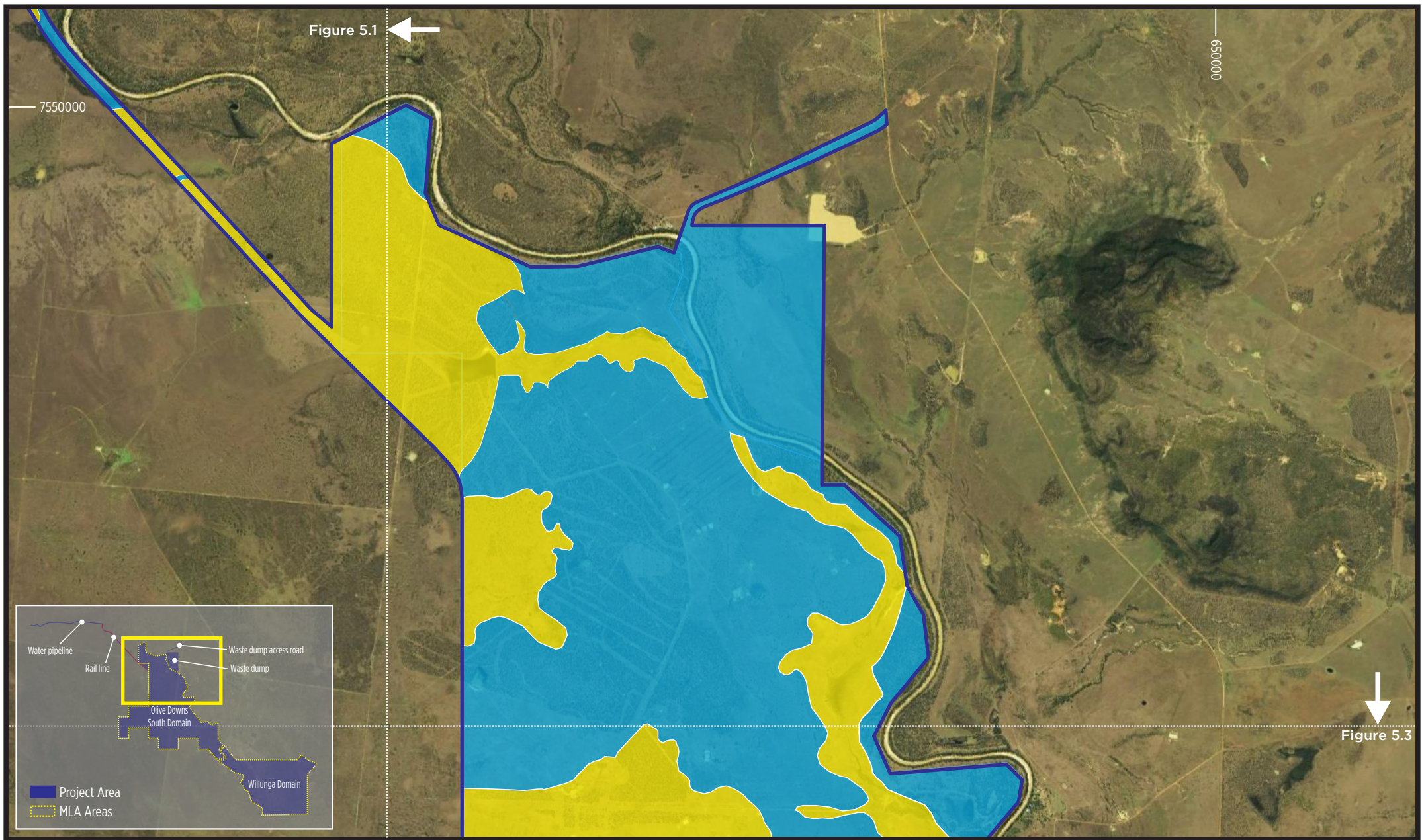


Figure 5.2: Pre Mine - Rainfed Broadacre Cropping

Revision 5
03/07/2018

0 1000
Metres
Projection: GDA94 Zone 55

Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 4
- Class 5

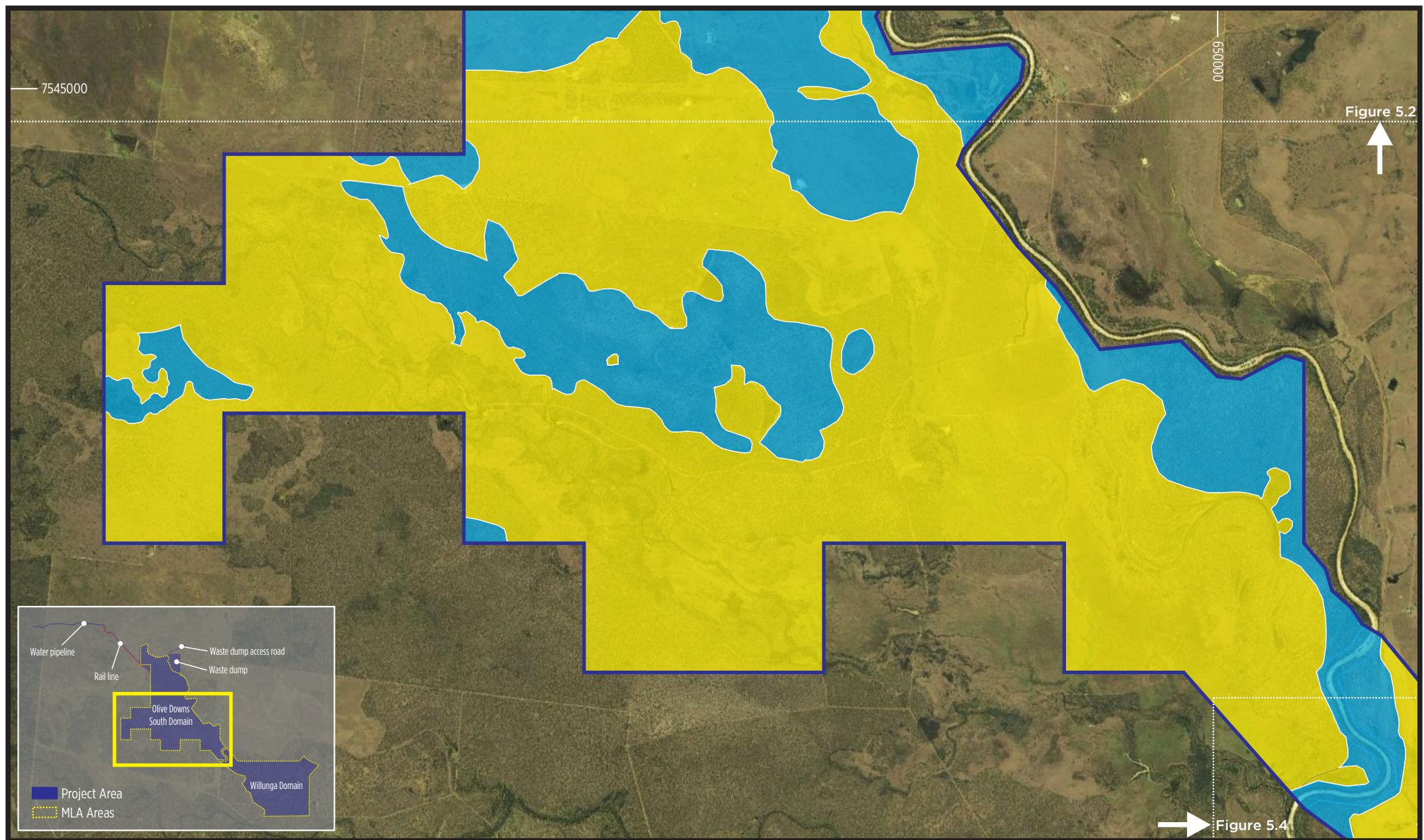


Figure 5.3: Pre Mine - Rainfed Broadacre Cropping

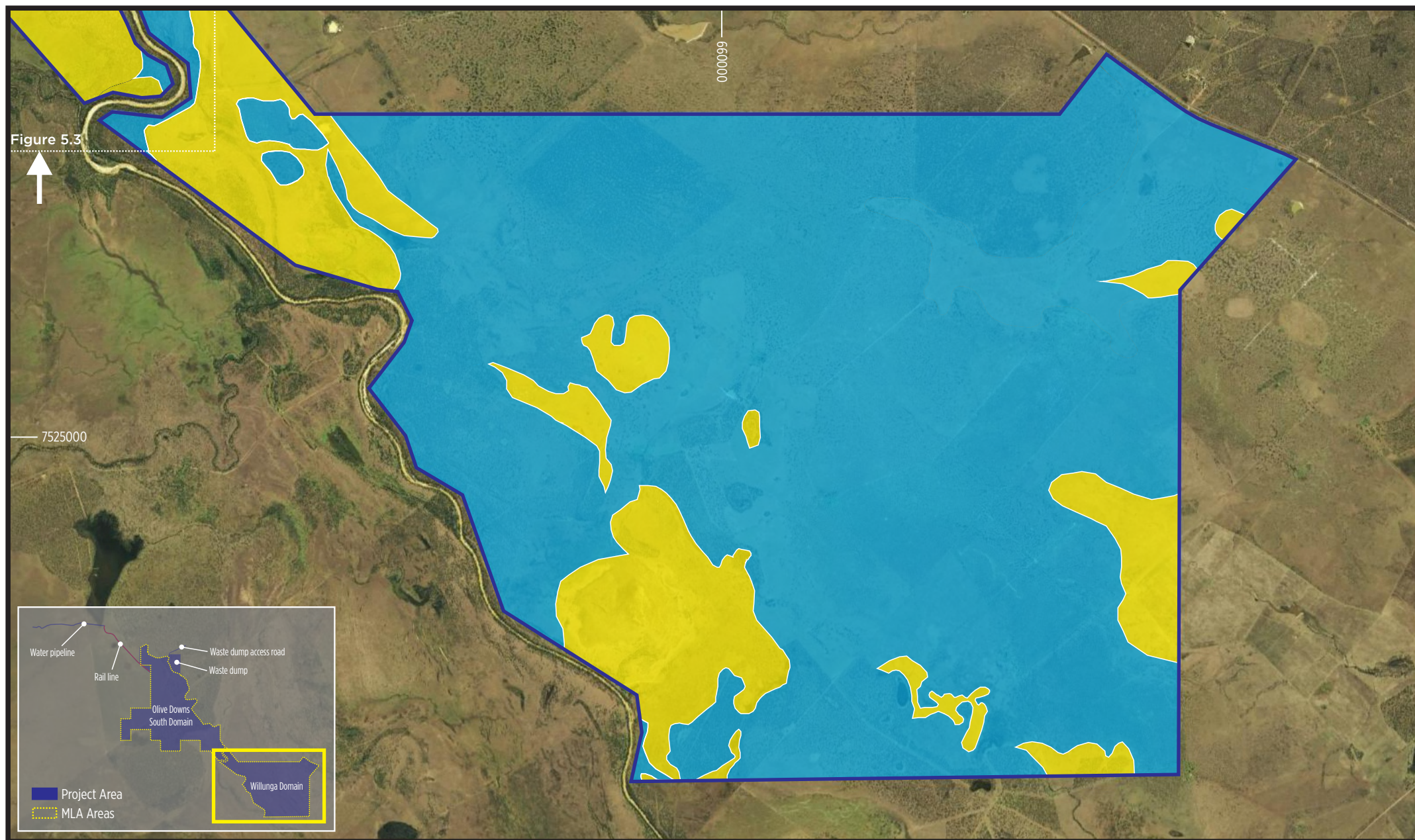


Figure 5.4: Pre Mine - Rainfed Broadacre Cropping

Revision 5
03/07/2018

0 1000
Metres
Projection: GDA94 Zone 55

Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 4
- Class 5



Figure 6.1: Pre Mine - Beef Cattle Grazing

Revision 5
03/07/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 3
- Class 4

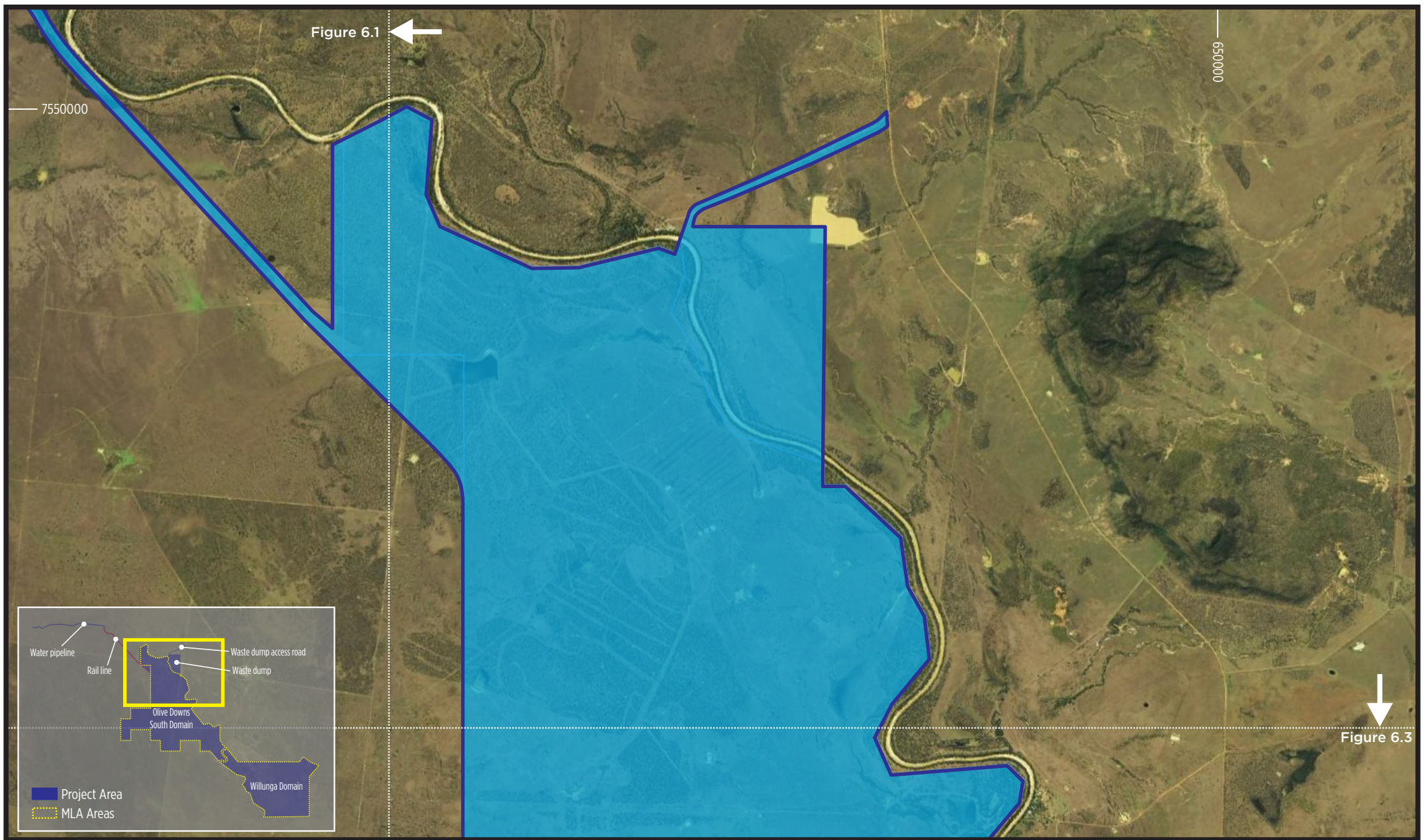


Figure 6.2: Pre Mine - Beef Cattle Grazing

Revision 5
03/07/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 3
- Class 4

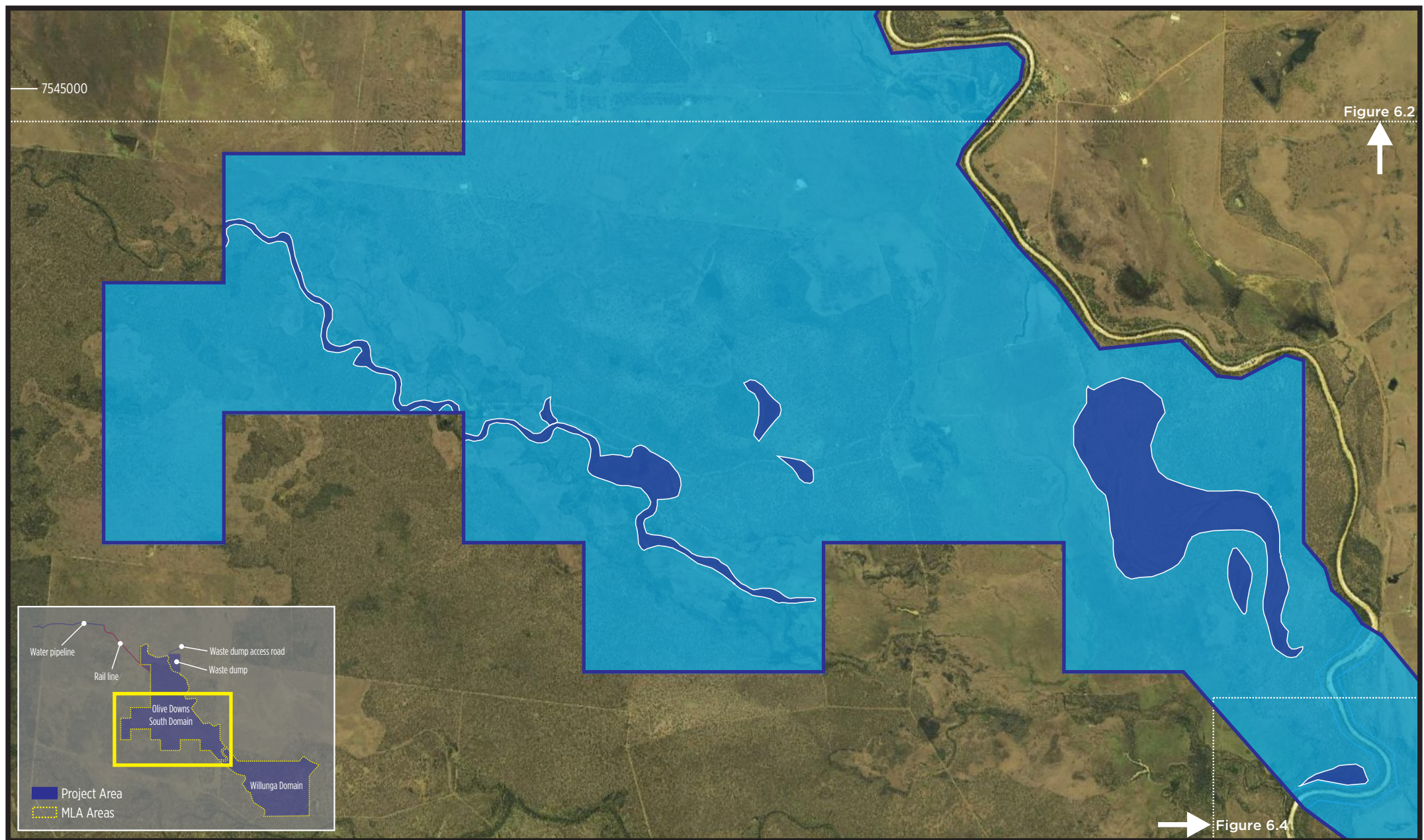


Figure 6.3: Pre Mine - Beef Cattle Grazing

Revision 5
03/07/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 3
- Class 4

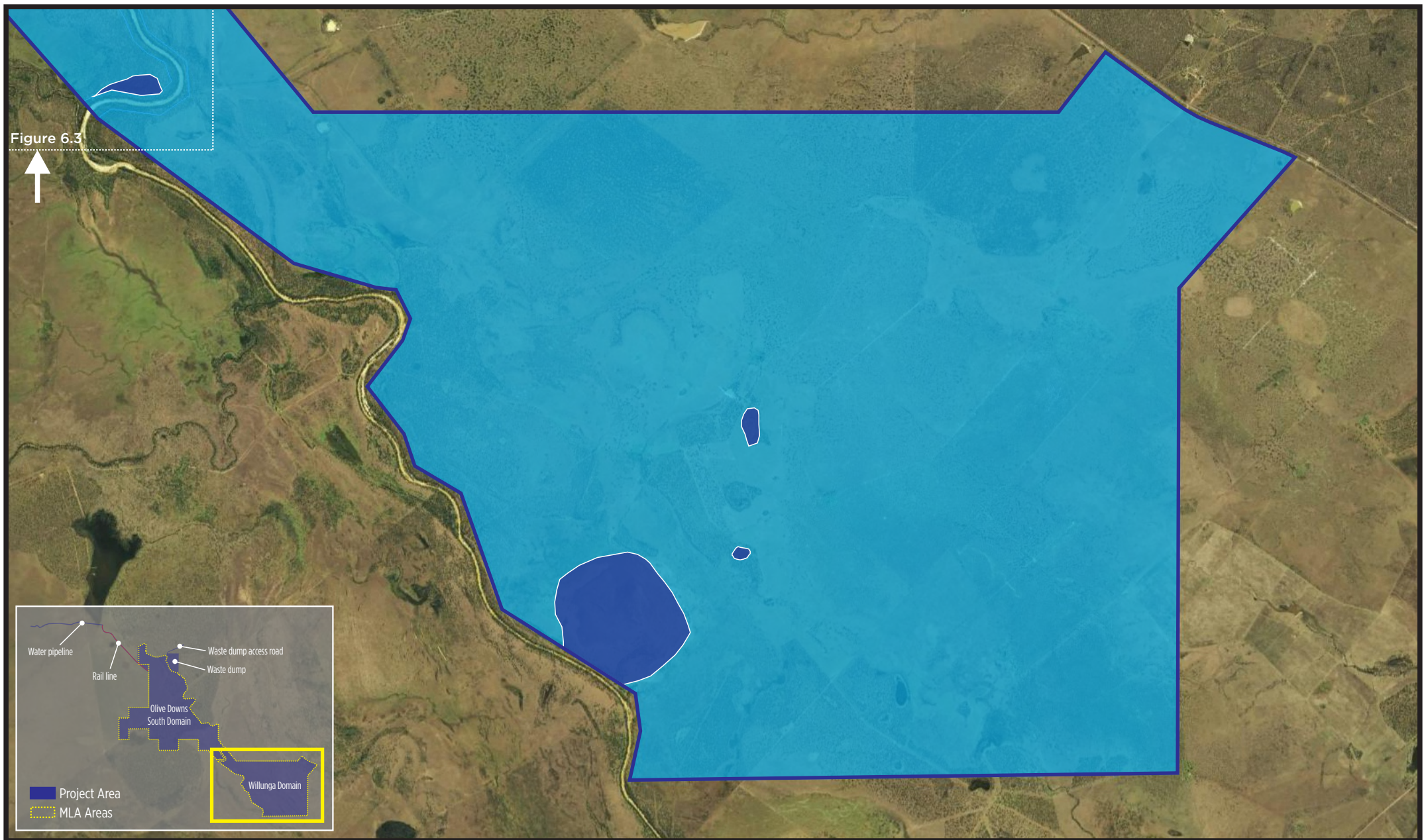


Figure 6.4: Pre Mine - Beef Cattle Grazing

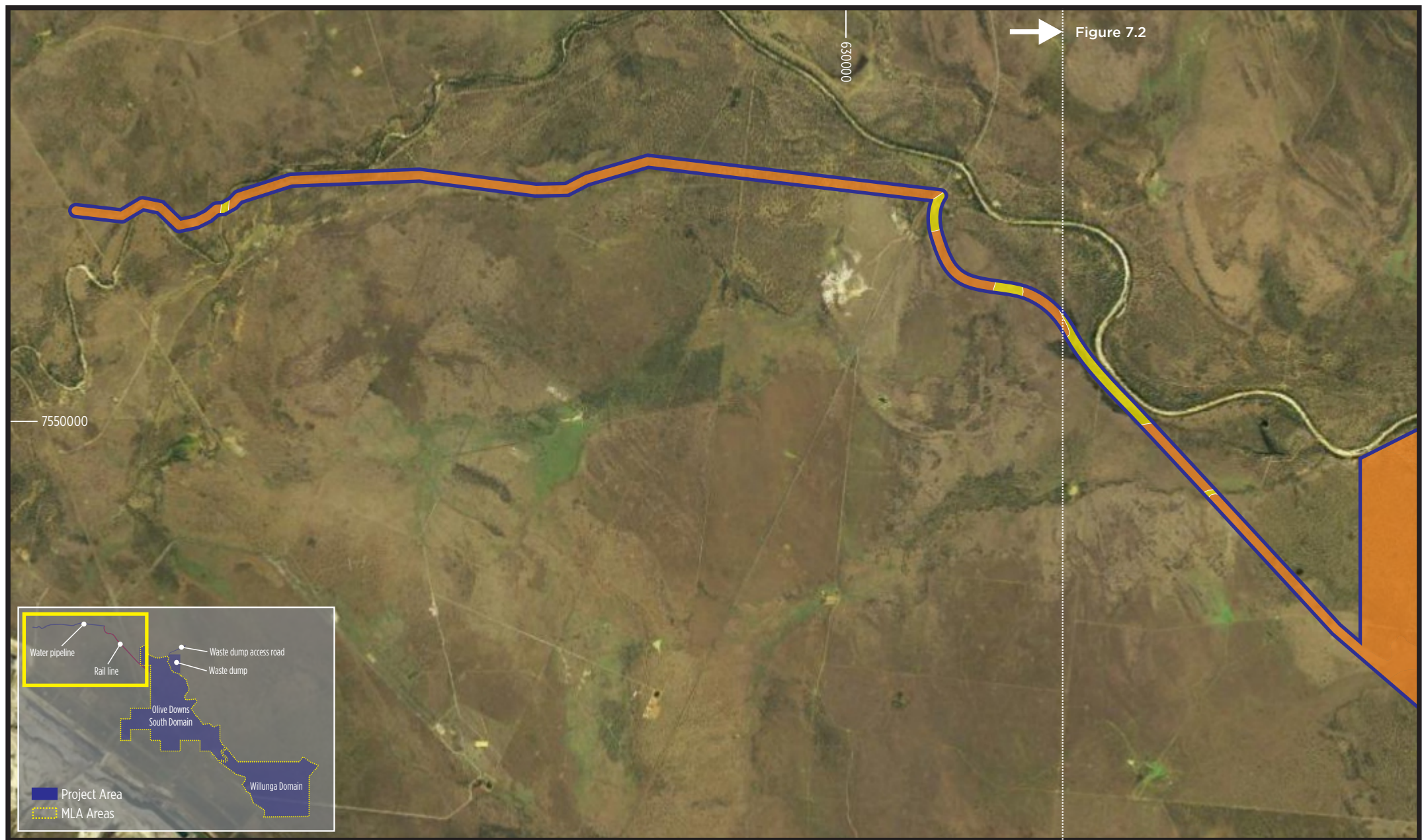


Figure 7.1: Agricultural Land Classes

Legend

- Project Area
- Class B
- Class C2
- Class C3

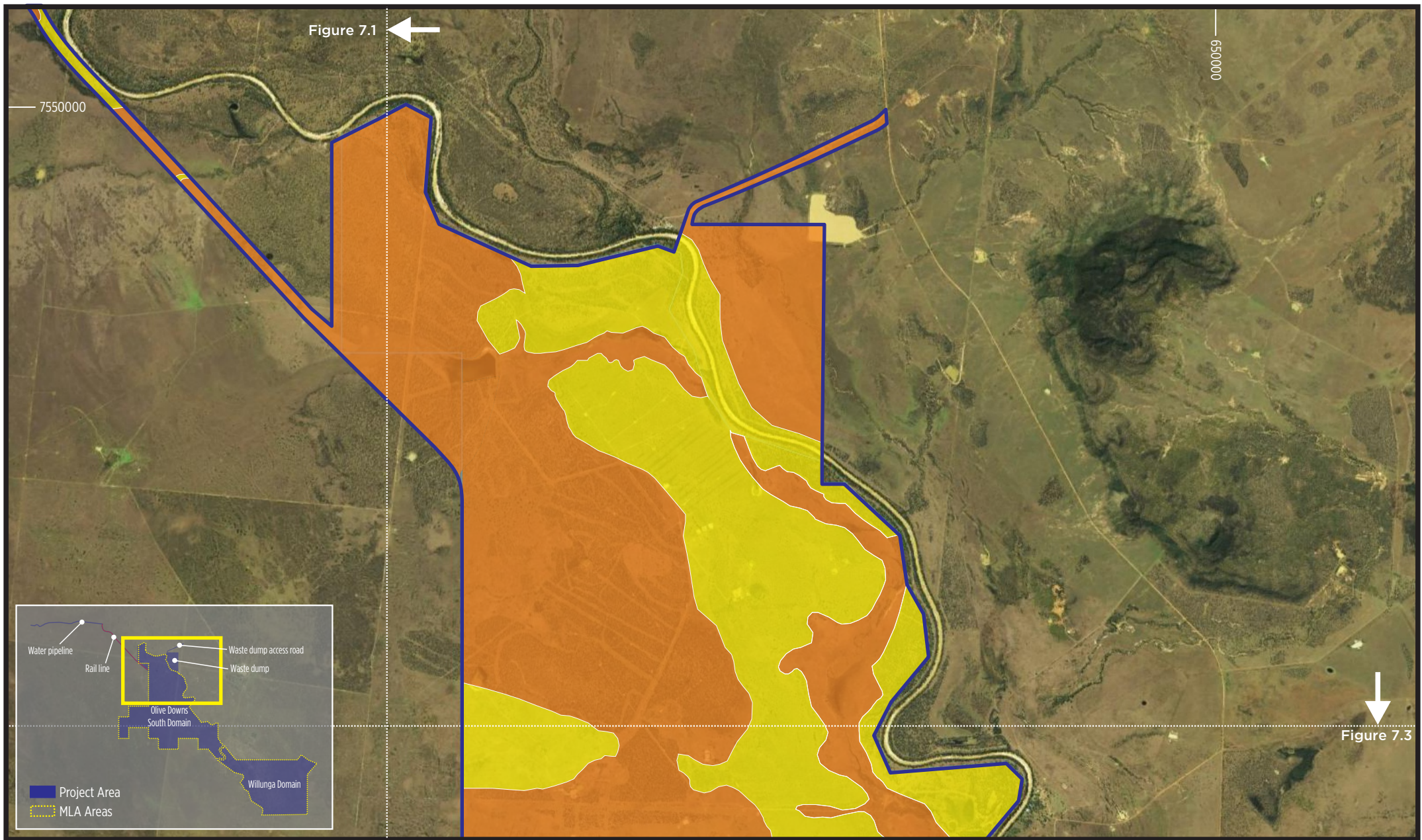


Figure 7.2: Agricultural Land Classes

Legend

- Project Area
- Class B
- Class C2
- Class C3

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Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

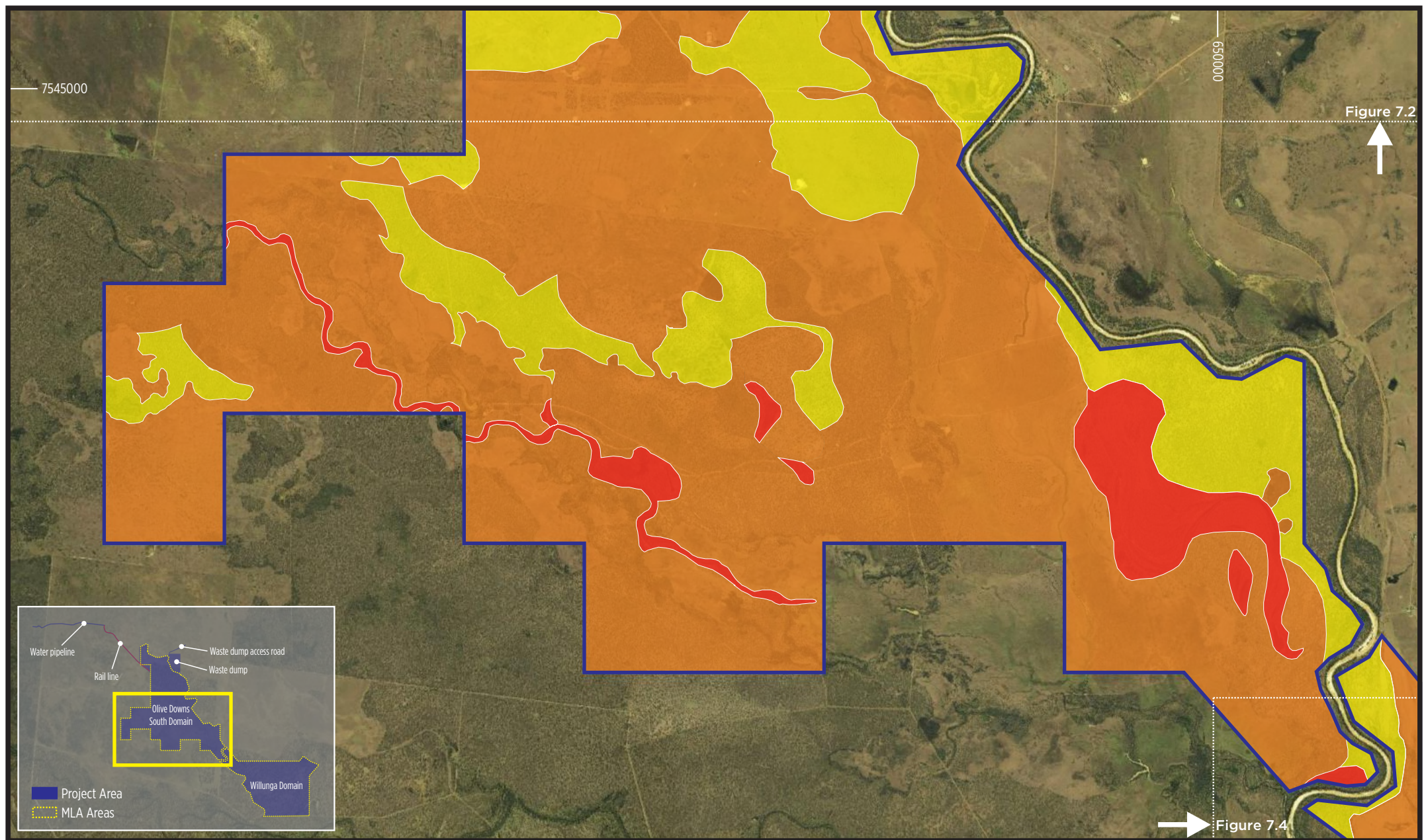
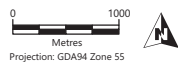


Figure 7.3: Agricultural Land Classes

Legend

- Project Area
- Class B
- Class C2
- Class C3

Revision 5
03/07/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

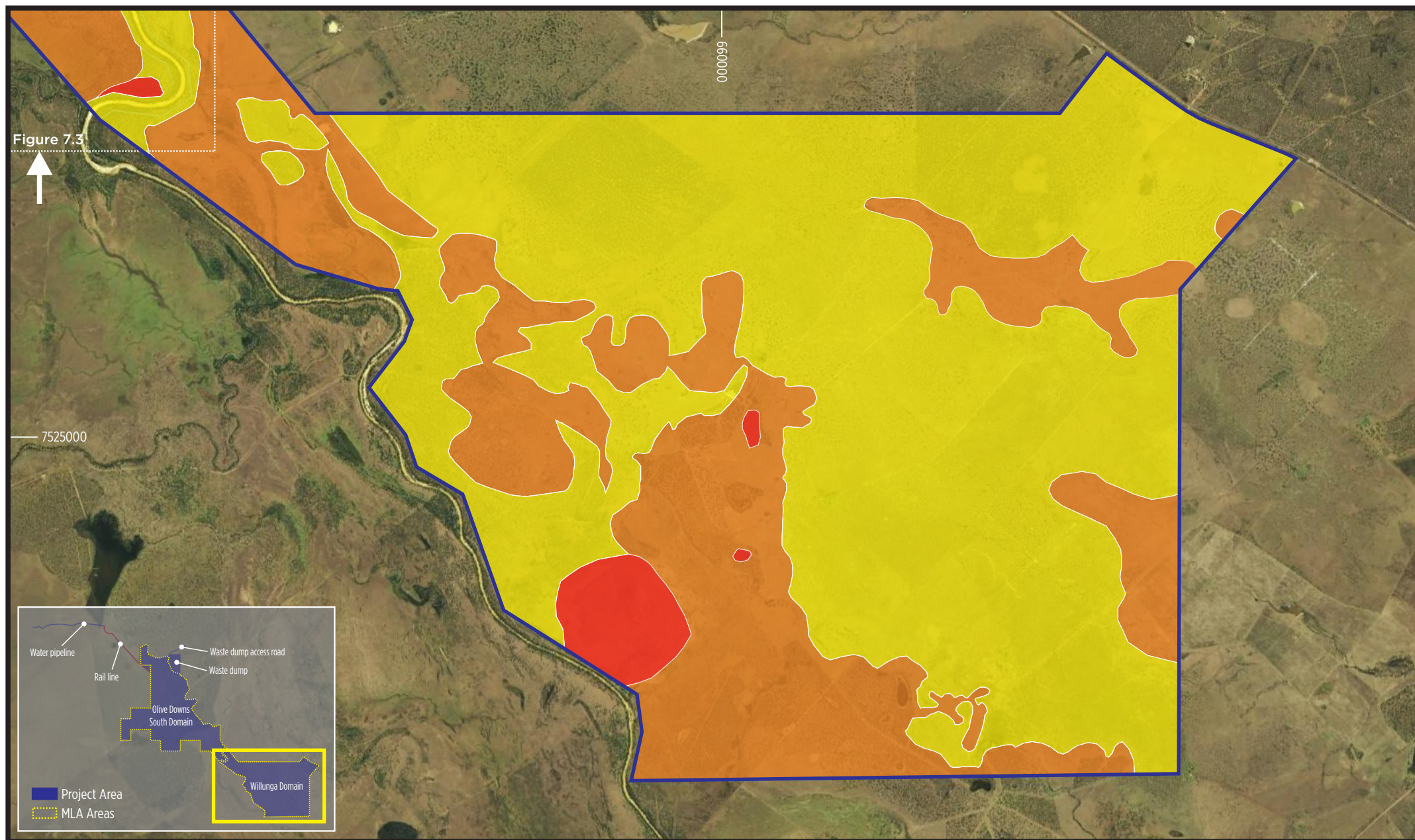
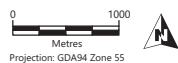


Figure 7.4: Agricultural Land Classes

Legend

- Project Area
- Class B
- Class C2
- Class C3

Revision 5
03/07/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

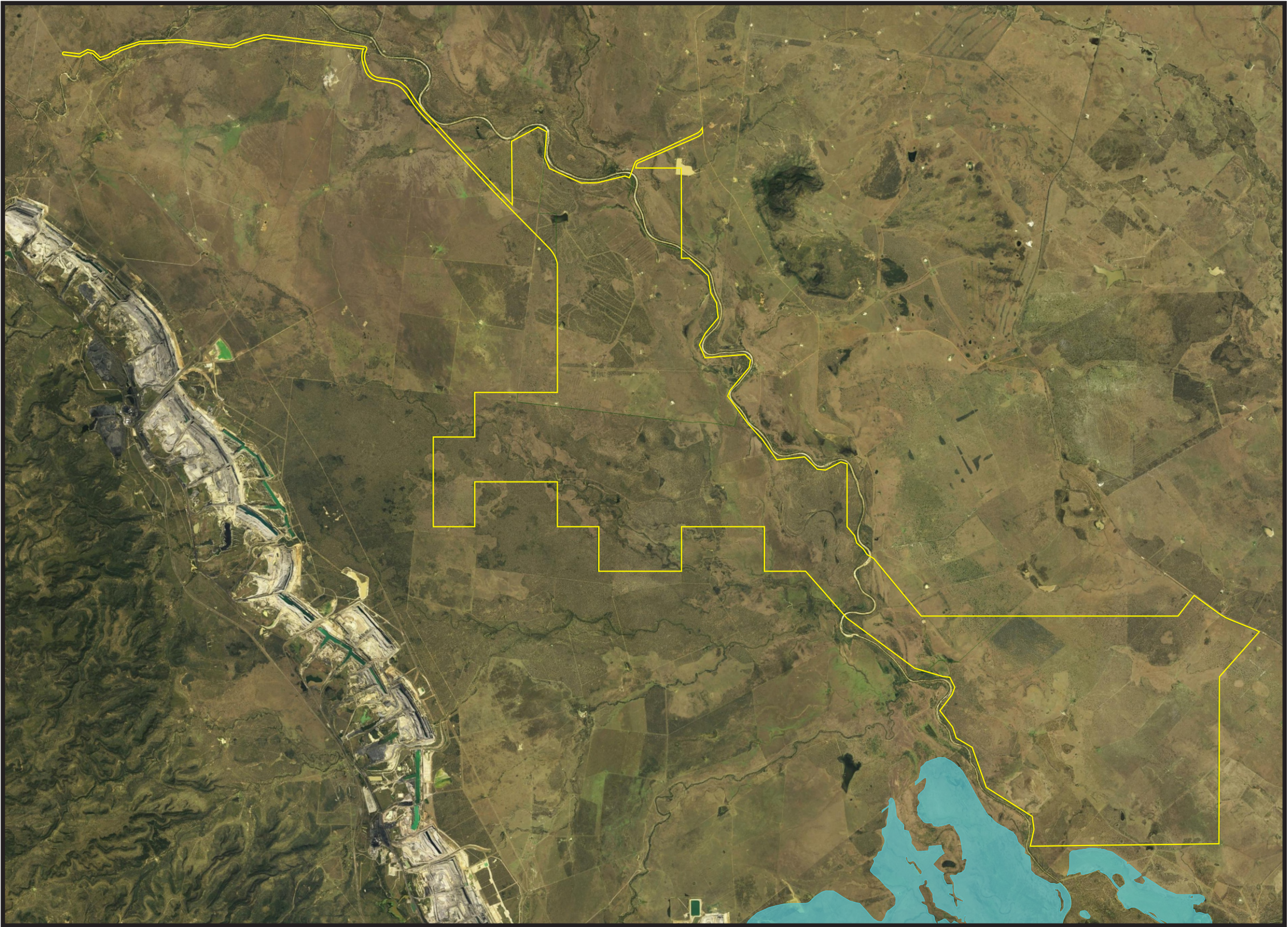


Figure 8: SCL Trigger Map

Legend

-  Project Area
-  SCL Trigger Map

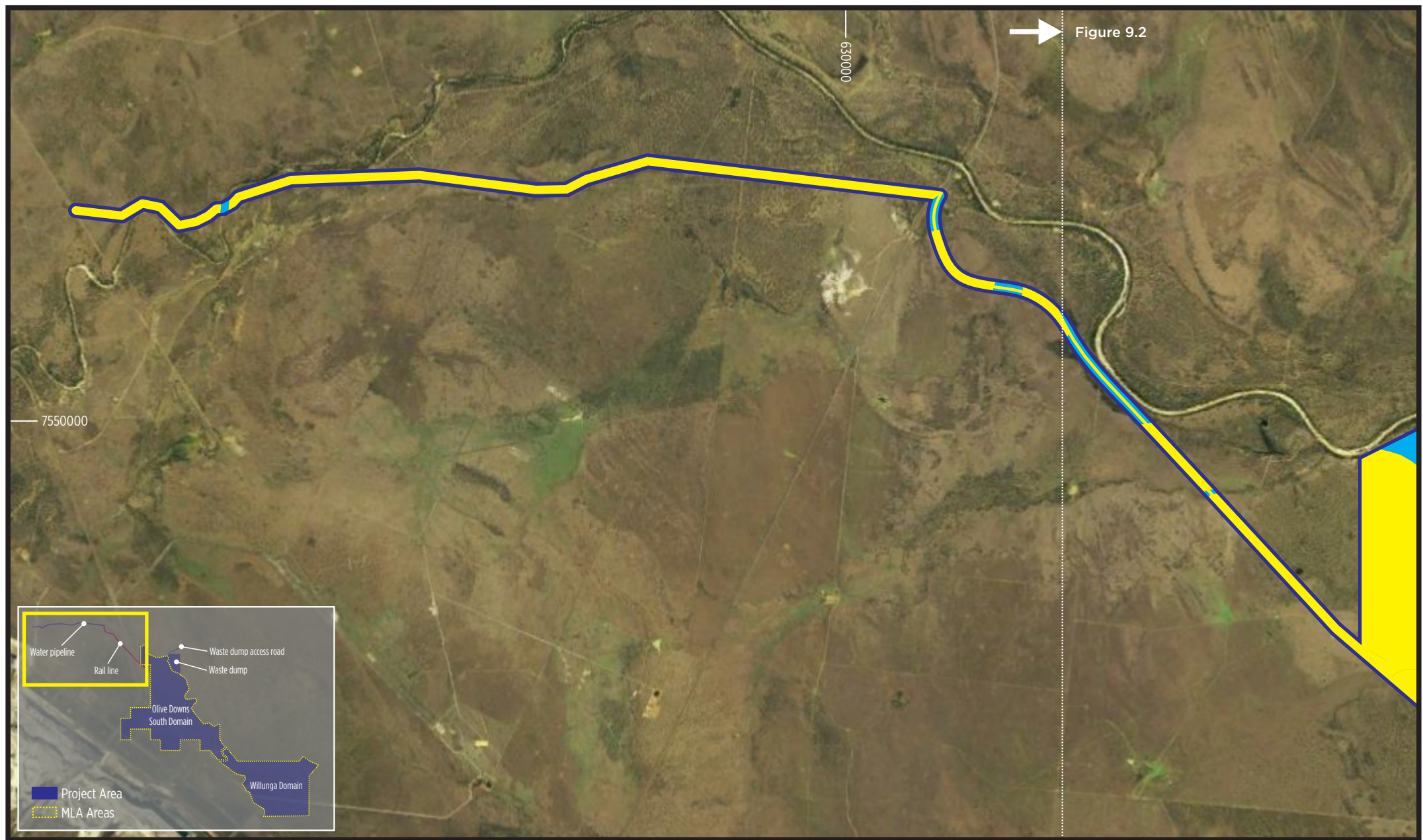


Figure 9.1: Post Mine - Rainfed Broadacre Cropping

Revision 3
29/06/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 4
- Class 5

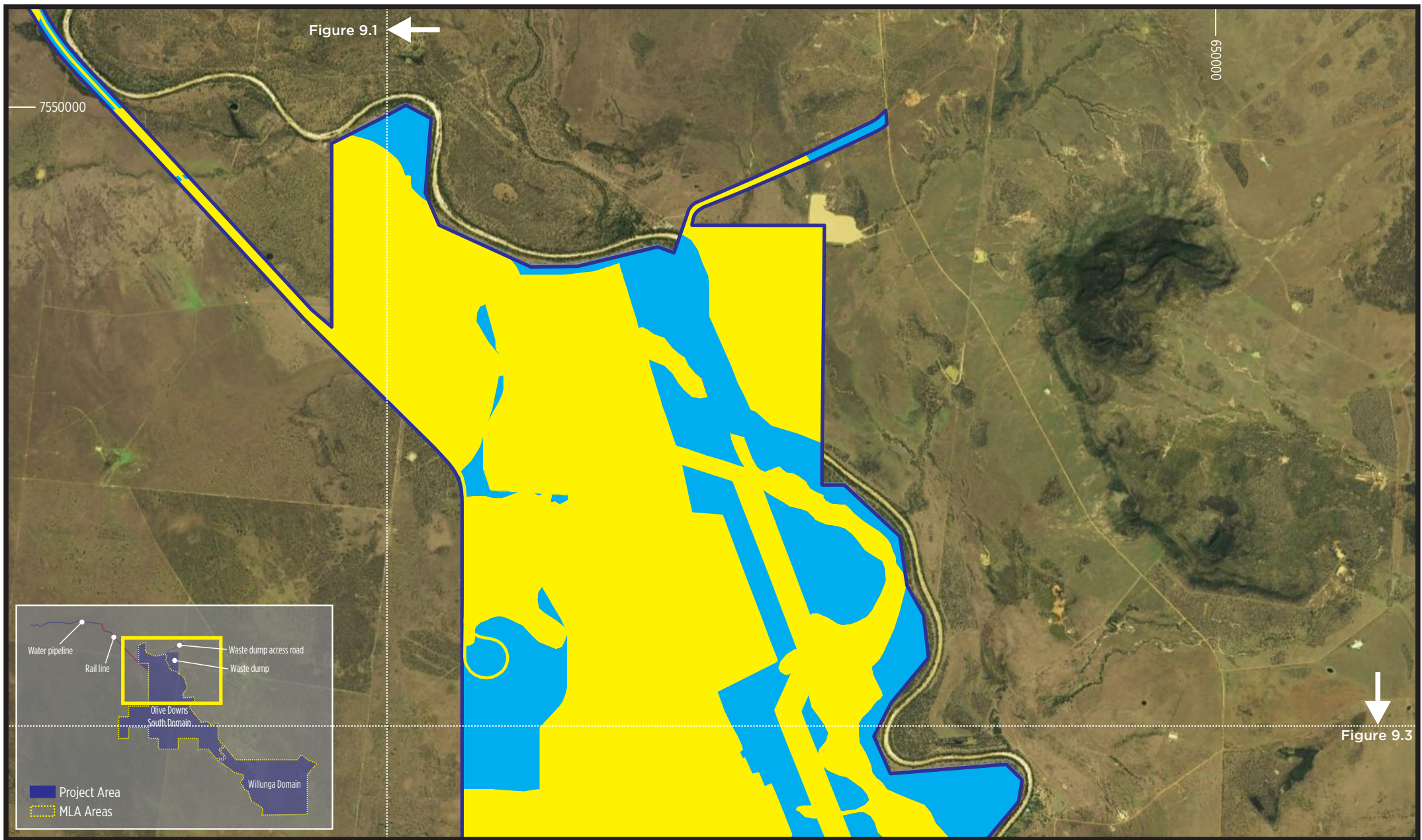


Figure 9.2: Post Mine - Rainfed Broadacre Cropping

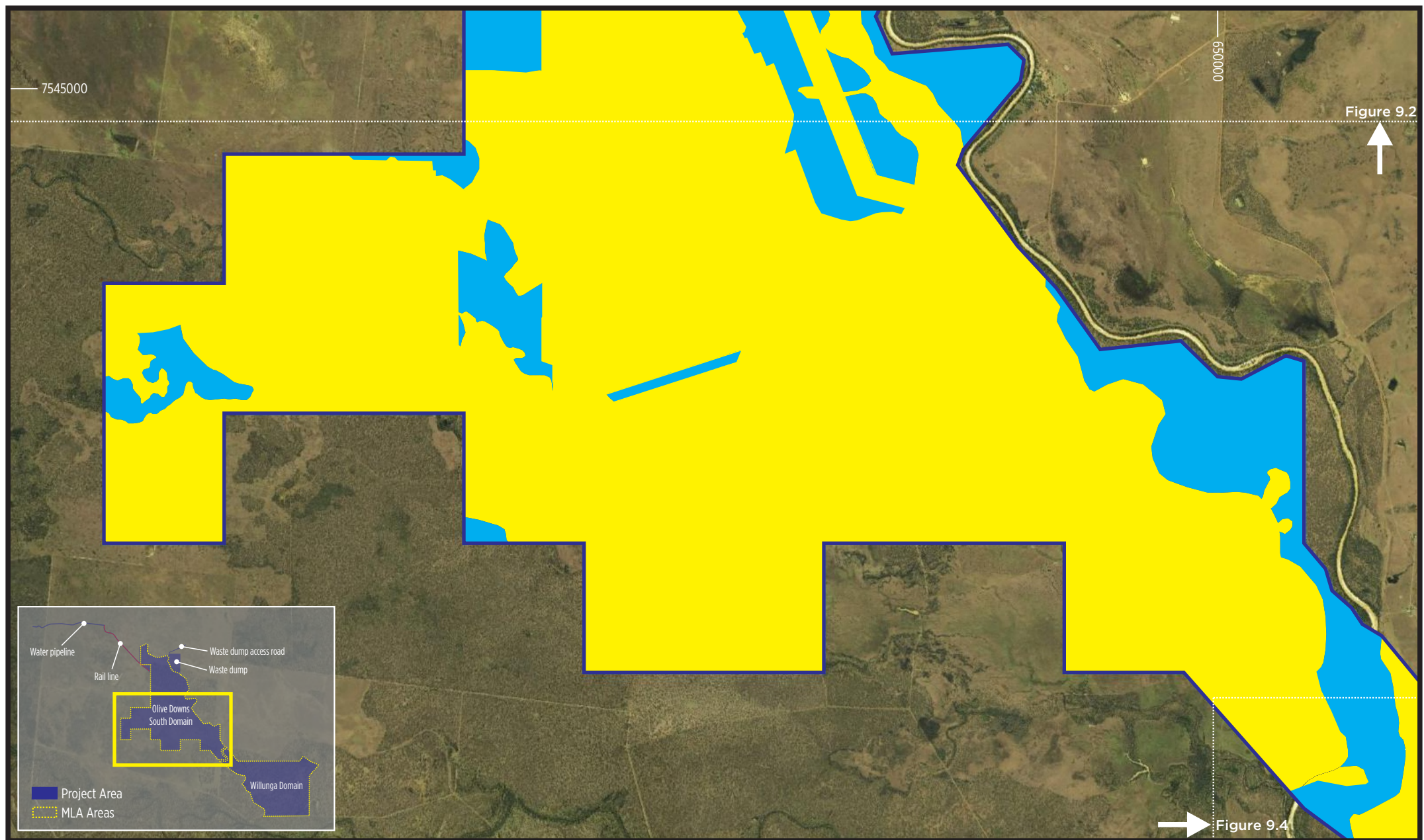


Figure 9.3: Post Mine - Rainfed Broadacre Cropping

Revision 3
29/06/2018

0 1000
Metres
Projection: GDA94 Zone 55

Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 4
- Class 5

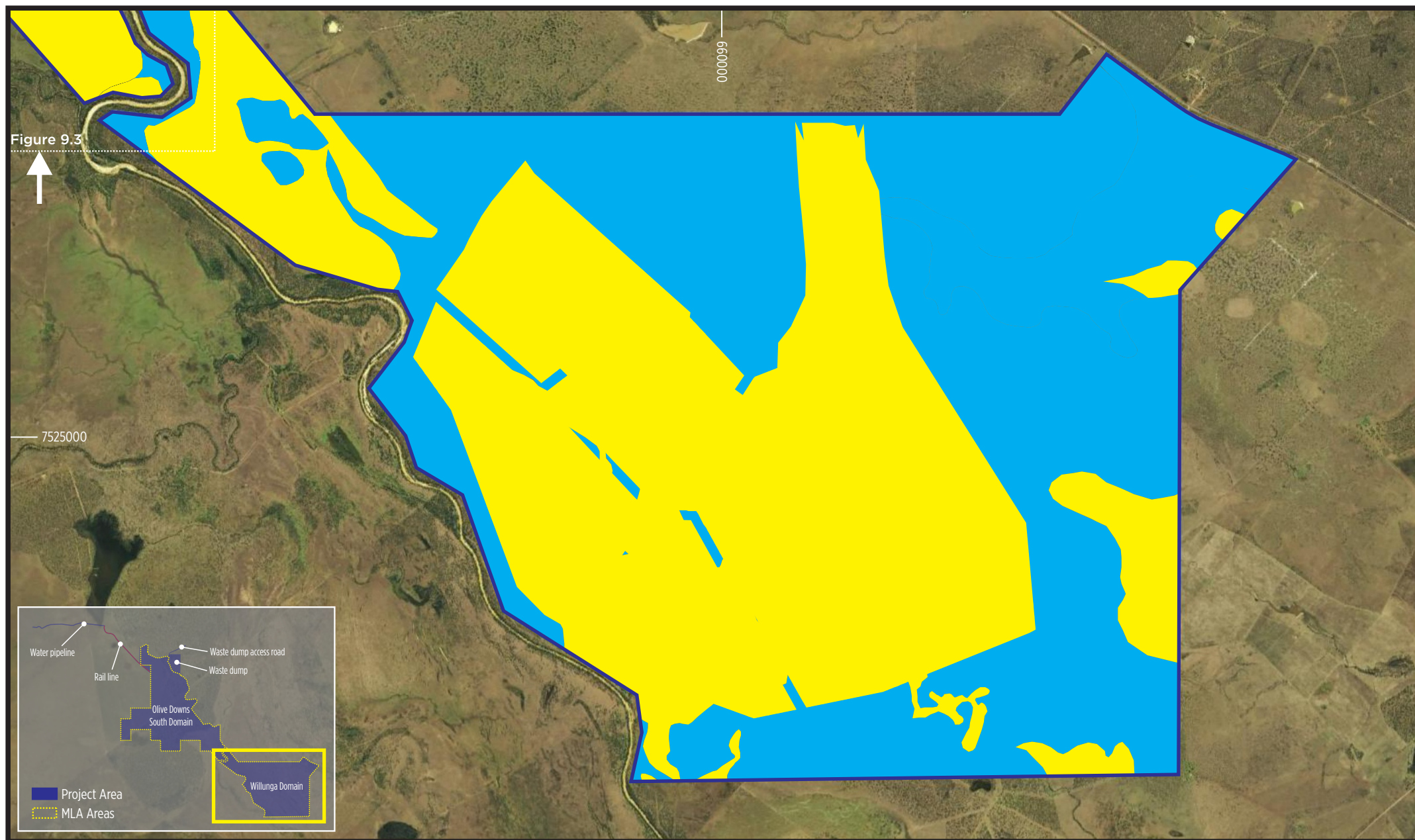


Figure 9.4: Post Mine - Rainfed Broadacre Cropping

Legend

- Project Area
- Class 4
- Class 5

Revision 3
29/06/2018

0 1000
Metres

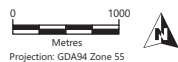
Projection: GDA94 Zone 55

Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT



Figure 10.1: Post Mine - Beef Cattle Grazing

Revision 3
29/06/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

Legend

- Project Area
- Class 3
- Class 4
- Class 5

- Open cut mining and waste dump areas
- Class 3 - Slope >70% of the land is <10% slope of land surface
- Class 4 - Slope >30% of the land has slope in the range 10-15% with <10% exceeding 15% of land surface

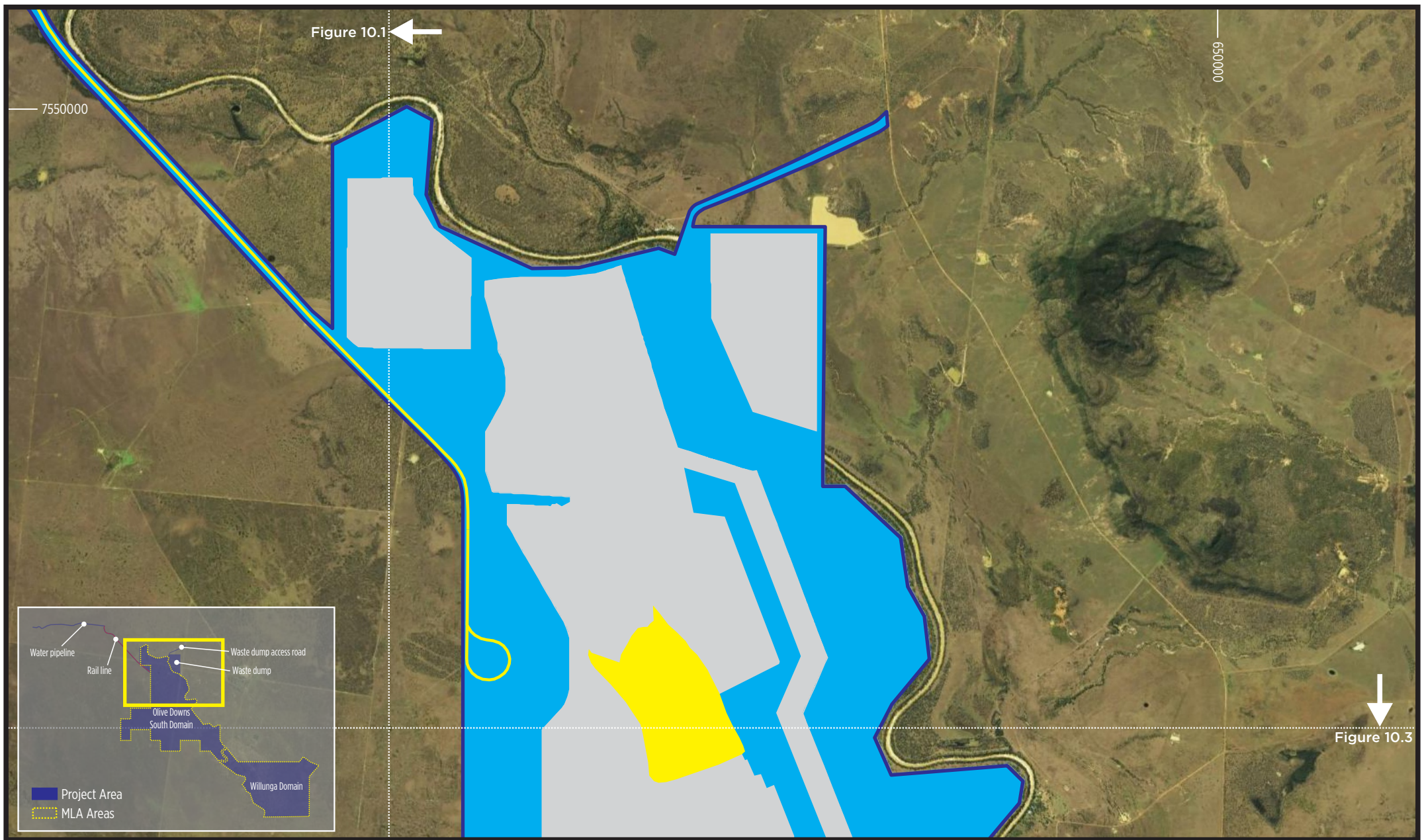


Figure 10.2: Post Mine - Beef Cattle Grazing

Legend

- Project Area
- Class 3
- Class 4
- Class 5

- Open cut mining and waste dump areas
- Class 3 - Slope >70% of the land is <10% slope of land surface
- Class 4 - Slope >30% of the land has slope in the range 10-15% with <10% exceeding 15% of land surface

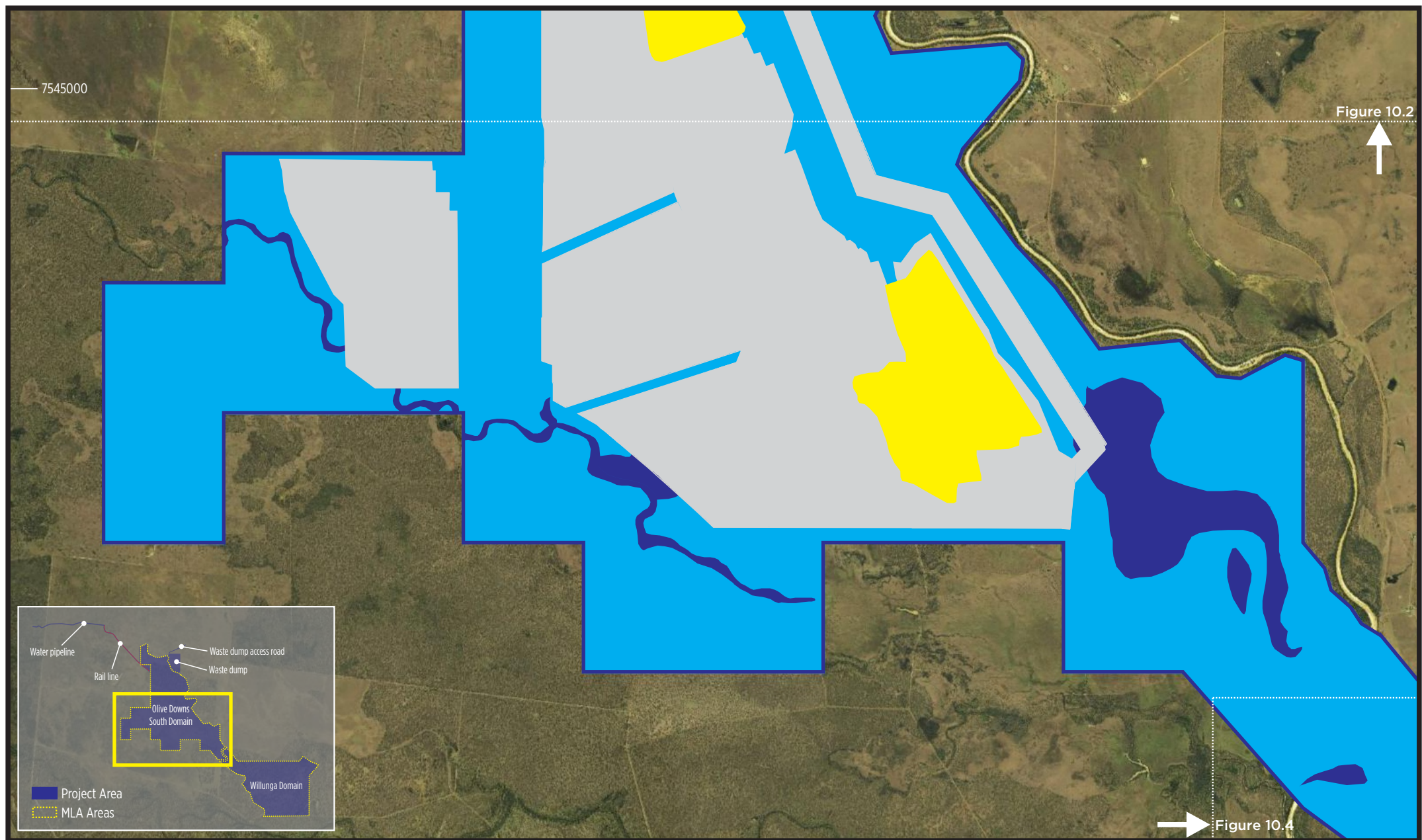


Figure 10.3: Post Mine - Beef Cattle Grazing

Legend

- Project Area
- Class 3
- Class 4
- Class 5

- Open cut mining and waste dump areas
- Class 3 - Slope >70% of the land is <10% slope of land surface
- Class 4 - Slope >30% of the land has slope in the range 10-15% with <10% exceeding 15% of land surface

Figure 10.2



Figure 10.4



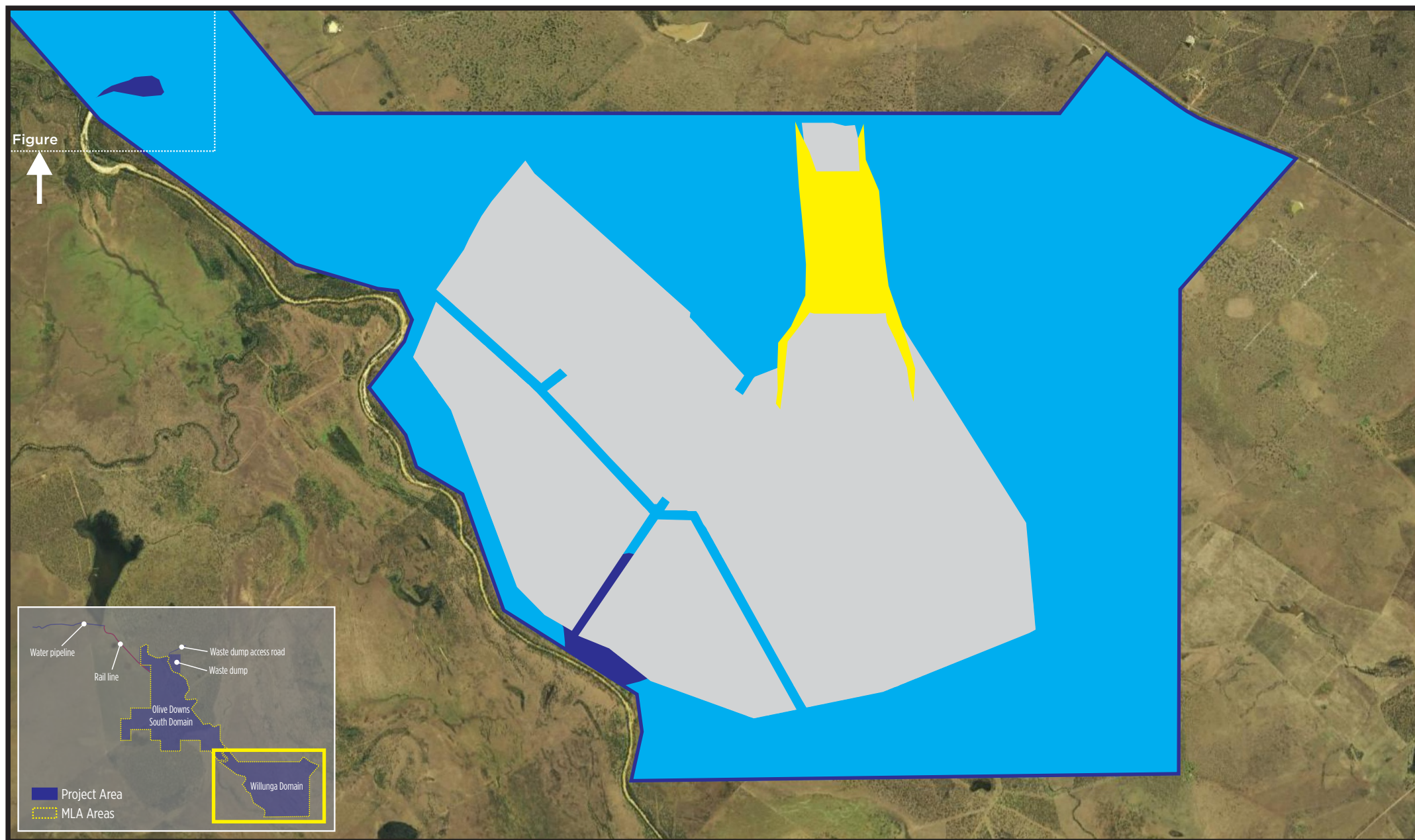
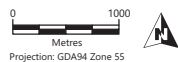


Figure 10.4: Post Mine - Beef Cattle Grazing

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29/06/2018



Soils and Land Suitability Assessment
OLIVE DOWNS COKING COAL PROJECT

14 ATTACHMENTS

Attachment 1 Contaminated Land Site Inspection

Contaminated Land Site Inspection

Olive Downs Coking Coal Project

Version 6

Pembroke Olive Downs Pty Ltd
10 July 2018



GTenvironmental

PO Box 2462, New Farm, QLD 4005
www.gtenvironmental.com.au

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Name of document:	Contaminated Land Site Inspection

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EXECUTIVE SUMMARY

GT Environmental Pty Ltd was commissioned by Pembroke Olive Downs Pty Ltd (Pembroke) to complete a Contaminated Land Site Inspection of the Olive Downs Coking Coal Project (the Project).

The Project includes a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres south-east of Moranbah, Queensland. The Project is comprised of the Olive Downs South domain (Mining Lease Application [MLA] 700032 and MLA 700033) and Willunga domain (MLA 700034), associated linear infrastructure (MLA 700035), waste dump (MLA 700036) and an electricity transmission line.

This Contaminated Land Site Inspection focused on the Olive Downs South, Willunga domains and associated linear infrastructure however, excluded Old Bombandy property located at the south of the Project.

The following conclusions were made:

- A search of the regulatory records; Environmental Management Register (EMR) and Contaminated Land Register (CLR) on 15 March 2017, 31 January 2018 and 1 February 2018, reported that the eleven properties associated with the Project are not included on the EMR or CLR.
- Fifteen points of interest were identified which included a cattle dip, a cattle yard with potential spray race unit, gas extraction wells, retention ponds, unlabelled and labelled drums, generators and above ground storage tanks. A risk assessment was conducted on points of interest located within or nearby proposed disturbance areas with the following recommended:
 - Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling is conducted. Stage 2 and 3 Environmental Site Assessments (ESAs) are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling is conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling if staining is observed. Identification and potential preliminary water samples for appropriate discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.

- The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.
- The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental assessments (i.e. prior to disturbance).

1 INTRODUCTION

1.1 Project Details

Pembroke Olive Downs Pty Ltd (Pembroke) proposes to develop the Olive Downs Coking Coal Project (the Project), a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland. The Project provides an opportunity to develop an open cut metallurgical coal resource within the Bowen Basin mining precinct that can deliver up to 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Project comprises the Olive Downs South (Mining Lease Application [MLA] 700032 and MLA 700033) and Willunga (MLA 700034) domains, associated linear infrastructure corridors (MLA 700035), waste dump (MLA 700036) and an electricity transmission line (ETL). The ETL is not included as part of this Contaminated Land Site Inspection.

The coal resource would be mined by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal. Up to 20 Mtpa of run-of-mine (ROM) coal would be extracted over the anticipated Project operational life of approximately 79 years.

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke to complete a Contaminated Land Site Inspection including an on-site inspection to identify potential contaminated land points of interest.

This Contaminated Land Site Inspection focused on the Olive Downs South and Willunga domains, linear infrastructure. The Old Bombandy property was excluded due to access restrictions at the time of fieldworks.

1.2 Scope of Report

The report provides a desktop and site inspection for potentially contaminated land at the Project and includes:

- Search and review of historical and current information relating to the site from the following sources:
 - Review of information held by Pembroke which includes State Government Environmental Management and Contaminated Land Registers (EMR/CLR).
 - Google earth aerial imagery of the Project.
- Site inspection including the identification of potential on and off-site sources of contamination, assess the nature and location of buildings and infrastructure, condition of the property, adjoining areas, interview of site personnel and current conditions; and
- Detailing the findings of the site inspection and recommendations, for further works.

2 SITE DESCRIPTION

2.1 Site Identification and Description

The site comprises of eleven lots and plans over seven properties within the Isaac Regional Council area, formerly Broadsound Shire Council area. The site details are summarised below in Table 1.

Table 1: Site Details

Details	Data	Comment
Site Titles	Lot 11 Plan KL135	Iffley
	Lot 9 Plan CNS98	Vermont Park
	Lot 8 Plan KL95	Willunga
	Lot 7 Plan KL96	Seloh Nolem
	Lot 9 Plan KL97	Old Bombandy
	Lot 4 Plan CNS15	Wynette
	Lot 5 Plan CNS90	Wynette, Winchester Downs
	Lot 15 Plan CNS111	Wynette
	Lot 8 Plan SP277384	Winchester Downs
	Lot 9 Plan GV33	Reserve
	Lot 2 Plan CNS77	Railway
Mineral Development Licences	277, 3012, 3013 and 3014	-
Adjacent Mineral Development Licences	183, 429, 519 and 3001	These MDLs are not within the site area but are adjacent to the Project.
Exploration Permit for Coal	649, 676, 688, 721, 755, 850, 1949 and 1951	-
Petroleum Lease	488	-
Authority to Prospect	759, 1031 and 1103	-
Local Government	Isaac Regional Council	-
Site Area	25,300 hectares	-

2.1.1 Surrounding Land Use

The surrounding land uses are broadly summarised in Table 2 below.

Table 2: Site Details

Detail	Comment
North	Grazing properties, woodlands and mining operations (Moorvale Mine)
East	Grazing properties and woodlands
South	Grazing properties, woodland and mining operations (Lake Vermont Mine)
West	Grazing properties, woodland and mining operations (Peak Downs Mine and Saraji Mine)

2.1.2 Topography and Hydrology

The landscape of the Project includes level plains to gently undulating plains with elevations of approximately 200 metres (m) Australian Height Datum (AHD). The overall elevation of the Project ranges from 150m AHD in the low-lying southeast of the Project to 250m AHD in the higher areas to the north of the Project (Queensland Government 2016).

The Project is bordered by a cluster of small mountains to the north-east, approximately 400m high, as well as a range of low-lying mountains ranging from 300-400m high, 10km to the south-west of the Project.

The Olive Downs South domain is located to the south and west of the Isaac River. The Willunga Domain is located to the north and east of the Isaac River, further downstream of the Olive Downs South domain.

The Project is located in the Isaac Connors Groundwater Management Area defined under the *Water Resource (Fitzroy Basin) Plan, 2011* under the *Queensland Water Act, 2000*. The hydrogeological conceptualisation suggests that the coal resource is consistent with previous studies in the region, and is a confined and semi-confined porous rock groundwater system.

2.1.3 Regional Geology

Regional mapping of the Project shows the Fair Hill and Rangal formations in the north of the Project, and Rewan and Blackwater formations in the south and east of the Project.

Broad scale geology undertaken by the superseded Department of Environment and Resource Management (DERM) in 2011 indicates the Project is dominated by Tertiary sediments, Cainozoic alluvium, as well as Mesozoic sediments (Raymond and McNeil 2011).

Soils mapping of the Land of Isaac Comet (Gunn et al. 1967) details substrate geology as tertiary sandstone, weathered tertiary clays and clay plains.

3 DESKTOP REVIEW

The following desktop review was undertaken for the Project.

3.1 Regulatory Records Sources

In accordance with the requirements of the Queensland *Environmental Protection Act 1994*, the Department of Environment and Science (DES) maintains registers of sites identified as having previous or current notifiable activities or contaminated by a hazardous contaminant.

The EMR identifies *low-risk* sites that have been used for an activity which is likely to cause land contamination, while the CLR identifies 'risk' sites; land identified by the Environment Protection Authority (EPA) as requiring remediation.

Table 3 summaries the searches conducted on 15 March 2017, 31 January 2018 and 1 February 2018, for the following eleven sites associated with the Project. Searches are included in Appendix A.

Table 3: Project EMR and CLR Search Results

Site	EMR	CLR
Lot 11 Plan KL135	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan CNS98	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 8 Plan KL95	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 7 Plan KL96	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan KL97	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot4 Plan CNS15	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot5 Plan CNS90	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 15 Plan CNS111	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 8 Plan SP277384	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan GV33	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 2 Plan CNS77	The site is NOT included on the EMR	The site is NOT included on the CLR

3.2 Aerial Photograph Review

Aerial imagery of the site was sourced from Google Imagery (Google Earth™) (2017). The imagery was reviewed to highlight any residential or grazing facilities, structures, water sources, discolouration of landforms, vegetation loss and/or significant development prior to arriving onsite.

It was noted that several cleared areas and water dams were visible with access roads throughout the Project.

3.3 Previous Environmental Investigations

GTE have not been provided with existing environmental reports relating to the Project. No further desktop assessment was undertaken prior to arriving on-site.

4 SITE INSPECTION

A site inspection was carried out by GTE during the Soils and Land Suitability Assessment inspections over the dates 17 to 26 June 2017, 7 to 16 July 2017, 27 July to 5 August 2017 and 24 to 26 November 2017. The purpose of the inspection was to document the environmental condition of the site, review historical and current activities, and identify points of interest of potential contaminated land.

4.1 Site Inspection

The Project site is used predominantly for beef cattle grazing across all properties. Land has been largely cleared, with some areas of limited to no clearing as evidenced by the type and density of vegetation. All points of interest highlighted within the aerial photography review were accessed.

Anecdotal evidence supplied by Pembroke and contractors Zeewood highlighted an early settlement immediately outside the Project boundary within the property Seloh Nolem.

A total of fifteen (15) points of interest were identified during the desktop and site inspection and were inspected, field notes recorded and photographed. These are summarised in Table 4 below, detailed in Section 4.1.1 to Section 4.1.15 and locations are presented in Figure 1.

Table 4: Summary of Points of Interest

Site	Date Inspected	Main Point of Interest
CL1	7/7/2017	Cattle yard, Cattle dip
CL2	8/7/2017	Cattle yard
CL3	10/7/2017	Old 205L drums
CL4	12/7/2017	Old 205L drum
CL5	13/7/2017	Gas extraction wells
CL6	13/7/2017	Retention pond, gas extraction well, generator
CL7	14/7/2017	Water tank, small petrol pump, fuel, old 205L drums
CL8	14/7/2017	Cattle yard
CL9	14/7/2017	Gas extraction well
CL10	14/7/2017	Water dam, combustible liquid above ground storage tank, power generator
CL11	14/7/2017	Test well location
CL12	14/7/2017	4 inch petrol pump
CL13	28/7/2017	Cattle yard with potential spray race unit
CL14	2/8/2017	Historic residence
CL15	25/11/2017	Generator

4.1.1 Point of Interest: CL1

Table 5 summarises point of interest CL1.

Table 5: Point of Interest: CL1

Site	CL1	Location (GDA94)	639544 mE 7535383 mS
Main Observations / Nature of Activities	Cattle yard containing a cattle dip approximately a quarter full. Three (3) unlabelled empty 205L drums. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs	 		

4.1.2 Point of Interest: CL2

Table 6 summarises point of interest CL2.

Table 6: Point of Interest: CL2

Site	CL2	Location (GDA94)	645302 mE 7535143 mS
Main Observations / Nature of Activities	Cattle yards containing cattle crush. Two (2) unlabelled empty 205L drums. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.3 Point of Interest: CL3

Table 7 summarises point of interest CL3.

Table 7: Point of Interest: CL3

Site	CL3	Location (GDA94)	645210 mE 7535047 mS
Main Observations / Nature of Activities	Two (2) labelled empty 205L drums (20W40).		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	One above ground storage tank. Contents unknown, appears to be a water tank.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.4 Point of Interest: CL4

Table 8 summarises point of interest CL4.

Table 8: Point of Interest: CL4

Site	CL4	Location (GDA94)	638285 mE 7536088 mS
Main Observations / Nature of Activities	One (1) unlabelled 1/8 205L drum.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.5 Point of Interest: CL5

Table 9 summarises point of interest CL5.

Table 9: Point of Interest: CL5

Site	CL5	Location (GDA94)	648404 mE 7532876 mS
Main Observations / Nature of Activities	Two gas extraction wells.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.6 Point of Interest: CL6

Table 10 summarises point of interest CL6.

Table 10: Point of Interest: CL6

Site	CL6	Location (GDA94)	649082 mE 7532200 mS
Main Observations / Nature of Activities	Retention pond. Gas extraction well. Generator. Unable to enter site as per signage, observations were based upon the photographed position.		
Staining	Surface staining was not observed	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.7 Point of Interest: CL7

Table 11 summarises point of interest CL7.

Table 11: Point of Interest: CL7

Site	CL7	Location (GDA94)	648523 mE 7536304 mS
Main Observations / Nature of Activities	Disused above ground storage tank. Small capacity petrol generator. Fuel container (20L). Three (3) unlabelled 205L drums.		
Staining	Surface staining was observed at the generator.	Odours	Hydrocarbon odours were present.
Vegetation	Semi-cleared, no visible signs of vegetation distress.	Surface	Unsealed surface with a small concrete pad
Above Ground Storage Tanks	Disused, partially deconstructed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	Delo 400 20L container observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs	 		

4.1.8 Point of Interest: CL8

Table 12 summarises point of interest CL8.

Table 12: Point of Interest: CL8

Site	CL8	Location (GDA94)	646176 mE 7540302 mS
Main Observations / Nature of Activities	Cattle yards and cattle crush. No cattle dip or spray race observed One (1) unlabelled empty 205L drum. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.9 Point of Interest: CL9

Table 13 summarises point of interest CL9.

Table 13: Point of Interest: CL9

Site	CL9	Location (GDA94)	643189 mE 7542966 mS
Main Observations / Nature of Activities	Gas extraction well.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.10 Point of Interest: CL10

Table 14 summarises point of interest CL10.

Table 14: Point of Interest: CL10

Site	CL10	Location (GDA94)	643364 mE 7543350 mS
Main Observations / Nature of Activities	Dam (water). Combustible liquid above ground storage tank. Power generator.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	Combustible liquid above ground storage tank.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.11 Point of Interest: CL11

Table 15 summarises point of interest CL11.

Table 15: Point of Interest: CL11

Site	CL11	Location (GDA94)	643407 mE 7544940 mS
Main Observations / Nature of Activities	Test well location.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.12 Point of Interest: CL12

Table 16 summarises point of interest CL12.

Table 16: Point of Interest: CL12

Site	CL12	Location (GDA94)	646328 mE 7538794 mS
Main Observations / Nature of Activities	Four inch petrol pump. Two (2) x above ground storage containers (water). One (1) x disused tank.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	Two (2) large modern water containers. One (1) disused tank.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.13 Point of Interest: CL13

Table 17 summarises point of interest CL13.

Table 17: Point of Interest: CL13

Site	CL13	Location (GDA94)	659655 mE 7524911 mS
Main Observations / Nature of Activities	Cattle yard, potentially used with a spray race unit and cattle crush. Four (4) unlabelled empty 205L drums. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.14 Point of Interest: CL14

Table 18 summarises point of interest CL14.

Table 18: Point of Interest: CL14

Site	CL14	Location (GDA94)	652310 mE 7529877 mS
Main Observations / Nature of Activities	Historic Residence. Historic Water tank <100m nearby.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.15 Point of Interest: CL15

Table 19 summarises point of interest CL15.

Table 19: Point of Interest: CL15

Site	CL15	Location (GDA94)	634066 mE 7550414 mS
Main Observations / Nature of Activities	Generator / Water pump. One (1) 205L drum.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Semi-cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

5 ENVIRONMENTAL ASSESSMENT

5.1 Project Site Contaminated Land Site Inspection

The inspection of the Project presented various areas of potential contamination related to beef cattle grazing, associated agricultural activities and existing infrastructure, including:

- a cattle dip;
- a cattle yard with potential spray race unit;
- gas extraction wells;
- retention ponds.
- unlabelled/labelled 205L drums;
- generators and associated fuel sources; and
- above-ground storage tanks.

Contaminates of concern relating to these points of interest may include, but are not limited to:

- heavy metals including, arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn);
- chemicals/pesticides (such as DDD/DDT/DDE);
- organochlorine pesticides (OC's) and organophosphorus pesticides (OP's); and
- benzene, toluene, ethylbenzene and xylene (BTEX) chemicals and hydrocarbons.

5.2 Project Site Disturbance and Further Assessment

Table 20 assesses if points of interest based on their position are within the Project disturbance footprint and if further assessment is required.

Table 20: Points of Interest within Disturbance Areas

Site	Area Proposed to be Disturbed	Recommendation
CL1	Yes (infrastructure)	Further investigation recommended
CL2	Yes (open cut)	Further investigation recommended
CL3	Yes (open cut)	Further investigation recommended
CL4	Yes (open cut)	Further investigation recommended
CL5	No	No further investigation required.
CL6	No	No further investigation required.
CL7	No	No further investigation required.
CL8	No	No further investigation required.
CL9	Yes (open cut)	Further investigation recommended
CL10	Yes (open cut)	Further investigation recommended
CL11	Yes (out of pit waste rock emplacement)	Further investigation recommended

Site	Area Proposed to be Disturbed	Recommendation
CL12	No	No further investigation required.
CL13	Yes (open cut)	Further investigation recommended
CL14	No	No further investigation required.
CL15	Yes (infrastructure)	Further investigation recommended

Review of the current disturbance plan highlights that nine (9) points of interest (CL1, CL2, CL3, CL4, CL9, CL10, CL11, CL13 and CL15) are within the Project disturbance footprint.

The points of interest identified above within disturbed areas were assessed against a preliminary risk assessment based upon the Australian and New Zealand Standard (AS/NZS) ISO 31000:2009 *Risk management – Principles and guidelines*. These guidelines consider the source, the likelihood of exposure and the potential receptors. This is outlined within Section 5.4.

Sites that are not predicted to be disturbed will be kept on a register of potentially contaminated sites. Prior to undertaking work that may impact these sites, further investigation would be undertaken.

5.3 Project Site Areas outside of GTE Site Inspection

The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental inspections (i.e. prior to disturbance).

5.4 Preliminary Risk Assessment

Assessing the available information gathered through the site inspection, the preliminary risk assessment identifies the likelihood of the hazard causing harm (injury and/or environmental damage) and the severity of that harm. In order to assess this, the following was undertaken;

- Evaluation of the likelihood and the severity of harm occurring using the risk matrix to assign a risk rating. The following risk matrix assigns a risk category from 1 to 5 (Minor to Catastrophic) to indicate the potential risk to human health or the environment;
- Identify factors that may contribute to the risk; and
- Where applicable, review health and safety information that is relevant to the particular hazard.

The preliminary risk assessment considered the potential contaminating activity, the quantities of potentially contaminated materials observed and the condition of the points of interest. As outlined in Section 5.2, points of interest within the disturbance areas are considered primarily for review with remaining points of interest outside of disturbance areas not assessed. Consideration of the likelihood of harm from the potential contamination and potential receptors (local waterways, groundwater aquifers, workforce and nearby residents) were also considered.

The contaminant to pathway to receptor model is shown below in Table 21 to inform preliminary risk assessment.

Table 21: Contaminant Pathway to Receptor Model

Source		Pathway		Receptor
Cattle dip Cattle yard with potential spray race unit 205L Container drums Gas extraction wells Generators Retention ponds Above ground storage tanks	>	Leaching Migration Dermal Inhalation	>	Groundwater Surface water Fauna Flora Workforce Residents

5.4.1 Preliminary Risk Matrix

The following risk matrix presented in Table 22 is based upon AS/NZS ISO31000:2009 to assess the risk ratings for the preliminary risk assessment in Section 5.4.2.

Table 22: Preliminary Risk Matrix

Potential Consequence or Impacts		Likelihood				
		Almost Certain (A)	Highly Likely (B)	Likely (C)	Possible (D)	Very Unlikely (E)
Hazard Severity		Several times per month	Once per month	Once per year	Once every 10-20 years	Once every 100 years
Minor (1)	Near miss with minor potential consequence.	Medium	Medium	Low	Low	Low
Significant (2)	Doctor treatment injury. Short term environmental damage.	High / Medium	Medium	Medium	Low	Low
Serious (3)	Lost time injury or non-life threatening health issue. Serious environmental damage.	High	High / Medium	Medium	Medium	Low
Major (4)	Single fatality or extreme injury or permanent health issue. High level environmental damage.	High	High	High / Medium	Medium	Medium
Catastrophic (5)	Multiple fatalities, long term environmental damage. High level prosecution expected.	High	High	High	High / Medium	Medium

5.4.2 Preliminary Risk Assessment Review and Recommendations

A preliminary risk assessment was conducted for the points of interest outlined in Section 5.2 that required further investigation using the preliminary risk matrix (Table 22). The results of the preliminary risk assessment are summarised in Table 23.

This review (based upon the desktop and field observations of the site inspection), will recommend whether further works, including Environmental Site Assessments (ESAs) (i.e. Stage 1 Preliminary Site Investigation, Stage 2 Detailed Site Investigation) and potential remediation plans are required. Detailed descriptions of recommendations are provided in Section 5.4.4.

Table 23: Preliminary Risk Assessment of Points of Interest

Point of Interest	Potential Contamination Source	Potential Pathway/s	Potential Receptor/s	Risk Rating Severity/ Likelihood	Recommendation
CL1	Cattle Dip	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	4/C – High/Medium	Stage 1 Preliminary Site Investigation including preliminary soil and water sampling. Stage 2 and 3 ESAs if significant contamination is identified and potential Stage 4 remediation action plan for the area would be prepared, if required.
CL2	Cattle Yard 205L Drums	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	1/D – Low	Interview with land owner/caretaker to identify chemical used (if any) onsite. Field observations during decommissioning of site. Stage 1 Preliminary Site Investigation and preliminary soil sampling if contamination is suspected.
CL3	Labelled 205L drums	Leaching, Migration.	Groundwater Surface water Flora, Fauna.	3/C Medium	Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling. Stage 2 and 3 ESAs if significantly contaminated and potentially Stage 4 remediation action plan for the area, would be prepared, if required.
CL4	Unlabelled 205L drum	Leaching, Migration.	Groundwater Surface water Flora, Fauna.	1/D Low	Stage 1 Preliminary Site Investigation inspection and if staining is observed beneath drum, preliminary soil sampling.
CL9	Gas extraction well	Leaching, Migration.	Groundwater Surface water.	1/D Low	Inspection of site during decommissioning of wells. Interviews with land owner/caretaker with respect to recorded environmental incidents onsite (i.e. hydraulic spills during construction).
CL10	Combustible liquid above ground storage tank Generator Water dam	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	3/C Medium	Stage 1 Preliminary Site Investigation inspection and preliminary borehole soil sampling if staining is observed. Identification and potential preliminary water sampling for appropriate discharge of water (if present). Stage 2 and 3 ESAs if significantly contaminated and potentially Stage 4 remediation action plan for the area would be prepared, if required.

Point of Interest	Potential Contamination Source	Potential Pathway/s	Potential Receptor/s	Risk Rating Severity/ Likelihood	Recommendation
CL11	Test extraction well	Leaching, Migration.	Groundwater, Surface water.	1/D Low	Inspection of site during decommissioning of wells. Interviews with land owner/caretaker with respect to recorded environmental incidents onsite (i.e. hydraulic spills during construction).
CL13	Cattle yard with potential spray race unit	Leaching, Migration.	Groundwater, Surface water, Flora, Fauna.	1/D Low	Interviews with land owner/caretaker with respect to activities undertaken onsite. Stage 1 Preliminary Site Inpreliminary soils samples if cattle spray race activities were conducted at point of interest.
CL15	Generator 205L Drum	Leaching, Migration, Dermal.	Groundwater, Surface water, Flora, Fauna, Workforce.	1/D Low	Inspection of generator area for staining. If staining is observed, Stage 1 Preliminary Site Investigation and preliminary soil sampling to be undertaken.

5.4.3 Review of Preliminary Risk Assessment

A review of the nine (9) points of interest conducted in Section 5.4.2 within or nearby proposed disturbance areas assessed the following:

- Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling are conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
- Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling are conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
- Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling are conducted if staining observed. Identification and potential preliminary water samples for appropriate discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
- The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.

5.4.4 Description of Environmental Site Assessments

This section of the report will provide descriptions of the stages of ESAs. The recommendations provided in Section 5.4.2 determine which ESA stage is required prior to the disturbance of the point of interest.

Stage 1 – Preliminary Site Investigation

A Stage 1 Preliminary Site Investigation would build on the information contained in this report and include:

- development of a site history including aerial photographs, available borehole logs, cadastral maps, regional surface water, geology, topography, hydrogeology, historical titles, local government records, heritage listed items, interviews with land owners, caretakers.
- basic sampling program to determine if contamination is present; and
- summary of sampling program results.

Stage 2 – Detailed Site Investigation

A Stage 2 Detailed Site Investigation is required when the results of the Stage 1 Preliminary Site Investigation indicate potential or actual contamination (i.e. levels above investigation threshold values as described in *National Environment Protection (Assessment of Site Contamination) Measure* [National Environment Protection Council 1999] or other relevant guidelines). The detailed site investigation should delineate the lateral and vertical extent of contamination and provide the following:

- maximum and average concentrations of the various contaminants;
- volumes of soil requiring remediation;
- leachability and mobility of contaminants;
- potential for groundwater contamination; and
- possibility of off-site migration through soil, surface water or groundwater.

Stage 3 – Health and Environmental Assessment and Determination of Remediation Plan

The results obtained from the Stage 2 Detailed Site Investigation should be used to determine the potential human and environmental impact of the contaminants on the current and proposed land uses. If the land use would result in unacceptable levels of human exposure or unacceptable environmental effects, then a remediation plan to manage the contamination must be prepared by a Suitably Qualified Person.

The remediation plan is to include site-specific remediation criteria, to be developed based on a risk assessment.

Stage 2 and 3 ESAs are usually incorporated in one report for review before proceeding with Stage 4.

Stage 4 – Implementation of a remediation plan and validation sampling

The remediation plan is to be implemented prior to the site being impacted by the Project activities. Validation sampling is to be conducted to confirm that the site has been satisfactorily remediated as part of the remediation plan.

Statistical analyses of results should be provided in validation reports to confirm the site is no longer contaminated, or no longer poses an unacceptable health or environmental risk. Australian Standard (AS) 4482.1-2005 *Guide to the Sampling and Investigation of Potentially Contaminated Soil* and the *National Environment Protection (Assessment of Site Contamination) Measure* (National Environment Protection Council 1999) guideline on data collection are useful references to establish the sampling pattern and density required.

6 CONCLUSION

The following conclusions have been made:

- A search of the regulatory records; EMR and CLR on 15 March 2017, 31 January 2018 and 1 February 2018, reported that the eleven properties associated with the Project are not included on the EMR or CLR.
- Fifteen points of interest were identified including a cattle dip, a cattle yard with potential spray race unit, gas extraction wells, retention ponds, unlabelled and labelled drums, generators and above ground storage tanks. A preliminary risk assessment was conducted on the points of interest located within or nearby proposed disturbance areas with the following recommendations:
 - Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling are conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
 - Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling is conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling are conducted if staining is observed. Identification and potential preliminary water samples for appropriate discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.
- The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental assessments (i.e. prior to disturbance).

7 REFERENCES

- Department of Environment, Queensland (1998). *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*. Brisbane.
- Gunn, R.H., Story, R., Galloway, R.W. and Fitzpatrick, E.A. (1967) *Lands of the Isaac-Comet Area, Queensland*. Land Research Series No.19. CSIRO Publishing, Collingwood, Victoria.
- Google Earth™, Google Earth: Map Data Sciences Pty Ltd 2017.
- National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination) Measure*.
- Queensland Government (2016) *Queensland Globe*. Accessed via Google Earth.
- Raymond, M. A. A. and McNeil, V. H. (2011) *Regional Chemistry of the Fitzroy Basin Groundwater*. Brisbane: Department of Environment and Resource Management, Queensland Government.

8 GLOSSARY OF TERMS

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

BTEX. Chemicals including benzene, toluene, ethylbenzene and xylene.

CLR. Contaminated Land Register. It is a public register which contain information about contaminated land in Queensland. Contaminated land is moved from the EMR to CLR where it is necessary to take action to remediate the land to prevent serious environmental harm and protect human health or other aspect of the environment.

DDD. Dichlorodiphenyldichloroethane, a breakdown product of DDT.

DDE. Dichlorodiphenyldichloroethylene a breakdown product of DDT.

DDT. Dichlorodiphenyltrichloroethane, an organochlorine pesticide once used to control insects.

DERM. Department of Environment and Resource Management.

DES. Department of Environment and Science.

EMR. Environmental Management Register. It is a public register which contain information about contaminated land in Queensland. Land listed on the EMR if certain types of activities have been, or are being, carried out on the land, or if the land is contaminated land.

EPC Exploration Permit for Coal.

ESA. Environmental Site Assessment.

ETL. Electricity Transmission Line.

MLA. Mineral Lease Application.

MDL. Mineral Development Licence.

9 FIGURE

Figure 1 Contaminated Land Points of Interest

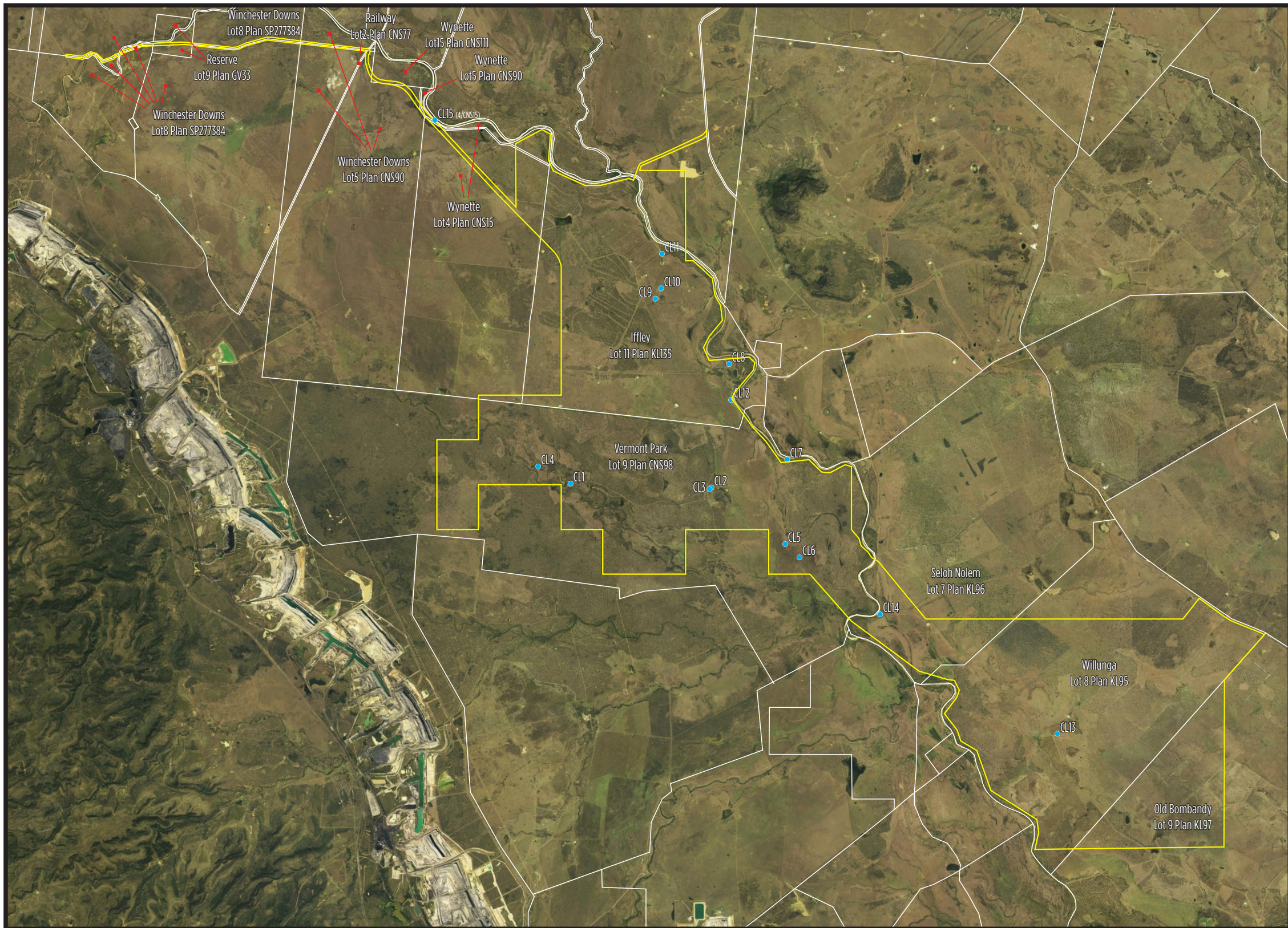
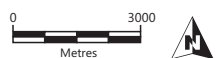


Figure 1: Contaminated Land Points of Interest

Legend

- Project Area
- Land Parcel Boundaries
- Contaminated Land Site Inspection

Revision 3
3/7/2018



10 APPENDICES

Appendix A

EMR/CLR Searches



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363394 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 11 Plan: KL135
1208 IFFLEY CONNECTION Road
VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363393 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 9 Plan: CNS98
PEAK DOWNS Highway
DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363392 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 8 Plan: KL95
FITZROY DEVELOPMENTAL Road
VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363391 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 7 Plan: KL96
937 IFFLEY CONNECTION Road
VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



Department of Environment and Heritage Protection (EHP)
ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363390 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 9 Plan: KL97
38877 FITZROY DEVELOPMENTAL Road
VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



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www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop
Suite 2 Level 3
24 McDougall Street
Milton QLD 4064

Transaction ID: 50363389 EMR Site Id: 15 March 2017
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 4 Plan: CNS15
ANNANDALE Road
DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

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www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop
3/24 McDougall Street
Milton QLD 4064

Transaction ID: 50433685 EMR Site Id: 31 January 2018
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 15 Plan: CNS111
ANNANDALE Road
DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



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GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop
3/24 McDougall Street
Milton QLD 4064

Transaction ID: 50433684 EMR Site Id: 31 January 2018
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 8 Plan: SP277384
831 PEAK DOWNS MINE Road
WINCHESTER

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



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ABN 46 640 294 485
400 George St Brisbane, Queensland 4000
GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop
3/24 McDougall Street
Milton QLD 4064

Transaction ID: 50433683 EMR Site Id: 31 January 2018
Cheque Number:
Client Reference:

This response relates to a search request received for the site:

Lot: 9 Plan: GV33
POITREL Road
COPPABELLA

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



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www.ehp.qld.gov.au

SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop
3/24 McDougall Street
Milton QLD 4064

Transaction ID: 50433682 EMR Site Id: 31 January 2018
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 2 Plan: CNS77
NORWICH PARK BRANCH RAILWAY
DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority



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GPO Box 2454, Brisbane QLD 4001, AUSTRALIA
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SEARCH RESPONSE
ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Tomas F MacKillop
3/24 McDougall Street
Milton QLD 4064

Transaction ID: 50433934 EMR Site Id: 01 February 2018
Cheque Number:
Client Reference:

This response relates to a search request received for the site:
Lot: 5 Plan: CNS90
ANNANDALE Road
DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated.
The EMR/CLR does NOT include:-

1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

Administering Authority

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15 APPENDICES

Appendix A

Detailed site descriptions

SITE 1

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638828 mE 7548435 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/06/2017
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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, 2% gently undulating plains	Poplar Box regrowth	Nil	Hard setting, 10-20% coarse fragments, 0- 50mm diameter	A1 0 – 0.14 Abrupt	Clayey Sand	Massive, loose	<5% coarse fragments	10YR3/2 Very dark greyish brown	Dry, rapid	Nil	0.05 / 7.0	No samples taken	Refusal at 0.53m BGL, two attempts at 0.05m
				B2 0.14 – 0.53	Sandy clay loam	Angular, firm	2% coarse fragments, 10 - 20 mm diameter	10YR3/2 Very dark greyish brown	Dry, well drained	Nil	0.4 / 7.5		

SITE 2

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638862 mE 7548002 mN	Aust. Soil Class: Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/06/2017
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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, upper slope, 1.5%	Poplar Box	Nil	Hard setting, no coarse fragments	A11 0 – 0.2 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/4 Dark yellow brown	Dry, rapid	Very fine, very few	0.05 / 6.5	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7 0.9 – 1.0	No additional observations
				A12 0.2 – 0.6 Gradual	Loamy sand	Massive, very weak	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 7.0		
				B2 0.6 – 1.0	Clay loam sandy	Subangular, very firm, 10mm	<2% manganese nodules	10YR4/3 Brown Mottle: 10YR5/8 30% Yellowish brown	Dry, imperfect	Nil	0.6 / 7.5 0.9 / 7.5		

SITE 3

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638715 mE 7547488 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/6/2014
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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, <2%	Morton Bay Ash, occasional Poplar Box	Nil	Soft, no coarse fragments	A11 0.0 – 0.20 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.20 – 0.52 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.3 / 7.0		
				B2 0.52 – 1.0	Clay loam sandy	Sub angular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 Yellowish brown, 20%	Dry, imperfect	Nil	0.8 / 7.0		

SITE 4

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639550 mE 7547598 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/6/2017
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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, upper slope, 2%	Poplar Box	Nil	Firm, no coarse fragments	A1 0 – 0.21 Diffuse	Loamy sand	Massive loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, very few	0.1 / 6.5	No samples taken	Isolated small area of Brigalow 100m away to the west
				B21 0.21 – 0.74 Abrupt	Sandy clay loam	Subangular, peds smaller than site 3, Very firm	<5% coarse fragments 2- 10mm diameter	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 6.5 0.6 / 7.5		
				B23 0.74 – 1.0	Clay loam sandy	Subangular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 2% Yellowish brown	Dry, rapid	Nil	0.9 / 8.0		

SITE 5

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638652 mE 7546697 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/6/2017
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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, <2%	Morton Bay Ash, occasional Poplar Box	Nil	Soft, no coarse fragments	A11 0.0 – 0.22 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.22 – 0.52 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.3 / 7.0		
				B2 0.52 – 1.0	Clay loam sandy	Sub angular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 Yellowish brown, 20%	Dry, imperfect	Nil	0.9 / 7.0		

SITE 6

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639484 mE 7545992 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/6/2017
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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, 3% gently undulating plains	Poplar Box regrowth	Nil	Hard setting, 10-20% coarse fragments, 0- 50mm diameter	A1 0 – 0.26 Abrupt	Sandy loam	Massive, loose	<5% coarse fragments	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.05 / 7.0	No samples taken	Refusal at 0.5m, with refusal at a further two attempts; 0.53m and 0.35m
				B21 0.26 – 0.35 Abrupt	Sandy clay loam	Angular, firm	2% coarse fragments, 10 - 20 mm diameter	10YR3/2 Very dark grayish brown	Dry, well drained	Nil	0.3 / 7.0		
				B22 0.35 – 0.5	Clay loam sandy	Sub angular, firm	Nil	10YR4/3 Brown	Dry, imperfect	Nil	0.4 / 7.5		

SITE 7

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639705 mE 7547057 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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, Undulating plain, midslope 3%	Poplar box 95%, Moreton Bay Ash 5%, <40% coverage	Semi cleared	Soft to firm, no coarse fragments	A1 0 – 0.30 Abrupt	Clayey sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, fine	0.05 / 6.5	No samples taken	Refusal on root at 0.9m
				B21 0.3 – 0.5 Abrupt	Loamy sand	Massive, 90% peds, very weak	<5% coarse fragments & white nodules 2- 6mm	10YR3/3 Dark brown	Dry, rapid	Nil	0.4 / 7.0		
				B22 0.5 – 0.9	Loamy sand	Moderate, peds 2- 10mm, weak	<2% black nodules & coarse fragments 2-15mm	10YR3/6 Mottle: 10YR5/8 20% Yellowish brown	Dry, imperfect	Nil	0.8 / 7.0		

SITE 8

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 640823 mE 7547668 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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, upper slope, <1%	Sparse tall trees, gums, Blackbutt	Semi cleared	Firm, no coarse fragments	A1 0 – 0.23 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown No mottles	Dry, well drained	Very fine, few	0.1 – 6.5	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7 0.9 – 1.0	No additional observations
				B21 0.23 – 0.57 Gradual	Loamy sand	Weak to moderate, very weak, peds <10mm	Nil	10YR3/3 Dark brown No mottles	Dry, humid	Nil	0.3 / 6.5		
				B22 0.57 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	7.5YR4/4 Dark Brown No mottles	Dry, humid	Nil	0.6 / 7.0 0.9 / 6.5		

SITE 9

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641896 mE 7547883 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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 inclined 1%	Ironbark white gums	Cleared area backing onto bushland	Firm, no coarse fragments	A1 0.0 – 0.2 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
				B21 0.2 – 0.4 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.4 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	7.5YR4/4 Brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 6.5		

SITE 10

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641130 mE 7547096 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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, upper slope 2%	Various tall trees; Moreton Bay Ash, Poplar Box, Gums.	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
				B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

SITE 11

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642402 mE 7546766 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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 2%	Sparse, tall woodlands - White gums, Moreton Bay Ash	Semi cleared	Soft, no coarse fragments	A1 0.0 – 0.21 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, fine	0.1 – 6.5	No samples taken	No additional observations
				B21 0.21 – 0.53 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 6.5		
				B22 0.53 – 1.0	Clayey sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	One medium root 5mm thick found	0.6 / 7.0 0.9 / 7.0		

SITE 12a

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640307 mE 7546621 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage.	Cracking with crust	A1 0.00 – 0.09 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7 0.8 – 0.9	Refusal at 0.9m due to rock/s.. Site located in depression
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 12b

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, June	Location (GDA ZONE 55): 640307 mE 7546621 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 19/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7 0.9 – 1.0	Site located in melon hole mount, 3 metres from 12a
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 13

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640848 mE 7545856 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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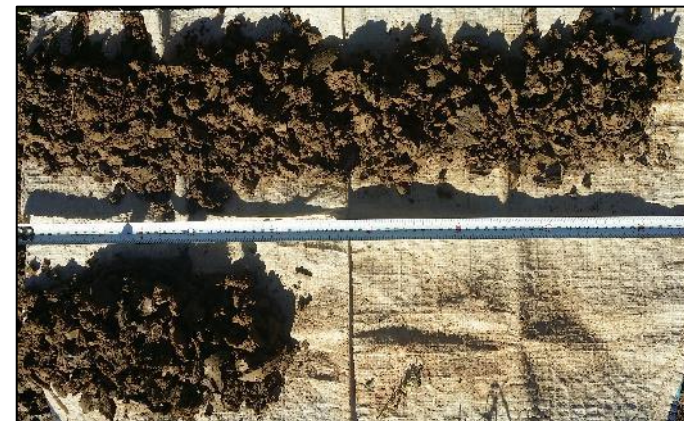
Landscape



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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00– 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 14

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 641257 mE 7545271 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Moderate, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located on melon hole mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 15

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639357 mE 7545231 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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, no coarse fragments	A11 0.0 – 0.22 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	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	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 Mottle: 2.5YR4/6 Red	Dry, imperfectly drained	Nil	0.9 / 7.0		

SITE 16

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 640064 mE 7545157 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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, wide depression	Blackbutt, Ironbark, white gums	Semi cleared	Firm, no coarse fragments, light grey colour compared with light yellow grey surface 50m to the north and south	A1 0.0 – 0.45 Diffuse	Silty loam	Massive, very weak	<2%, 0.5 – 1mm coarse fragments	10YR2/1 Black	Dry, well drained	Very fine, very few to 0.15m	0.0 / 7.0 0.3 / 7.0	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7 0.9 – 1.0	No additional observations
				B2 0.45 – 1.0	Clayey sand	Weak, 1- 20mm peds, weak	Black nodules <2% and coarse fragments <5%	10YR4/2 Dark greyish brown Mottle: <5% 10YR5/2 greyish brown And <2% 10YR4/6 Dark yellow brown	Dry, Imperfectly drained		0.6 / 7.0 0.9 / 7.0		

SITE 17

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt,	Location (GDA ZONE 55): 640643 mE 7544470 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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, 2.5% mid-slope	Mostly Ironbark and Bloodwood, <5% Moreton Bay Ash	Nil	Hard setting, <2% black nodules and coarse fragments 2- 6mm diameter	A11 0.0 – 0.36 Abrupt	Loamy Sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown No mottle	Dry, rapid	Very few, very fine	0.10 / 7.0	0.00 – 0.10 0.36 – 0.46 0.60 – 0.70 0.90 - 100	No additional observations
				A12 0.36 – 0.47 Abrupt	Loamy sand	Weak 1- 10mm peds, subangular, Weak strength	<2% black nodules	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.36 / 6.5		
				B2 0.47 – 1.0	Silty clay loam	Weak 1- 10mm peds, moderate strength	<5% black nodules and coarse fragments	10YR4/4 Dark yellowish brown Mottles: <5% 10YR6/8 Brownish yellow <2% 2.5YR4/6 Red	Dry, well drained	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 18

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 641888 mE 7546236 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.1m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 19

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 641954 mE 7545569 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 20/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 20

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 642873 mE 7545626 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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, opening depression / swamp conditions due to landform	Brigalow / tall sparse woodlands	<20% minor normal gilgai	Cracking, poached	A1 0.00 – 0.27 Diffuse	Light clay	Weak, peds 1-10mm, sub- angular, strength – firm	<2% black nodules 1-5mm	10YR3/2 Very dark greyish brown	Dry, well drained	Few, very fine	0.00 / 6.5	No samples taken	No additional observations
				B2 0.27 – 1.00	Light clay	Moderate, peds 1- 20mm, sub- angular, strength- Very firm	<2% black nodules 1-5mm	10YR3/2 Very dark greyish brown	Slightly moist, well drained	Few, very fine	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 21

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 642493 mE 7544291 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00– 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.85m	0.05 – 6.5	No samples taken	No recovery at 0.85m
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		Site located in melon hole depression,

SITE 22

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 643330 mE 7542927 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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	Brigalow regrowth, 70%+ coverage	Melon holes approx.. 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Moderate, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.1m	0.0 – 6.5	No samples taken	Site located in melon hole depression,
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 23

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644793 mE 7544494 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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% slope	Blackbutt, minor Poplar Box & Moreton Bay Ash, long grass	Nil	Soft, no coarse fragments	A1 0.0 – 0.22 Abrupt	Clayey sand	Weak, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, very fine	0.1 – 6.5	No samples taken	No additional observations
				B21 0.22 – 0.49 Abrupt	Loamy sand	Weak, very weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.3 / 6.5		
				B22 0.49 – 1.00	Clayey sand	Moderate, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.6 / 7.0 0.9 / 6.5		

SITE 24

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 645525 mE 7543737 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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% slope	Moreton Bay Ash, Blackbutt, gums, long grass	Nil	Soft, no coarse fragments	A1 0.00 – 0.30 Abrupt	Silty loam	Weak, weak	Nil	10YR2/1 Black	Dry, rapid	Very fine, few	0.1 – 6.5	0.00 – 0.10 0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	No additional observations
				B21 0.30 – 0.58 Abrupt	Clay loam	Moderate, weak	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	0.3 / 6.5		
				B22 0.58 – 1.00	Clay loam	Moderate, weak	<2% black nodules	7.5YR2.5/3 Very dark brown	Dry, well drained	Nil	0.7 / 7.0 0.9 / 6.5		

SITE 25a

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 644923 mE 7542220 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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 <1.0%	Sparse regrowth – Brigalow and other	Shallow linear gilgai, approx. 3m diameter x 0.3m deep, 20-30% coverage Mound	Cracking, <2% coarse fragments <5mm diameter	A1 0 – 0.21 Abrupt	Light clay	Weak, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	0.00 - 0.10 0.30 – 0.40 0.70 – 0.80 0.90 – 1.00	Site located in gilgai depression
				B21 0.21 – 0.68 Clear	Light clay	Weak, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0		
				B22 0.68 – 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

SITE 25b

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 644923 mE 7542220 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 21/6/2017
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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 <1.0%	Sparse regrowth – Brigalow and other	Shallow linear gilgai, approx. 3m diameter x 0.3m deep, 20-30% coverage Depression	Cracking, <2% coarse fragments <5mm diameter	A1 0 – 0.21 Abrupt	Light clay	Weak, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	0.00 – 0.10 0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	Site located on gilgai mound
				B21 0.21 – 0.76 Clear	Light clay	Weak, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0		
				B22 0.76 – 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

SITE 26a

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640146 mE 7543555 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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, <5mm cracks, 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 grayish brown	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	Dry, well drained	Nil	0.30 / 6.5 0.60 / 7.0 09.0 / 7.0		

SITE 26b

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640146 mE 7543555 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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, <5mm cracks, 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 grayish brown	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	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0	0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	

SITE 27

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 641169 mE 7543418 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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 – 0.27 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.27 – 0.51 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.51 – 1.00	Silty clay loam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 28

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 639637 mE 7542190 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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 grayish brown	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 grayish brown	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	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 29

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 642137 mE 7542156 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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 – 0.29 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken.	No additional observations
				A12 0.29 – 0.52 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.52 – 1.00	Silty clay loam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 30

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 641607 mE 7541014 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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, nearby gully mid slope 2%	Ironbark, Poplar Box, Moreton Bay Ash	Semi cleared	Hard setting, <5% coarse fragments <10mm	A11 0.00 – 0.23 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, medium	0.10 / 6.5	No samples taken	No additional observations
				A12 0.23 – 0.45 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.45 – 1.00	Silty clay loam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Humid, well drained	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 31

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639834 mE 7541276 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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, no coarse fragments	A1 0.00 – 0.13 Abrupt	Clayey sand	Weak, peds 2-10mm, weak	Nil	10YR3/3 Dark brown	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	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	Moderately moist, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 32

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 640566 mE 7540061 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 22/6/2017
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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 2.5%	Very sparse Poplar Box 100m+ away, Blackbutt, Gums	Extensive clearing	Hard settling, trampled surface, no coarse fragments	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.1 / 6.5	No samples taken	No additional observations
				A12 0.25 – 0.68 Abrupt	Loamy sand	Weak, very weak	Nil	10YR4/3 Brown	Dry, rapid	Very fine, very few	0.3 / 6.5 0.6 / 7.5		
				B2 0.68 – 1.00	Clay loam sandy	Moderate, subangular peds <20mm, firm	<2% coarse fragments 2- 5mm, black nodules	10YR4/4 Dark yellowish brown Mottle: 10YR5/8 Strong brown	Moderately moist, imperfectly drained	Nil	0.9 / 8.0		

SITE 33

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643054 mE 7539958 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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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, ridge, upper slope 1%	Sparse tall woodland, limited clearing with Poplar Box regrowth	Semi cleared	Hard setting, coarse fragments 5% 5mm diameter	A11 0.00 – 0.27 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	0.00 / 6.5	Very fine, few	No samples taken	No recovery at 0.75m, hard to auger
				A12 0.27 – 0.49 Abrupt	Loamy sand	Weak subangular peds <10mm, weak	<2% manganese nodules	10YR4/2 Dark grayish brown	Dry, well drained	0.30 / 6.5	Nil		
				B2 0.49 – 0.75	Clay loam sandy	Weak subangular peds <15mm, weak	<5% manganese nodules	10YR4/3 Brown Mottle: 10YR4/6	Dry, well- moderately drained	0.60 / 6.5	Nil		

SITE 34

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 639343 mE 7540015 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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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 gray	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 gray	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 grayish brown	Moderately moist, well to moderately drained	Nil	0.60 / 7.0		

Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.	Soil Profile Description								
				B23 0.81 – 1.05	Silty clay loam	Weak angular peds <10mm, firm	-	10YR4/2 Dark grayish brown	Dry, moderately moist	-	0.90 / 7.0	

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640332 mE 7538899 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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Soil Profile



Appendix A – Detailed Site Descriptions

Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.	Soil Profile Description									
				B23 0.80 – 1.05	Silty clay loam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, moderately moist	Nil	0.90 / 7.0		

SITE 36

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Juneee	Location (GDA ZONE 55): 642009 mE 7538199 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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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, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <10% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 – 0.18 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B21 0.18 – 0.70 Abrupt	Light clay	Moderate angular peds <20mm, firm	<5% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5		
				B22 0.70 – 1.00	Silty clay loam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 37

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 640780 mE 7538332 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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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, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <20% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 – 0.18 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B21 0.18 – 0.70 Abrupt	Light clay	Moderate angular peds <20mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5		
				B22 0.70 – 1.00	Silty clay loam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 38

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 642345 mE 7538845 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 23/6/2017
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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, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <20% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 – 0.17 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B21 0.17 – 0.70 Abrupt	Light clay	Moderate angular peds <20mm, firm	<5% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5		
				B22 0.70 – 1.00	Silty clay loam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 39

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 645889 mE 7539715 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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%	Mixed regrowth	Normal gilgai 30% coverage	Firm, cracking 5-15mm, thick crust	A1 0.00 – 0.17 Diffuse	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No recovery at 0.80m
				B21 0.17 – 0.60 Abrupt	Light clay	Moderate angular peds <20mm, firm	<2% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5		
				B22 0.60 – 0.80	Light clay	Weak angular peds <10mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 40

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 644357 mE 7539882 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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 <1.0%	Sparse regrowth – Brigalow and other	Shallow linear gilgai, approx. 3m diameter x 0.3m deep, 20-30% coverage	Cracking, <2% coarse fragments <5mm diameter	A1 0.00 – 0.21 Abrupt	Light clay	Moderate, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	No samples taken	No additional observations
				B21 0.21 – 0.68 Clear	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0		
				B22 0.68 – 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

SITE 41

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 646290 mE 7537672 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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	Brigalow and various regrowth	Melon holes 0.3-0.8m deep, 50% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	A1 0.00 – 0.17 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No recovery at 0.85m
				B2 0.17 – 0.85	Light clay	Moderate angular peds <20mm, firm	<2% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

SITE 42

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 646209 mE 7539072 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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	Brigalow and various regrowth	Melon holes 0.3-0.8m deep, 50% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	A1 0.00 – 0.20 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B2 0.20 – 1.00	Light clay	Moderate angular peds <20mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

SITE 43

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 647284 mE 7537230 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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, upper slope	Mixed woodland, Brigalow and Poplar Box	Nil	Hard setting, no coarse fragments	A11 0.00 – 0.14 Abrupt	Silty loam	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very fine, few	0.10 / 6.0	0.00 – 0.10 0.20 – 0.30 0.50 – 0.60	No recovery at 0.67m
				A12 0.14 – 0.36 Abrupt	Silty loam	Weak subangular, weak	Nil	7.5YR3/4 Dark reddish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.36 – 0.67	Loam	Weak subangular peds < 10mm, weak	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.60 / 6.5		

SITE 44

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645284 mE 7536971 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/6/2017
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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, mid slope 2%	Poplar Box	Nil	Firm, no coarse fragments	A11 0.00 – 0.24 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.24 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.89 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.89 – 1.00	Clay loam sandy	Subangular, very firm	Very hard, 10% red & white nodules and coarse fragments	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		

SITE 45

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643930 mE 7538329 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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 <2%	Various regrowth	Extensive cleared	Hard setting, coarse fragments 2- 5mm – 10- 20% coverage	A11 0.00 – 0.14 Abrupt	Loamy sand	Massive loose	<5% coarse fragments, 2-6mm	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.5	No samples taken	Refusal after three attempts at 0.45m
				A12 0.14 – 0.45	Loamy sand	Massive loose	<10% coarse fragments, 2-6mm	10YR4/2 Dark grayish brown	Dry, moderately well drained	Nil	0.30 / 6.5		

SITE 46

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 647017 mE 7536252 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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	Brigalow and various regrowth	Normal gilgai <0.3m deep 30% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	0.00 – 0.12 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				0.12 – 1.00	Light clay	Moderate angular peds <20mm, firm	<2% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

SITE 47

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645420 mE 7536076 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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, mid slope 2%	Poplar Box	Nil	Firm, no coarse fragments	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.25 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.92 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.92 – 1.00	Clay loam sandy	Subangular, very firm	<2% coarse fragments 2-6mm	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		

SITE 48

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645024 mE 7535576 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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, mid slope 2%	Poplar Box, some Moreton Bay Ash	Nil	Firm, no coarse fragments	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.25 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.88 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 7.0		
				B22 0.88 – 1.00	Clay loam sandy	Subangular, very firm	<2% coarse fragments 2-6mm	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		

SITE 49

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 643862 mE 7535154 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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, mid slope 2%	Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.10 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown No mottles	Dry, rapid	Very fine, very few	0.05 / 6.5	0.00 – 0.05 0.25 – 0.35 0.60 – 0.70 0.90 – 1.00	No additional observations
				A12 0.10 – 0.37 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 No mottles	Dry, rapid	Very fine, very few	0.30 / 6.5		
				A21 0.37 – 0.80 Abrupt	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown No mottles	Dry, well drained	Very fine, very few	0.60 / 6.5		
				A22 0.80 – 1.00	Loamy sand	Weak, rounded peds <20mm, Weak	<5% Manganese nodules	2.5YR2.5/3 Dark reddish brown No mottles	Dry, well drained	Nil	0.90 / 6.5		

SITE 50

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 643672 mE 7535697 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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, mid slope 1%	Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.10 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
				A12 0.10 – 0.36 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Very fine, very few	0.30 / 6.5		
				A21 0.36 – 0.82 Abrupt	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Very fine, very few	0.60 / 6.5		
				A22 0.82 – 1.00	Loamy sand	Weak, rounded peds <20mm, Weak	<5% Manganese nodules	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 6.5		

SITE 51

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt,	Location (GDA ZONE 55): 644257 mE 7536493 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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, mid slope 1%	Blackbutt, gums	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
				B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

SITE 52

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 643169 mE 7536162 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/6/2017
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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 1-2%	Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.12 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
				A12 0.10 – 0.38 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Very fine, very few	0.30 / 6.5		
				A21 0.38 – 0.82 Abrupt	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Very fine, very few	0.60 / 6.5		
				A22 0.82 – 1.00	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 6.5		

SITE 53

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644557 mE 7534788 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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 2%	Mixed rall woodlands; Poplar Box, White Gums, Blackbutt	Nil	Firm / Hard setting, no coarse fragments	A11 0.00 – 0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.14 – 0.58 Diffuse	Loamy sand	Massive, loose	<5% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.58 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<10% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 54

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642671 mE 7536617 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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, mid slope 2%	Blackbutt, gums	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
				B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

SITE 55

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 647922 mE 7535666 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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
Mid slope 1.5%	Sparse shrubs, short grass	Minimal gilgai visible, complete clearing	Firm, some cracking, no coarse fragments	0.00 – 0.18 Abrupt	Light clay	Weak peds 1-5mm, firm	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Fine, few	0.05 / 7.0	No samples taken	No recovery at 0.80m
				0.18 – 0.80 Abrupt	Medium clay	Moderate sub angular peds 5- 30mm, strong	Nil	10YR3/3 Dark brown	Dry, well drained	Fine, few	0.30 / 7.0 0.60 / 7.5		Difficult augering between 0.70 – 0.80
				0.80 – 0.90	Light clay	Strong subangular <10mm, firm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, very few	0.90 / 8.0		

SITE 56

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 645865 mE 7535219 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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, lower slope 2% into water body	Brigalow regrowth, tall Brigalow nearby, extensive clearing	Extensive clearing	Firm, fine cracking, <10% coarse fragments and black nodules	A1 0.00 – 0.11 Abrupt	Sandy clay loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.05 / 6.5	No samples taken	Similar to site 55, but textures vary due to proximity to SMU boundary
				B21 0.11 – 0.38 Graduate	Clay loam sandy	Moderate, subangular peds <20mm, firm	<5% manganese nodules	10YR4/3 Brown	Dry, well drained	Fine, few	0.30 / 6.5		
				B22 0.38 – 1.00	Light clay	Moderate, subangular peds <30mm, firm	<5% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 <2% 0.8 – 1.0m	Dry, well drained	Very fine, very few	0.60 / 6.5 0.90 / 6.5		

SITE 57

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645115 mE 7534838 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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 2%	Mixed rall woodlands; Poplar Box, White Gums, Blackbutt	Nil	Firm / Hard setting, no coarse fragments	A11 0.00 – 0.12 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.12 – 0.61 Diffuse	Loamy sand	Massive, loose	<2% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.61 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<5% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 58

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643464 mE 7534654 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/6/2017
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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 2%	Mixed rall woodlands; Poplar Box, White Gums, Blackbutt	Nil	Firm / Hard setting, no coarse fragments	A11 0.00 – 0.13 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
				A12 0.13 – 0.57 Clear	Loamy sand	Massive, loose	<5% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.57 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<10% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 59

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642373 mE 7534439 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 7/07/2017
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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, 2% gently undulating plains, midslope	Poplar Box regrowth	Nil	Firm, <5% coarse fragments, 0- 10mm diameter	A11 0 – 0.08 Abrupt	Loamy sand	Massive, loose	<2% coarse fragments, 2- 6mm	10YR4/3 Brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
				A12 0.08 – 0.60 Abrupt	Loamy sand	Massive, loose, peds <10%, 10mm, rounded, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very fine, very few	0.3 / 6.5 0.6 / 7.0		
				B2 0.60 -1.00	Clay loam sandy	Massive, very weak	<20% coarse fragments, 2- 6mm	10YR5/4 Yellow brown	Dry, well drained	Nil	0.9 / 7.5		

SITE 60

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 640162 mE 7535256 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 7/07/2017
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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, mid slope, 1.5%	Poplar Box with various woodlands such as Blackbutt	Access track nearby	Hard setting with minor cracking, no coarse fragments	A11 0 – 0.12 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/3 Dark Brown No mottle	Dry, rapid	Fine, very few	0.05 / 6.5	0.0 – 0.1 0.3 – 0.4 0.5 – 0.6 0.6 – 0.7 0.9 – 1.0	No additional observations
				A12 0.12 – 0.42 Abrupt	Clayey sand	Massive to weak, weak, <10% peds <10mm	Nil	10YR3/3 Dark brown No mottle	Dry, rapid	Fine, very few	0.2 / 6.5		
				B21 0.42 – 0.60 Abrupt	Clay loam sandy	Moderate, weak, peds 10- 30mm subangular	Nil	10YR4/4 Dark yellowish brown No mottle	Dry, well drained	Nil	0.6 / 7.5		
				B22 0.60 – 0.73 Abrupt	Light clay	Moderate, weak, peds 10- 30mm subangular	Nil	7.5YR4/3 Brown No mottle	Dry, well drained	Nil	Nil		

Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.	Soil Profile Description									
				B22 0.73 – 1.00	Light clay	Moderate, weak, peds 10- 30mm subangular	Nil	10YR3/3 Dark brown No mottle	Dry, well drained	Nil	0.9 / 7.5		

SITE 61

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Connors, Humboldt, Blackwater,	Location (GDA ZONE 55): 639679 mE 7535396 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 18/6/2014
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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%	Spare Morton Bay Ash, occasional other Eucalypts spp.	Shallow gilgai, extensive clearing	Cracking, surface crust, no coarse fragments	A11 0.0 – 0.08 Abrupt	Silty loam	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.08 – 0.19 Abrupt	Silty loam	Massive, weak	<2% coarse fragments, 2- 6mm	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, fine	0.1 / 6.5		
				B21 0.19 – 0.6 Abrupt	Light clay	Moderate, very firm, <20mm subangular	Nil	10YR3/1 Dark grey	Dry, well drained	Very few, fine	0.3 / 6.5		
				B22 0.6 – 0.7 Abrupt	Light clay	Moderate, very firm, <20mm subangular	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 7.5		

Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.	Soil Profile Description									
				0.7 – 0.95	Light clay	Moderate, firm, <10mm subangular	<2% manganese nodules	10YR4/3 Brown	Dry, well drained	Nil	0.8 / 7.5		

SITE 62

Soil Mapping Unit: A1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Blackwater	Location (GDA ZONE 55): 641685 mE 7533763 mN	Aust. Soil Class. : Haplic Grey Kandosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 7/7/2017
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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
Drainage line <1%	Moreton Bay Ash, Paperbark and various eucalyptus	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0 – 0.55 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown No mottles	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	Cutting, open face
				B2 0.55 – 1.00	Sandy loam	Massive loose	Nil	10YR3/3 Dark brown No mottles	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5		

SITE 63

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 642716 mE 7535827 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 7/7/2017
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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 plus regrowth 40% cover	Melon holes 5-10m wide 0.5m deep, 20% cover.	Cracking 3- 10mm, crusting	A1 0.00 – 0.12 Abrupt	Light clay	Moderate, strong 5- 15mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.1 / 7.5	No samples taken	Check aerial imagery
				B2 0.12 – 1.00	Light clay	Moderate, strong 10- 40mm sub- angular	<1% Calcium carbonate	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.3 / 7.5 0.6 / 7.5 0.9 / 7.5		

SITE 64

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 641517 mE 7536522 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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, 1% Very gently undulating plains	Blackbutt, minor Moreton Bay Ash	Nil microrelief Extensive clearing No erosion	Firm to soft, no coarse fragments	A1 0 – 0.13 Abrupt	Loamy sand	Massive, loose	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Fine, few	0.05 / -	No samples taken	No additional observations
				A21 0.13 – 0.5 Abrupt	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	5YR4/3 Reddish brown	Dry, rapid	Fine, very few	0.3 / -		
				A22 0.5 – 1.0	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	2.5YR4/4 Reddish brown	Dry, rapid	Nil	0.6 / - 0.9 / -		

SITE 65

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 640759 mE 7536657 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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, 2% Very gently undulating plain, downslope	Blackbutt	Nil microrelief Slightly clearing No erosion	Firm to soft, no coarse fragments	A1 0 – 0.14 Abrupt	Clayey sand	Massive, loose	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Fine, few	0.05 / -	No samples taken	No additional observations
				B21 0.14 – 0.52 Abrupt	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	5YR4/3 Reddish brown	Dry, rapid	Fine, very few	0.3 / -		
				B22 0.52 – 1.0	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	2.5YR4/4 Reddish brown	Dry, rapid	Nil	0.6 / - 0.9 / -		

SITE 66

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641596 mE 7536037 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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, mid-slope, <1.5%	Moreton Bay Ash, Poplar Box	Nil	Hard setting, no coarse fragments	A1 0 – 0.10 Abrupt	Clayey sand	Massive, loose	<1% coarse fragments, <2mm	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.1 / -	0.0 – 0.1 0.3 – 0.4 0.6 – 0.7	Boundary 150m to the south east, eucalyptus
				B21 0.10 – 0.45 Abrupt	Clayey sand	Weak, strong, sub- angular peds <10mm	<10% coarse fragments, <2mm	10YR3/1 Very dark grey	Dry, rapid	Fine, few	0.3 / -		
				B22 0.45 – 0.8	Clayey sand	Weak, strong, sub- angular peds <10mm	Nil	10YR4/1 Dark grey	Dry, rapid	Nil	0.6 / -		

SITE 67

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641184 mE 7534924 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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
Flat plain 0.5%	Poplar Box	Minor clearing	Hard setting, no coarse fragments	A11 0.00 – 0.26 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very fine, very few	0.10 / 6.0	No samples taken	No recovery at 0.80m
				A12 0.26 – 0.48 Abrupt	Clay loam sandy	Weak <10mm subangular peds, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 7.0		
				B2 0.48 – 0.80	Clay loam sandy	Weak <10mm subangular peds, firm	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Nil	0.60 / 7.5		

SITE 68

Soil Mapping Unit: L1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641301 mE 7533293 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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, Ironbark, various regrowth	Nil	Hard setting, some very minor cracking, no coarse fragments	A1 0.00 – 0.18 Abrupt	Clayey sand	Massive weak	Nil	10YR4/2 Dark greyish brown No mottle	Dry, rapid	Very few, very fine	0.10 / 6.5	0.00 – 0.10 0.30 – 0.40 0.60 – 0.70 0.90 – 1.00	No additional observations
				B21 0.18 – 0.35 Abrupt	Light clay	Moderate subangular peds 10- 20mm, firm	Nil	10YR3/3 Dark brown No mottle	Dry, moderately well- drained	Nil	0.30 / 6.5		
				B22 0.35 – 0.75 Abrupt	Light clay	Moderate subangular peds 10- 20mm, strong	<2% calcium carbonate	10YR4/4 Dark yellowish brown No mottle	Dry, moderately well- drained	Nil	0.60 / 7.5		
				B23 0.75 – 1.00	Light clay	Moderate subangular peds 10- 20mm, very strong	<2% calcium carbonate	7.5YR4/3 Brown No mottle	Dry, moderately well- drained	Nil	0.90 / 7.5		

SITE 69

Soil Mapping Unit: L1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639657 mE 7533857 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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	Hard setting, <5% coarse fragments, minor cracking	A11 0.00 – 0.06 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/2 Dark greyish brown	Dry, rapid	Very fine, very few	0.10 / 6.5	No samples taken	No additional observations
				A12 0.06 – 0.21 Abrupt	Loamy sand	Massive, weak	Nil	10YR5/2 Greyish brown	Dry, rapid	Very fine, very few	0.20 / 6.5		
				B2 0.21 – 1.00	Light clay	Moderate, subangular peds 10- 20mm, firm	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	fine, very few, very coarse 0.22-0.34m	0.60 / 7.5 0.90 / 8.0		

SITE 70

Soil Mapping Unit: L1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642876 mE 7532061 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 8/7/2017
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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, 0.5%	Poplar Box	Gully erosion	Hard setting, coarse fragments <2% 2-5mm	A1 0.00 – 0.27 Abrupt	Loamy sand	Weak, peds 5-20mm, firm	10% Coarse fragments 5mm diameter – high due to cutting location	10YR4/2 Dark greyish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	Exposed cutting
				B2 0.27 – 1.00	Light clay	Weak, peds 10-30mm, strong	<5% manganese nodules	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 6.5 0.60 / 7.0 0.60 / 7.0		

SITE 71

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 641112 mE 7533281 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow nearby	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1- 3mm	A1 0.00 – 0.13 Abrupt	Light clay	Weak subangular peds 2- 10mm, firm	Nil	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.00 / 7.5	No samples taken	No additional observations
				B21 0.13 – 0.60 Abrupt	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.30 / 7.5		
				B22 0.60 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR5/3 Brown	Dry, well drained	Nil	0.65 / 7.5 0.90 / 7.5		

SITE 72

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638941 mE 7536129 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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,	Poplar box, minor Moreton Bay Ash	Nil	Hardsetting, minor fine cracking	A1 0.00 – 0.29 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Fine, few	Nil	No samples taken	No additional observations
				B2 0.29 - 1.00	Clay loam sand	Weak, firm <10mm subangular	0.90-1.00 - <5% Calcium Carbonate	10YR4/4 Dark yellowish brown	Dry, Rapid	Fine, few to 0.40m	Nil		

SITE 73

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638343 mE 7536301 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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,	Poplar box, minor Moreton Bay Ash	Nil	Hardsetting, minor fine cracking	A1 0.00 – 0.29 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Fine, few	Nil	No samples taken	No additional observations
				B2 0.29 - 1.00	Clay loam sand	Weak, firm <10mm subangular	0.90-1.00 - <5% Calcium Carbonate	10YR4/4 Dark yellowish brown	Dry, Rapid	Fine, few to 0.40m	Nil		

SITE 74

Soil Mapping Unit: A1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Blackwater	Location (GDA ZONE 55): 637205 mE 7536563 mN	Aust. Soil Class. : Haplic Grey Kandosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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
Drainage line	Moreton Bay Ash, Paperbark and various eucalyptus	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0.00 – 0.40 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	No additional observations
				B2 0.40 – 1.00	Sandy loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5		

SITE 75

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 638118 mE 7537230 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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 plus regrowth 40% cover	Normal gilgai 5-10m wide <0.3m deep, 20% cover.	Cracking 3- 10mm, crusting	A1 0.0 – 0.11 Abrupt	Light clay	Moderate, strong 5- 15mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.1 / 7.5	No samples taken	Cracking surface begins 200m to south
				B2 0.11 – 1.00	Light clay	Moderate, strong 10- 40mm sub- angular	<1% Calcium carbonate	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.3 / 7.5 0.6 / 7.5 0.9 / 7.5		

SITE 76

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638988 mE 7537849 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 9/7/2017
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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, Upper slope 2%	Eucalypts, Blackbutt, Ironbark	Nil	Firm, no coarse fragments	A11 0.00-0.10 Abrupt	Loamy sand	Massive, loose	Nil	7.5YR3/2 Dark brown	Dry, Rapid	Fine, very few	0.1 / 6.5	No samples taken	No additional observations
				A12 0.10-0.60 Abrupt	Loamy sand	Massive, loose	Nil	7.5YR4/2 Brown	Dry, Rapid	Fine, very few	0.3 / 6.5		
				B21 0.60-0.90 Abrupt	Clay loamy sand	Moderate, sub angular peds 5- 15mm, weak	Nil	7.5YR4/3 Brown Mottle 10YR5/8 Yellowish brown 10%	Dry, Well drained	Nil	0.6 / 6.5		
				B22 0.90-1.00	Clay loamy sand	Moderate, sub angular peds 5- 15mm, weak	Nil	7.5YR4/4 Brown Mottle 2% 2.5YR3/6 Dark red 30% 10YR5/8 Yellowish brown	Moderately moist, Well drained	Nil	0.9 / 6.5		

SITE 77

Soil Mapping Unit: A1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Blackwater	Location (GDA ZONE 55): 639075 mE 7535363 mN	Aust. Soil Class. : Haplic Grey Kandosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 10/7/2017
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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
Drainage line	Moreton Bay Ash, Paperbark and various eucalyptus	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0.00 – 0.40 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	No additional observations
				B2 0.40 – 1.00	Sandy loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5		

SITE 78

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 637975 mE 7535725 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 10/7/2017
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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	Poplar box	Semi-cleared	Nil	A11 0.00-0.08 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.08-0.39 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, Rapid	Very few, very fine	0.30 / 6.5		
				B21 0.39-0.81 Abrupt	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments	10YR5/3 Brown	Wet, well drained	Very few, very fine	0.60 / 7.0		
				B22 0.81-1.00	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments / manganese	10YR4/3 Brown	Wet, well drained	Very few, very fine	0.90 / 7.0		

SITE 79

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 636803 mE 7536266 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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	Poplar box	Semi-cleared	Nil	A11 0.00-0.10 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.10-0.35 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, Rapid	Very few, very fine	0.30 / 6.5		
				B21 0.35-0.80 Abrupt	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments	10YR5/3 Brown	Wet, well drained	Very few, very fine	0.60 / 7.0		
				B22 0.80-1.00	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments / manganese	10YR4/3 Brown	Wet, well drained	Very few, very fine	0.90 / 7.0		

SITE 80

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 636281 mE 7535894 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow nearby	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1- 3mm	A1 0.00 – 0.10 Abrupt	Light clay	Weak subangular peds 3- 10mm, firm	Calcium carbonate 2%	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.00 / 8.0	No samples taken	No additional observations
				B21 0.10 – 0.35 Abrupt	Light clay	Moderate subangular peds 10- 40mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 8.0		
				B22 0.35 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 8.0 0.90 / 8.0		

SITE 81

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 635795 mE 7535541 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow nearby	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1- 3mm	A1 0.00 – 0.10 Abrupt	Light clay	Weak subangular peds 3- 10mm, firm	Calcium carbonate 2%	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.00 / 8.0	No samples taken	No additional observations
				B21 0.10 – 0.35 Abrupt	Light clay	Moderate subangular peds 10- 40mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 8.0		
				B22 0.35 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 8.0 0.90 / 8.0		

SITE 82

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 637217 mE 7535832 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, mid slope 1.0%	Poplar box	Nil	Hard setting, cracking 1- 3mm, <1% coarse fragments 1- 3mm	A11 0.00-0.09 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, Rapid	Very few, very fine	0.10 / 6.0	No samples taken	Difficulty augering past 0.60m
				A12 0.09-0.58 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Nil	0.30 / 6.0		
				B21 0.58-0.75 Abrupt	Light clay	Moderate, strong 5-20mm sub angular	<30% 2-4mm coarse fragments	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.75-1.00	Light clay	Moderate, strong 20- 50mm sub angular	10% 2-4mm coarse fragments	10YR3/4 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

SITE 83

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 635670 mE 7534393 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, very minor shallow gilgai	Cracking, surface crust, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Depression
				B21 0.09-0.70 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.70-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

SITE 84

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 635021 mE 7534371 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, very minor shallow gilgai	Cracking, surface crust, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Mound
				B21 0.10-0.70 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.70-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

SITE 85

Soil Mapping Unit: L1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 634851 mE 7533622 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, lower slope 2%	Eucalypts	Limited clearing, Nil microrelief Nil Erosion	Firm, no coarse fragments, minor cracking	A1 0.00-0.12 Abrupt	Loamy Sand	Massive, very weak	Nil	10YR2/2 Very dark brown	Dry, Rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
				B21 0.12-0.22 Abrupt	Light clay	Moderate, weak 5-20mm sub angular	<2% 2-5mm coarse fragments	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B22 0.22-0.57 Abrupt	Light clay	Moderate, firm 20-60mm sub angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.50 / 6.5		
				B23 0.57-1.00	Light clay	Moderate, firm 20-60mm sub angular	<2% 2-5mm coarse fragments	7.5YR4/3 Brown Mottle 7.5YR2/3 Pink	Dry, imperfect	Nil	0.90 / 7.0		

SITE 86

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 634354 mE 7533735 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, very minor shallow gilgai	Cracking, surface crust, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Depression
				B21 0.10-0.68 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.68-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

SITE 87

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 634228 mE 7535114 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, very minor shallow gilgai	Cracking, surface crust, no coarse fragments	A1 0.00-0.12 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Depression
				B21 0.12-0.71 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.71-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

SITE 88

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 634520 mE 7536198 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	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	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

SITE 89

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 635087 mE 7535166 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	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	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

SITE 90

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 635264 mE 7536132 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 11/7/2017
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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, upper slope, 0.5%	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.32 Abrupt	Clayey sand	Weak, weak/loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.10 / 7.5 0.30 / 7.5	No samples taken	Refusal at 0.95m
				B21 0.32-0.60 Abrupt	Clayey sand	Moderate, firm, < 10mm sub-angular	< 5% 2- 6mm coarse fragments	10YR4/2 Dark greyish brown	Dry, rapid	Nil	0.60 / 7.5		
				B22 0.60-0.95	Clayey sand	Moderate, firm, < 10mm sub-angular	< 20% 2- 6mm coarse fragments	7.5YR4/3 Brown Mottle 2% 10YR5/8 Yellowish brown	Dry, rapid	Nil	0.90 / 7.5		

SITE 91

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 634095 mE 7537118 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, upper slope, 0.5%	Poplar box	Nil	Firm, No coarse fragments	A11 0.00-0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	0.0-0.1 0.3-0.4 0.6-0.7 0.9-1.0	No additional observations
				A12 0.14-0.45 Abrupt	Loamy sand	Weak, weak, 5- 20mm sub- angular	<2% 2-6mm coarse fragments	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 6.5		
				B2 0.45-1.00	Light clay	Moderate, firm, 5- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.5 0.90 / 8.0		

SITE 92

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 635679 mE 7536839 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, upper slope, 0.5%	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.44 Abrupt	Loamy sand	Massive, loose	<10% 2-6mm coarse fragments	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B2 0.44-1.00	Clay loamy sand	Moderate, firm, 5- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.30 / 6.5		

SITE 93

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 636775 mE 7538190 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, upper slope, 0.5%	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.52 Abrupt	Loamy sand	Massive, loose	<10% 2-6mm coarse fragments	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B2 0.52-0.45	Light clay	Moderate, firm, 5- 30mm sub- angular	Nil	7.5YR4/4 Brown	Dry, well drained	Very few, very fine	0.30 / 6.5		

SITE 94

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 636346 mE 7538814 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	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	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

SITE 95

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Juneee	Location (GDA ZONE 55): 639736 mE 7537440 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, 2.5%	Poplar box, Blackbutt	Nil	Firm, <3% <10mm coarse fragments	A11 0.00-0.18 Abrupt	Loamy Sand	Massive, very weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				A12 0.18-0.39 Abrupt	Loamy Sand	Massive, very weak	Nil	5YR4/3 Reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				A21 0.39-0.64 Abrupt	Loamy Sand	Weak, weak <20mm sub angular	Nil	2.5YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.5		
				A22 0.64-1.10	Loamy Sand	Weak, weak <20mm sub angular	Nil	2.5YR4/8 Red	Dry, rapid	Nil	0.90 / 7.0		

SITE 96

Soil Mapping Unit: A2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644069 mE 7534469 mN	Aust. Soil Class. : Subnatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, Large open depression	Eucalypts	Nil	Soft, moist, no coarse fragments	A1 0.00-0.04 Abrupt	Clayey sand	Weak, weak	Nil	10YR4/1 Dark grey	Moist, rapid	Very few, very fine	0.02 / 6.5	0.0-0.04 0.15-0.25 0.40-0.50 0.90-1.00	No additional observations
				A2 0.04-0.25 Abrupt	Loamy Sand	Weak, weak	<10% 2-4mmcoarse fragments	10YR4/4 Dark yellowish brown	Moist, rapid	Very few, very fine			
				B2 0.25-1.00	Light medium clay	Moderate, weak 30-60mm sub angular	<10% 2-4mmcoarse fragments	10YR4/3 Brown Mottle 10YR5/6 Yellowish brown	Moist, imperfect	Nil	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 97

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 643376 mE 7533082 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, 0.5%	Regrowth, Brigalow	Normal gilgai 0.10-0.30 depth, 50% coverage	Cracking, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	0.10 / 6.5	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

SITE 98

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644747 mE 7533749 mN	Aust. Soil Class: Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 12/7/2017
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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, mid- slope, 3.0%	Poplar box	Nil	Hard setting, no coarse fragments	A1 0.00-0.61 Abrupt	Clayey Sand	Apedal, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, very fine	0.10 / 6.5 0.30 / 6.5 0.60 / 6.5	No samples taken	No additional observations
				B21 0.61-0.84 Abrupt	Sandy clay loam	Weak, weak <10mm peds	Nil	10YR4/3 Brown	Dry, rapid	Nil	Nil		
				B22 0.84-1.96	Clay loam sand	Weak, weak <10mm peds	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.90 / 6.5		

SITE 99

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 646568 mE 7534581 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse fragments	A1 0.00-0.18 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
				B2 0.18-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

SITE 100

Soil Mapping Unit: A2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 648469 mE 7534176 mN	Aust. Soil Class. : Subnatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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, Brigalow, edge of Eucalypts,	Creek nearby	Soft, No coarse fragments	A1 0.00-0.22 Abrupt	Sandy Loam	Weak/ massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B21 0.22-0.48 Abrupt	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR2.5/2 Very dark brown	Dry, well drained	Nil	0.30 / 6.5 0.60 / 6.5		
				B22 0.48-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR3/4 Dark brown	Dry, well drained	Nil	0.90 / 6.5		

SITE 101

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55): 647484 mE 7533515 mN	Aust. Soil Class. :	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse fragments	0.00-0.19 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
				0.19-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

SITE 102

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 648525 mE 7532703 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse fragments	A1 0.00-0.20 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
				B2 0.20-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

SITE 103

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 648058 mE 7532086 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse fragments	A1 0.00-0.18 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
				B2 0.18-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

SITE 104

Soil Mapping Unit: A2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 650766 mE 7533194 mN	Aust. Soil Class. : Subnatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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, lower slope, wide depression with water	Eucalypts	Gully erosion nearby	Hard setting, minor cracking, no coarse fragments	A1 0.00-0.16 Abrupt	Clay Loam	Weak, firm, 5-10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.10 / 6.0	0.0-0.10 0.30-0.40 0.60-0.70 0.90-1.00	No additional observations
				B21 0.16-0.60 Abrupt	Medium clay	Moderate, very firm, 5- 40mm sub- angular	Nil	7.5YR4/1 Dark grey	Dry, well drained	Nil	0.30 / 6.0 0.60 / 6.0		
				B22 0.60-1.00	Medium clay	Moderate, very firm, 5- 40mm sub- angular	Nil	5YR3/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 7.0		

SITE 105

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 650016 mE 7531034 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 13/7/2017
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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	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse fragments	A1 0.00-0.20 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
				B2 0.20-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

SITE 106

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Connors, Humboldt, Blackwater,	Location (GDA ZONE 55): 651192 mE 7531738 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 14/7/2017
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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, Minor Brigalow regrowth	Minor to no disturbance	Cracking, 5- 20mm peds, no coarse fragments	A11 0.00-0.26 Abrupt	Silty loam	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Very few, very fine	0.05 / 6.0 0.20 / 6.0	0.00-0.05 0.40-0.50 0.60-0.70 0.90-1.00	No additional observations
				A12 0.26-0.56 Abrupt	Silty loam	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.40 / 6.0 0.60 / 6.5		
				B2 0.56-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/3 Brown	Dry, moderately well- drained	Very few, very fine	0.90 / 7.0		

SITE 107

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 649633 mE 7536125 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 14/7/2017
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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, <1.0%	Tall woodland Eucalypts, Ironbark, Moreton Bay ash	200m from an active drainage line	Firm, no coarse fragments	A1 0.00-0.15 Abrupt	Clayey sand	Weak, massive	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.10 / 6.5	0.00-0.10 0.20-0.30 0.40-0.50 0.70-0.80	No additional observations
				B21 0.15-0.32 Abrupt	Loamy sand	Weak, weak	Nil	7.5YR2.5/2 Very dark brown	Dry, rapid	Very few, very fine	0.25 / 6.5		
				B22 0.32-0.58 Abrupt	Loamy sand	Weak, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B23 0.56-1.00	Sandy loam	Moderate, weak, 10- 40mm sub- angular	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.80 / 7.0		

SITE 108

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 651186 mE 7534542 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 14/7/2017
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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, <1.0%	Poplar box	Nil	Hard setting, minor cracking, no coarse fragments	A1 0.00-0.33 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				B21 0.33-0.47 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	Nil		
				B22 0.47-1.00	Loamy sand	Weak, very weak <10mm sub- rounded	Nil	7.5YR4/4 Brown	Dry, rapid	Nil	Nil		

SITE 109

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 652513 mE 7530172 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 14/7/2017
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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 <2.0%	Poplar box	Nil	Soft, no coarse fragments	A1 0.00-0.27 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				B21 0.27-0.52 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	Nil		
				B22 0.52-1.00	Loamy sand	Weak, very weak <10mm sub- rounded	Nil	7.5YR4/3 Brown	Dry, rapid	Very few, very fine	Nil		

SITE 110

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 652119 mE 7531776 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, upper slope <0.5%	Poplar box, Eucalypts, Moreton Bay Ash	Nil	Firm, no coarse fragments	A1 .00-0.10 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
				B21 0.10-0.38 Abrupt	Loamy sand	Massive, loose	Nil	10YR42/2 Very dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				B22 0.38-1.00	Loamy sand	Weak, very weak <10mm sub- rounded	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.0 0.90 / 6.0		

SITE 111

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Connors, Humboldt, Blackwater,	Location (GDA ZONE 55): 652028 mE 7529155 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, <2.0%	Long native grass, various sparse regrowth, surrounding eucalypts	Extensive clearing	Cracking, no coarse fragments	A1 0.00-0.11 Abrupt	Silty clay loam	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
				A2 0.11-0.25 Abrupt	Clay loam	Weak, firm, <5mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B21 0.25-0.45 Abrupt	Light clay	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Nil	0.30 / 6.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Strong, very firm, <5mm sub-angular	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.80 / 7.0		

SITE 112

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Connors, Humboldt, Blackwater,	Location (GDA ZONE 55): 653059 mE 7529089 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, <2.0%	Long native grass, various sparse regrowth, surrounding eucalypts	Extensive clearing	Cracking, no coarse fragments	A1 0.00-0.10 Abrupt	Silty clay loam	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
				A2 0.10-0.26 Abrupt	Clay loam	Weak, firm, <5mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B21 0.26-0.45 Abrupt	Light clay	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Nil	0.30 / 6.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Strong, very firm, <5mm sub-angular	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.80 / 7.0		

SITE 113

Soil Mapping Unit: L1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 653777 mE 7530076 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, <2.0%	Long native grass, various sparse regrowth	Extensive clearing	Firm, no coarse fragments	A1 0.00-0.10 Abrupt	Loamy sand	Weak, firm, <5mm sub- angular	Nil	10YR3/1 Very dark grey	Dry, rapid	Very few, very fine	0.05 / 7.0	No samples taken	No additional observations
				A2 0.10-0.28 Abrupt	Clay loam	Moderate, firm, 5- 15mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.20 / 8.0		
				B21 0.28-0.45 Abrupt	Light clay	Moderate, firm, 10- 30mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.30 / 8.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Moderate, firm, 10- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown Mottle 10YR6/3 2% Pale brown	Dry, imperfect	Nil	0.80 / 8.0		

SITE 114

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 654298 mE 7529141 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, Lower slope, <2.0%	Long native grass, various sparse regrowth	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.09 Abrupt	Sandy clay loam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				B2 0.09-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 115

Soil Mapping Unit: L2	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 655184 mE 7528626 mN	Aust. Soil Class. : Mesonatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 15/7/2017
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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, <2.0%	Long native grasses	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.14-0.40 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, very fine	0.30 / 6.5		
				A13 0.40-0.63 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 6.5		
				B2 0.63-1.00	Light medium clay	Moderate, firm, 10- 40mm sub- angular	Nil	7.5YR5/4 Brown Mottle 10YR5/8 10% Yellowish brown	Dry, imperfect	Nil	0.90 / 6.5		

SITE 116

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Connors, Humboldt, Blackwater,	Location (GDA ZONE 55): 653456 mE 7528398 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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%	Long native grasses	Extensive clearing	Hard setting, minor cracking, no coarse fragments	A11 0.00-0.11 Abrupt	Silty loam	Massive, loose	Nil	10YR4/3 Brown	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.11-0.42 Abrupt	Silty loam	Massive, weak	Nil	7.5YR3/2 Brown	Dry, well drained	Nil	0.20 / 6.0		
				A2 0.42-0.56 Abrupt	Silty loam	Weak, firm, <10mm sub-angular	Nil	7.5YR4/4 Brown	Dry, well drained	Nil	0.30 / 6.0		
				B2 0.56-1.00 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	5YR4/4 Brown	Dry, well drained	Nil	0.80 / 7.0		

SITE 117

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 654086 mE 7527936 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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%	Native grass	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.10 Abrupt	Sandy clay loam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				B2 0.10-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 118

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 654513 mE 7527525 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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, lower slope / Depression creek	Eucalypts, Blackbutt regrowth, boundary of Brigalow	Shallow gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.10 Abrupt	Sandy clay loam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				B2 0.10-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 119

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 655807 mE 7527774 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, Depression	Eucalypts, Moreton Bay Ash	Depression	Poached, moist, nearby cracking, no coarse fragments	A1 0.00-0.12 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Moderately moist, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B21 0.12-0.40 Abrupt	Clayey loam	Moderate, 10-30mm, firm	Buried ash 30%	10YR3/2 Very dark greyish brown	Moderately moist, rapid	Nil	0.30 / 7.0		
				B22 0.40-1.00	Clayey sand	Moderate, weak	Nil	10YR4/3 Brown Mottle 10YR5/8 2% Yellowish brown	Moderately moist, rapid	Nil	0.60 / 7.5 0.90 / 7.5		

SITE 120

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 656167 mE 7528401 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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, mid- slope <1%	Native grasses	Extensive clearing	Soft, no coarse fragments	A11 0.00-0.09 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.09-0.48 Abrupt	Clayey sand	Massive, loose	Nil	7.5YR3/2 Brown	Dry, rapid	Nil	0.30 / 6.5		
				B21 0.48-0.69 Abrupt	Loamy sand	Weak, weak, <20mm sub-angular	Nil	7.5YR4/4 Brown	Dry, rapid	Nil	0.60 / 6.5		
				B22 0.69-1.00 Abrupt	Clayey sand	Moderate, weak, <20mm sub-angular	Nil	5YR4/4 Brown	Dry, rapid	Nil	0.90 / 7.5		

SITE 121

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 655685 mE 7529620 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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, mid- slope <1.0%	Poplar box	Nil	Soft, no coarse fragments	A11 0.00-0.04 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.04-0.25 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.30 / 6.5		
				B21 0.25-0.65 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 6.5		
				B23 0.65-1.00	Clayey sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.90 / 7.5		

SITE 122

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 657450 mE 7529247 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 16/7/2017
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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, Lower slope, <2.0%	Long native grass, various sparse regrowth	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.09 Abrupt	Sandy clay loam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				B2 0.09-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 123

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 655379 mE 7525271 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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, lower slope 1.0%	Poplar box	Minor clearing, nearby track	Firm, no coarse fragments	A1 0.00-0.18 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B21 0.18-0.38 Abrupt	Loamy sand	Weak, very weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				B22 0.38-1.00	Loamy sand	Weak, very weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 124

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 656402 mE 7525687 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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 wide crest 1.0%	Blackbutt, very minor poplar box, very minor Moreton Bay Ash	Nil	Firm, no coarse fragments	A11 0.00-0.20 Abrupt	Loamy sand	Massive, loose, single grain	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.20-0.55 Diffuse	Loamy sand	Weak, very weak 5- 20mm	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A2 0.55-1.00	Clayey sand	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 125

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 657459 mE 7525340 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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%	Blackbutt	Limited clearing	Firm, no coarse fragments	A11 0.00-0.18 Abrupt	Loamy sand	Massive, loose, single grain	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.18-0.57 Diffuse	Loamy sand	Weak, very weak 5- 20mm	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A2 0.57-1.00	Clayey sand	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 126

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 656603 mE 7523809 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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 1.5%	Poplar box, Blackbutt	Nil	Firm to hard setting, no coarse fragments	A1 0.00-0.08 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B21 0.08-0.70 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B22 0.70-1.00	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 127

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 657120 mE 7522945 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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 0.5%	Brigalow regrowth	Melon holes 0.30-0.40 deep, 50% coverage 2.0- 4.0m wide	Hard setting, cracking, no coarse fragments	A1 0.00-0.08 Abrupt	Light clay	Moderate, weak, 5- 10mm peds	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B2 0.08-1.00	Light clay	Moderate, weak, 5- 30mm peds	Nil	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

SITE 128

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 658079 mE 7524200 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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, simple slope 1.5%	Poplar box, Blackbutt	Nil	Firm, no coarse fragments	A1 0.00-0.10 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B21 0.10-0.68 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B22 0.68-1.00	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 129

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 659506 mE 7524898 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 27/7/2017
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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%	Blackbutt	Nil	Firm, no coarse fragments	A11 0.00-0.20 Abrupt	Loamy sand	Massive, loose, single grain	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.20-0.55 Diffuse	Loamy sand	Weak, very weak 5- 20mm	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A2 0.55-1.00	Clayey sand	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 130

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 658711 mE 7526388 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 28/7/2017
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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, mid slope 2.0%	Regrowth, native grasses	Extensive clearing	Soft, no coarse fragments	A11 0.00-0.11 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	Brigalow regrowth 100- 200m to north and south.
				A12 0.11-0.38 Diffuse	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.40 / 7.0		
				B2 0.38-1.00	Clay loam sand	Moderate, weak 10- 30mm sub- angular	Nil	10YR4/6 Dark yellowish brown Mottle <10% 10YR4/4 Dark yellowish brown, <5% 7.5YR3/6 Dark red	Dry, well drained	Very few, very fine	0.60 / 7.0 0.90 / 7.0		

SITE 131

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, June	Location (GDA ZONE 55): 656738 mE 7527426 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 28/7/2017
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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, mid slope 1.0%	Poplar box, Blackbutt, various mixed vegetation	Nil	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.05 / 7.0	0.00-0.10 0.30-0.40 0.60-0.70 0.90-1.00	No additional observations
				A12 0.09-0.60 Diffuse	Loamy sand	Massive, weak	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 7.0		
				B2 0.60-1.00	Sandy clay loam	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 7.0		

SITE 132

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 656306 mE 7526757 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 28/7/2017
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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, mid slope 1.5%	Poplar box, Blackbutt, various mixed vegetation	Nil	Firm, no coarse fragments	A1 0.00-0.11 Abrupt	Clayey sand	Massive, weak	Nil	10YR4/2 Dark greyish brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B21 0.11-0.52 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				B22 0.52-1.00	Clayey sand	Weak, very weak <10mm sub-angular	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

SITE 133

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 657814 mE 7526575 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 28/7/2017
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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, mid slope <1.0%	Brigalow regrowth	Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 134

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 658493 mE 7525489 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 28/7/2017
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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, mid slope <1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 135

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 657256 mE 7528300 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 136

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 658578 mE 7527872 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 137

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 659839 mE 7526642 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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, lower slope 1.0%	Regrowth	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				A12 0.09-0.48 Abrupt	Loamy sand	Weak, very weak peds, < 10mm rounded	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.48-1.00	Sandy clay loam	Moderate, very weak peds, < 10mm rounded	Nil	2.5YR3/3 Dark reddish brown Mottle < 10% grey	Dry, rapid	Nil	Nil		

SITE 138

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661441 mE 7526760 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 139

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660286 mE 7528127 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 140

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660936 mE 7529367 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.13 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.13-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 141

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661978 mE 7528566 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 29/7/2017
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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, mid slope <1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 142

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 662807 mE 7529517 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 30/7/2017
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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, mid slope <1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 143

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 663668 mE 7529201 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 30/7/2017
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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, mid slope <1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 144

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Juneee	Location (GDA ZONE 55): 664015 mE 7527856 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 30/7/2017
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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, lower slope 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 145

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 664274 mE 7527288 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 30/7/2017
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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%	Native grasses	Limited to extensive clearing,	Soft, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	5YR5/3 Reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.09-0.50 Abrupt	Loamy sand	Massive, weak	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A13 0.50-1.00	Loamy sand	Massive, weak	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

SITE 146

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 662583 mE 7526662 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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%	Sparse Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 147

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661088 mE 7525448 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 30/7/2017
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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%	Very sparse mixed regrowth	Limited clearing	Firm, no coarse fragments	A1 0.00-0.12 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR2.5/2 Very dark brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				A2 0.12-0.50 Abrupt	Clayey sand	Weak, very weak peds, < 10mm rounded	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.50-1.00	Sandy clay loam	Moderate, very weak peds, < 10mm rounded	Nil	5YR4/6 Yellowish brown	Dry, rapid	Very few, very fine	Nil		

SITE 148

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661208 mE 7524699 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 31/7/2017
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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, upper slope 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 149

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 662277 mE 7523306 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: /7/2017
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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, mid- slope 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 150

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 663573 mE 7523798 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 31/7/2017
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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, mid- slope 1.0%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 151

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661705 mE 7521700 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 31/7/2017
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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 1.0%	Poplar Box	Extensive clearing	Soft, no coarse fragments	A11 0.00-0.18 Diffuse	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				A12 0.18-0.56 Abrupt	Loamy sand	Weak, very weak peds, < 10mm rounded	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.56-1.00	Sandy clay loam	Moderate, very weak peds, < 10mm rounded	Nil	2.5YR3/3 Dark reddish brown Mottle < 10% grey	Dry, rapid	Nil	Nil		

SITE 152

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660701 mE 7520607 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 31/7/2017
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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, wide crest	Moreton Bay Ash, Blackbutt, Poplar Box	Limited clearing	Firm, no coarse fragments	A11 0.00-0.22 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				A12 0.22-0.62 Abrupt	Loamy sand	Weak, very weak peds, < 10mm rounded	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.62-1.00	Sandy clay loam	Moderate, very weak peds, < 10mm rounded	Nil	2.5YR3/3 Dark reddish brown Mottle < 10% grey	Dry, rapid	Nil	Nil		

SITE 153

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 658969 mE 7520534 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 31/7/2017
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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, Melon holes, 0.40m deep, 3-6m 50% coverage	Firm, cracking 2-10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	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	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 154

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 659548 mE 7521648 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 1/8/2017
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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 1.0%	Brigalow regrowth	Extensive clearing, Gilgai, 0.30m deep, 3-6m 50% coverage	Firm, cracking 2-10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 155

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660283 mE 7522488 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 1/8/2017
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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 1.0%	Brigalow regrowth	Extensive clearing, Gilgai, 0.30m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 156

Soil Mapping Unit: R1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660027 mE 7523667 mN	Aust. Soil Class. : Red Rudosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 1/8/2017
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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, wide crest	Poplar Box, Blackbutt	Limited clearing	Soft, no coarse fragments	A11 0.00-0.08 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				A12 0.08-0.36 Abrupt	Loamy sand	Massive, weak	Nil	5YR4/3 Reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				A13 0.36-1.00	Loamy sand	Massive, weak	Nil	2.5YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.5 0.90 / 6.5		

SITE 157

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 658904 mE 7524056 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 1/8/2017
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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	Gilgai, 0.30m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 158

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 658542 mE 7523742 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 1/8/2017
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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	Poplar Box, Blackbutt	Nil	Firm, no coarse fragments	A11 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				A12 0.30-0.70 Abrupt	Loamy sand	Weak, 2- 10mm weak sub-angular	2% coarse fragments 2- 6mm	10YR4/3 Brown	Dry, rapid	Nil	0.30 / 7.0 0.60 / 6.5		
				B2 0.70-1.00	Clay loam sand	Weak, 10- 20mm weak sub-angular	Nil	10YR4/4 Dark yellowish Brown Mottle 2% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.90 / 6.5		

SITE 159

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 664687 mE 7526519 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 2/8/2017
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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	Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 160

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 663710 mE 7525434 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 2/8/2017
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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	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 161

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 666641 mE 7529563 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 2/8/2017
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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 <2%	Poplar Box, native grasses	Extensive clearing	Soft, no coarse fragments	A1 0.00-0.07 Abrupt	Clayey sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B21 0.07-0.32 Abrupt	Loamy sand	Weak, 5- 10mm weak sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 6.5		
				B22 0.32-0.66	Clayey sand	Weak, 5- 10mm weak sub-angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.90 / 6.5		

SITE 162

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 665391 mE 7525740 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 2/8/2017
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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	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 163

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 666679 mE 7527163 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 2/8/2017
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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 <2%	Sparse shrubs, buffel grass	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.20 Diffuse	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				A12 0.20-0.60 Abrupt	Clayey sand	Weak, 10- 20mm weak sub-angular	Nil	7.5YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 6.5		
				B2 0.60-1.00	Sandy clay loam	Moderate, 10-30mm weak sub- angular	Nil	7.5YR4/4 Brown Mottle 5% 10R4/6 Red	Dry, moderate to well drained	Nil	0.90 / 6.5		

SITE 164

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 667067 mE 7527683 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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, lower slope <1.5%	Brigalow regrowth	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 165

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 668188 mE 7528861 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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 <2.0%	Poplar Box	Semi-cleared, trampled nearby	Soft, no coarse fragments	A1 0.00-0.19 Abrupt	Clayey sand	Massive, weak/ Apedal	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B21 0.19-0.52 Abrupt	Loamy sand	Massive, Apedal	Nil	10YR5/2 Grayish brown	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.52-1.00	Loamy sand	Massive, weak	Nil	10YR5/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 6.5		

SITE 166

Soil Mapping Unit: C1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 665456 mE 7529384 mN	Aust. Soil Class. : Endohypersodic Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.08 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.08-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 167

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 665246 mE 7527938 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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 <2.0%	Poplar Box	Extensive clearing	Soft to firm, no coarse fragments	A1 0.00-0.14 Abrupt	Clayey sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
				B21 0.14-0.50 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.50-1.00	Clayey sand	Weak, peds, 10-30mm weak	Nil	10YR4/4 Dark yellowish brown Mottle 10YR5/8 Yellowish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 6.5		

SITE 168

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 646122 mE 7540417 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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 1.0%	Blackbutt, Eucalypts	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Clayey sand	Massive, weak	Nil	7.5YR3/2 Dark brown	Dry, rapid	Very few, fine	0.05 / 7.0	No samples taken	No additional observations
				A12 0.09-0.10 Abrupt	Clayey sand	Massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, fine	Nil		
				B2 0.1 0-1.00	Loamy sand	Moderate, weak, 10- 30mm sub- angular	Nil	7.5YR3/4 Dark brown	Dry, rapid	Nil	0.30 / 7.0 0.60 / 6.5 0.90 / 6.5		

SITE 169

Soil Mapping Unit: B1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt	Location (GDA ZONE 55): 638672 mE 7549660 mN	Aust. Soil Class. : Subnatric Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 3/8/2017
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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, upper slope 1.0%	Eucalypts, Moreton Bay Ash	Nil	Soft to firm, no coarse fragments	A1 0.00-0.10 Abrupt	Loam	Massive, weak	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.05 / 6.0	No samples taken	Alluvial
				A2 0.10-0.30 Abrupt	Silty loam	Massive, weak	Nil	10YR3/1 Very dark brown	Dry, rapid	Very few, very fine	Nil		
				B21 0.30-0.52 Abrupt	Loam	Weak, weak, 10- 30mm sub- angular	Nil	10YR3/1 Very dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				B22 0.52-1.00	Loamy sand	Weak, weak, 10- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.60 / 6.0 0.90 / 7.5		

SITE 170

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 637680 mE 7547045 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 4/8/2017
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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, no coarse fragments	A1 0.00-0.38 Diffuse	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	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 Mottle 5% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.60 / 7.5 0.90 / 7.5		

SITE 171

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 637940 mE 7547836 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 4/8/2017
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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, no coarse fragments	A1 0.00-0.40 Diffuse	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, very few	0.10 / 6.5 0.30 / 6.5	No samples taken	No additional observations
				B2 0.40-1.00	Clay loam sand	Moderate, angular, 5- 20 weak	<2% coarse fragments 2mm	10YR4/3 Brown Mottle 5% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.60 / 7.5 0.90 / 7.5		

SITE 172

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 641398 mE 7532215 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 4/8/2017
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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 <1.5%	Poplar box	Nil	Soft, no coarse fragments	A11 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-0.47 Abrupt	Loamy sand	Massive, weak	<10% coarse fragments <5mm	10YR6/3 Dark brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.47-1.00	Sandy clay loam	Moderate, weak, <10mm sub-angular	Nil	10YR4/4 Dark yellow brown Mottle <2% 10YR5/8 Yellowish brown	Dry, well drained	Very few, fine	0.60 / 6.0 0.90 / 6.0		

SITE 173

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644245 mE 7545543 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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 <2.0%	Poplar box	Extensive cleared	Firm, Fine cracking, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 174

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642897 mE 7546691 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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 <1.5%	Eucalypts, Blackbutt regrowth	Access track nearby	Frim, No coarse fragments	A11 0.00-0.10 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.10-0.35 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Few, fine	0.30 / 6.0		
				A13 0.35-1.00	Loamy sand	Massive, weak	Nil	10YR3/6 Dark yellowish brown	Dry, rapid	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 175

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643999 mE 7547737 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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, Eucalypt regrowth	Extensive clearing, No microrelief, No erosion	Cracking, soft to firm, no coarse fragments	A1 0.00-0.22 Abrupt	Silty loam	Weak, weak, <10mm sub rounded	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				B2 0.22-1.00	Light clay	Moderate, Weak to firm, <20mm sub-angular	Nil	10YR3/3 Dark brown	Dry, Well drained	Nil	0.30 / 6.0 0.60 / 6.5 0.90 / 7.0		

SITE 176

Soil Mapping Unit: B2-DV	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643734 mE 7547624 mN	Aust. Soil Class. : Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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, Open depression <1.5%	Brigalow	Gully erosion, no micro relief, No disturbance	Cracking, Soft to firm, no coarse fragments	A1 0.00-0.60 Abrupt	Silty loam	Weak, weak, <10mm sub rounded	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				B2 0.60-1.00	Light clay	Moderate, Weak to firm, <20mm sub-angular	Nil	10YR3/3 Dark brown	Dry, Well drained	Nil	0.30 / 6.0 0.60 / 6.5 0.90 / 7.0		

SITE 177

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643285 mE 7547142 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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, Eucalypts	Semi-cleared, No microrelief, No erosion	Soft, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 178

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 642897 mE 7548610 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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, Blackbutt	Semi-cleared	Soft, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 179

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645013 mE 7549539 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 24/11/2017
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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%	Predominantly Blackbutt, Iron Bark	Semi-cleared	Firm, no coarse fragments	A1 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				B2 0.30-0.70	Clayey sand	Massive, weak	Nil	10YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0 0.60 / 6.0 0.90 / 6.0		

SITE 180

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 638448 mE 7545811 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/11/2017
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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, no coarse fragments	A11 0.00-0.12 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark brown	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	Dry, rapid	Few, fine	0.30 / 6.5		
				A13 0.32-0.70 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/6 Dark yellowish brown	Dry, rapid	Very few, very fine	0.60 / 6.5		
				B2 0.70-0.85	Clay loamy sand	Weak, weak, <5mm sub- angular	Nil	10YR4/3 Brown	Dry, Well drained	Nil	0.90 / 7.0		

SITE 181

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 636937 mE 7547191 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/11/2017
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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, no coarse fragments	A1 0.00-0.10 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	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	Dry, rapid	Nil	0.30 / 6.5		
				A2 0.47-0.70 Abrupt	Clayey sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	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	Dry, rapid	Nil	0.90 / 7.0		

SITE 182

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 635944 mE 7548438 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/11/2017
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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, no coarse fragments	A1 0.00-0.27 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
				B21 0.27-0.86 Abrupt	Clay loam sand	Moderate, weak <10mm sub-angular	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 6.0 0.60 / 6.5		
				B22 0.86-1.00	Clay loam sand	Moderate, weak, <10mm sub-angular	<2% calcium carbonate	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

SITE 183

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 634838 mE 7549412 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/11/2017
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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, firm	A1 0.00-0.11 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	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	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

SITE 184

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 633712 mE 7550670 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 25/11/2017
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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, no coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	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	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	Dry, rapid	Nil	0.60 / 6.0 0.90 / 6.0		

SITE 185

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 619052 mE 7553183 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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 wide crest, Upper slope <2.0%	Poplar box, minor Ironbark	Semi to extensive cleared, No microrelief No Erosion	Soft, no coarse fragments	A11 0.00-0.05 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.05-0.33 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				A13 0.33-0.65 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.60 / 6.0		
				B21 0.65-0.80 Abrupt	Sandy clay loam	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown	Dry, well drained	Nil	0.70 / 6.5		
				B22 0.80-1.00	Clay loam sand	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/6 Strong brown	Dry, well drained	Nil	0.90 / 7.0		

SITE 186

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 621083 mE 7553263 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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, Creek, gully / open depression	Eucalypts	Gully erosion, No microrelief No erosion	Soft, loose, no coarse fragments	Nil	Loamy sand	Massive, weak	Nil	10YR5/2 Grayish brown	Dry, rapid	Few, fine	Nil	No samples taken	No additional observations

SITE 187

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 632756 mE 7551848 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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, minor fine cracking, no coarse fragments	A11 0.00-0.10 Abrupt	Silty loam	Weak, weak	Nil	10YR2/2 Very dark brown	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	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 10-20%	Dry, Imperfect	Nil	0.60 / 7.0 0.90 / 7.5		

SITE 188

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 631308 mE 7552792 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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	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	Dry, rapid	Few, fine	0.30 / 6.0		

SITE 189

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 629781 mE 7553506 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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, no coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	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	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	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

SITE 190

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 627807 mE 7553767 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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, no coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	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	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	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

SITE 191

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 625603 mE 7553409 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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, no coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
				A12 0.15-0.70 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.30 / 6.5 0.60 / 6.5		
				B2 0.70-1.00	Clay loam sandy	Moderate, weak, 10- 30mm sub-angular	Nil	10YR5/4 Yellowish brown Mottle <5% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.90 / 6.0		

SITE 192

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 623381 mE 7553646 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Detailed - 50mm hand auger	Survey Date: 26/11/2017
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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 <1.5%	Poplar box	Nil	Firm, no coarse fragments	A11 0.00-0.04 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.04 / 6.0	No samples taken	No additional observations
				A12 0.04-0.22 Gradual	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.20 / 6.5		
				A13 0.22-0.44 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 6.5		
				B21 0.44-0.70 Abrupt	Clay loam Sandy	Moderate, weak, 5-20mm sub-angular	Nil	10YR4/6 Dark yellowish brown	Dry, rapid	Nil	0.60 / 7.0		
				B22 0.70-1.00	Clay loam sandy	Moderate, weak, 5-20mm sub-angular	Nil	10YR3/6 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

Appendix B Observation site descriptions

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob1	638752 mE 7548118 mN	S1	Poplar Box, light brown firm surface
Ob2	639159 mE 7548139 mN	S1	Poplar Box all around, with very small patch of Brigalow nearby.
Ob3	639339 mE 7548097 mN	S1	Very small patch of Brigalow <20m wide, Poplar Box to the west, Poplar Box and other mix vegetation to the East
Ob4	639375 mE 7547774 mN	S1	Minor Brigalow patch in small depression, Poplar Box all around area.
Ob5	639449 mE 7547743 mN	S1	Various mix vegetation all around, but only Poplar Box in immediate area of site, some minor depressions nearby

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob6	638723 mE 7547859 mN	S1	Poplar Box only to north, towards south various mixed vegetation, Moreton Bay Ash, Poplar Box, and Gums 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob7	638617 mE 7547036 mN	S1	Poplar Box only to north, towards south various mixed vegetation 
Ob8	639214 mE 7546993 mN	S1	Firm, light brown surface with Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob9	638569 mE 7546676 mN	Boundary S1 / C2	Surface cracking to south, Poplar Box to the north
Ob10	638561 mE 7546535 mN	C2	Various regrowth, very minor Poplar Box, Brigalow, small cracks in surface
Ob11	639065 mE 7546449 mN	Boundary S1 / C2	Cracking surface to the south
Ob12	639039 mE 7546320 mN	C2	Cracking surface, Brigalow regrowth
Ob13	639706 mE 7547373 mN	S1	Poplar Box
Ob14	639823 mE 7547230 mN	Boundary S1 / S2	Very gradual boundary due to difference soil profiles are nearby detailed sites in S1 and S2 soil mapping units
Ob15	640083 mE 7547286 mN	C1	Brigalow with melon holes starting towards the south
Ob16	639964 mE 7547147 mN	Boundary S2 / C1	Melon holes starting towards east
Ob17	640322 mE 7547043 mN	Boundary S2 / C1	Melon holes starting towards west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob18	639963 mE 7546770 mN	S2	Gums, Poplar Box 
Ob19	640195 mE 7546733 mN	Boundary C2 / C1	Cracking surface with melon holes beginning to the east, Brigalow
Ob20	640430 mE 7546417 mN	Boundary C2 / C1	Cracking surface with melon holes beginning to the north, Brigalow

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob21	639519 mE 7546438 mN	S1	Poplar Box
Ob22	639844 mE 7546269 mN	C2	Cracking surface
Ob23	639520 mE 7546195 mN	C2	Large open depression, inundated

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob24	642279 mE 7547774 mN	S2	Gums, firm sandy surface  A photograph showing a gum tree with a thick, dark trunk and a spreading canopy of green leaves. The tree is situated in a field of tall, dry grass. In the background, there are more trees and a clear blue sky.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob25	642525 mE 7547379 mN	S2	Firm surface, Ironbark, White Gums 
Ob26	642039 mE 7547577 mN	S2	Poplar Box
Ob27	641406 mE 7547677 mN	S2	Moreton bay Ash

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob28	641655 mE 7546982 mN	S2	Loamy sand surface, light brown, with Poplar Box
Ob29	641133 mE 7547074 mN	S2	Moreton Bay Ash
Ob30	640468 mE 7547102 mN	S2	Loamy sand surface, light brown, Poplar Box
Ob31	640509 mE 7546304 mN	C2	Minor drainage line, cracking surface
Ob32	640602 mE 7546188 mN	C2	Brigalow, cracking surface
Ob33	640646 mE 7546122 mN	Boundary C2 / C1	Gilgai getting deeper towards south (Melon Holes)
Ob34	641180 mE 7546807 mN	Boundary S2 / C1	Cracking surface with melon holes to south, Poplar Box with firm surface to north
Ob35	641417 mE 7546713 mN	Boundary S2 / C2	Cracking surface to south, Poplar Box with firm surface to north
Ob36	642192 mE 7546532 mN	C2	Dam, surrounded by cracking surface with very minor gilgai
Ob37	641289 mE 7546413 mN	Boundary C2 / C1	Gilgai getting deeper (0.3m+) towards south (Melon Holes)

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob38	641966 mE 7546043 mN	C1	Melon holes approx. 4m diameter, 0.4m deep, depressions at 50% coverage, cracking surface 
Ob39	639287 mE 7546017 mN	Boundary S1 / C2	Cracking surface start to north, inundated area to north east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob40	639340 mE 7545650 mN	S1	Firm light brown surfaces, Poplar Box
Ob41	639710 mE 7545620 mN	Boundary S1 / B1	Very diffused boundary, Blackbutt to the south
Ob42	640498 mE 7545947 mN	Boundary C1 / B1	Cracking to the east
Ob43	641454 mE 7545839 mN	C1	Melon holes approx. 4m diameter, 0.4m deep, depressions at 50% coverage, cracking surface
Ob44	642858 mE 7545859 mN	C2	Brigalow
Ob45	642688 mE 7545775 mN	Boundary C1 / C2	Cracking, minor gilgai to the north, melon holes start to the south
Ob46	642251 mE 7545825 mN	C1	Melon holes approx. 4m diameter, 0.4m deep
Ob47	642494 mE 7545445 mN	C1	Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob48	641940 mE 7545190 mN	C1	Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob49	641379 mE 7545137 mN	C1	Brigalow, starts to change to Poplar Box toward south west
Ob50	641458 mE 7545027 mN	C1	Melon Holes, cleared, cracking surface
Ob51	641538 mE 7544887 mN	Boundary C1 / B1	Brigalow, cracking surface to the north east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob52	643072 mE 7545168 mN	C1	Melon Holes, cleared, cracking surface
Ob53	642617 mE 7544828 mN	C1	Melon Holes, cleared, cracking surface
Ob54	642194 mE 7544493 mN	C1	Dam, inundated
Ob55	643573 mE 7545088 mN	S2	Poplar Box, light brown sandy surface
Ob56	643225 mE 7544831 mN	C1, near a C1/C2 Boundary	Sparse Brigalow, Melon Holes
Ob57	642749 mE 7544477 mN	C1	Brigalow Regrowth, Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob58	640424 mE 7544720 mN	B1	Silty loam surface, yellow red surface north to grey surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob59	639673 mE 7544810 mN	B1	Poplar Box, Ironbark, silty loam surface, land use grazing 
Ob60	639497 mE 7544482 mN	B1	Poplar Box, silty loam surface
Ob61	639794 mE 7544376 mN	B1/C2 Boundary	Cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob62	640283 mE 7544309 mN	C2	Cracking surface, normal gilgai 0.25m deep, 30% coverage
Ob63	639479 mE 7544206 mN	C2	Cracking surface, normal gilgai
Ob64	639321 mE 7543726 mN	C2	Cracking surface, normal gilgai
Ob65	639944 mE 7543965 mN	C2	Cracking surface, normal gilgai – deeper (0.2 – 0.3m) to the north, <0.2m to the south
Ob66	640756 mE 7544038 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob67	640645 mE 7543776 mN	C2	Cracking surface, normal gilgai
Ob68	641111 mE 7543707 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob69	641544 mE 7544162 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob70	641895 mE 7544431 mN	B1	Poplar Box, Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob71	642282 mE 7543922 mN	B1	Poplar Box 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob72	641817 mE 7543722 mN	B1	Poplar Box 
Ob73	641496 mE 7543181 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting, <5% coarse fragments <10mm
Ob74	641009 mE 7543022 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob75	640710 mE 7543411 mN	B1	Poplar Box, Blackbutt, some Brigalow starting 100m to north
Ob76	640599 mE 7542888 mN	B1	Poplar Box and Blackbutt, with isolated patch of Brigalow nearby
Ob77	640421 mE 7542761 mN	B1/C2 Boundary	Brigalow and cracking surface starts to the west
Ob78	640250 mE 7542631 mN	C2	Cracking surface, minor normal gilgai
Ob79	640137 mE 7542544 mN	B1/C2 Boundary	Brigalow and cracking surface starts to the east
Ob80	639921 mE 7542386 mN	B1	70% Poplar Box, 30% Blackbutt
Ob81	639693 mE 7542920 mN	C2	Cracking surface, minor normal gilgai
Ob82	639308 mE 7543232 mN	C2	Cracking surface, minor normal gilgai
Ob83	639389 mE 7542297 mN	C2	Brigalow regrowth and cracking surface starts to the north and west
Ob84	639291 mE 7541919 mN	B1	Poplar Box and Blackbutt
Ob85	639588 mE 7541646 mN	B1/S2 Boundary	Poplar Box to the north, cleared to the south
Ob86	640411 mE 7541931 mN	B1	Poplar Box and Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob87	641311 mE 7542587 mN	B1	Poplar Box and Blackbutt
Ob88	641736 mE 7542972 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting, <5% coarse fragments <10mm
Ob89	642123 mE 7543231 mN	B1	Blackbutt mostly, with some Poplar Box
Ob90	642116 mE 7542370 mN	B1	Ironbark, Poplar Box, Surface hard setting, <5% coarse fragments <10mm
Ob91	641241 mE 7541929 mN	B1	Ironbark, Poplar Box and Blackbutt
Ob92	641640 mE 7540923 mN	B1/S1 Boundary	Firm light brown surface, Poplar Box
Ob93	640635 mE 7541353 mN	B1	Blackbutt, firm light brown surface with no coarse fragments

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob94	642565 mE 7541626 mN	B1	Mixed vegetation including Ironbark, Poplar Box and Blackbutt 
Ob95	643114 mE 7542067 mN	B1/C1 Boundary	Melon holes and cracking surface to the east, Poplar Box and Blackbutt to the west
Ob96	642791 mE 7543229 mN	C1	Clay starting toward east, very gradual boundary

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob97	643220 mE 7543467 mN	C1	Brigalow, melon holes, cracking surface 
Ob98	643286 mE 7544087 mN	C1	Melon holes, 0.3-0.4m deep, 50% coverage

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob99	643495 mE 7544624 mN	C2	Inundated depression 
Ob100	644039 mE 7544684 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob101	644449 mE 7544448 mN	S2	Loamy sand surface texture, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob102	644379 mE 7544229 mN	C2	Cracking surface, normal gilgai <0.2m deep, 30% coverage
Ob103	645180 mE 7544108 mN	S2	Loamy sand surface texture, Poplar Box
Ob104	645344 mE 7543602 mN	C2	Cracking surface, normal gilgai
Ob105	645322 mE 7543293 mN	C1/C2 Boundary	Gilgai becomes deeper (Melon holes) towards west, 0.3m + deep
Ob106	644798 mE 7543388 mN	C1	Cracking surface, melon holes 0.4m deep
Ob107	643797 mE 7543732 mN	C1	Cracking surface, melon holes 0.4m deep
Ob108	645610 mE 7543021 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob109	645454 mE 7542942 mN	C2	Dam, cracking surface
Ob110	644927 mE 7542918 mN	C1	Cracking surface, melon holes 0.4m deep
Ob111	644148 mE 75428 mN	C1	Cracking surface, melon holes 0.4m deep
Ob112	643449 mE 7542325 mN	C1	Cracking surface, melon holes 0.4m deep
Ob113	643399 mE 7543239 mN	C1	Very minor patch of Poplar Box, cracking all around

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob114	645500 mE 7542622 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob115	645850 mE 7542503 mN	S2	Gums to east, Poplar Box to west, sandy surface
Ob116	645333 mE 7542509 mN	C2	Cracking surface, Poplar Box 100m to east 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob117	644630 mE 7541998 mN	C2	Normal gilgai <0.3m deep, 40% coverage
Ob118	644183 mE 7542115 mN	C2	Normal gilgai <0.3m deep, cracking surface
Ob119	644183 mE 7541667 mN	C1/C2 Boundary	Normal gilgai (<0.3m) to east, melon holes (0.3- 0.4m deep) to west
Ob120	643790 mE 7541387 mN	C1	Melon Holes
Ob121	643302 mE 7541022 mN	C1/B1 Boundary	Melon holes with cracking surface to east, Poplar Box and firm surface to west
Ob122	642799 mE 7540658 mN	B1	Dams, firm light brown surface (non-cracking)
Ob123	642342 mE 7540560 mN	C1/S1 Boundary	Poplar Box to west, cracking / Brigalow to east
Ob124	642087 mE 7540784 mN	S1	Poplar Box
Ob125	641741 mE 7540015 mN	S1	Poplar Box, firm light brown surface, no cracking and no coarse fragments
Ob126	640052 mE 7540046 mN	C2/S1 Boundary	Cracking surface starts towards west
Ob127	639797 mE 7540050 mN	C2/S1 Boundary	Cracking surface starts towards east
Ob128	639596 mE 7540157 mN	S1	Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob129	639315 mE 7540373 mN	S2	Firm light brown surface, cleared 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob130	640866 mE 7540195 mN	C2	Cracking surface, dam 
Ob131	640993 mE 7540393 mN	C2	Brigalow areas towards east
Ob132	641154 mE 7540564 mN	C2	Cracking surface, Brigalow nearby, changing to firm surface <100m to west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob133	641293 mE 7540695 mN	C2/S2 Boundary	Cracking to south
Ob134	640893 mE 7540659 mN	S2	Firm non-cracking surface, cleared
Ob135	640460 mE 7540542 mN	S2	Firm non-cracking surface, cleared
Ob136	640471 mE 7541197 mN	S2	Firm non-cracking surface, cleared
Ob137	643149 mE 7539809 mN	S1	Isolated brigalow patch, narrow wet gully, all areas surrounding non cracking surface
Ob138	643063 mE 7539714 mN	S1	Crest, firm surface
Ob139	642469 mE 7539069 mN	C2/S1 Boundary	Cracking surface towards south, non-cracking to north
Ob140	642066 mE 7538851 mN	C2	Cracking surface, normal gilgai <0.2m deep, 20% coverage
Ob141	641170 mE 7538865 mN	C2	Cracking surface, normal gilgai <0.2m deep, 20% coverage
Ob142	640430 mE 7538932 mN	C2	Cracking surface, with diffused interfingering boundary of non-clay/cracking surface areas
Ob143	639433 mE 7538949 mN	C1	Cracking surface, normal gilgai <0.2m deep, 20% coverage, melon holes observed to the west
Ob144	639623 mE 7539560 mN	C1	Cracking surface, normal gilgai <0.2m deep, 20% coverage

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob145	640939 mE 7539291 mN	C1/S1 Boundary	Cracking surface to the south, non-cracking firm surface to the north
Ob146	641199 mE 7539488 mN	S1	Poplar Box, Blackbutt, firm light brown surface
Ob147	642074 mE 7539461 mN	S1	Firm to hard setting, non-cracking surface, extensive clearing
Ob148	643630 mE 7539909 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob149	644078 mE 7540295 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob150	643662 mE 7540907 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob151	644710 mE 7541125 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage
Ob152	645155 mE 7540789 mN	S2	Poplar Box, Blackbutt, firm sandy surface
Ob153	645407 mE 7540162 mN	S2	Poplar Box, Blackbutt, firm sandy surface. Cracking surface observed to the west.
Ob154	645004 mE 7540003 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes observed to the west.
Ob155	644941 mE 7539851 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes observed to the south.
Ob156	645314 mE 7539941 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob157	646683 mE 7540275 mN	S2	Blackbutt, Eucalypts, firm sandy surface.
Ob158	646943 mE 7539762 mN	S2	Wide isolated depression, Eucalypts with minor Moreton Bay Ash, Poplar Box Black butt
Ob159	646630mE 7539414 mN	S2	Blackbutt, Eucalypts, firm sandy surface.
Ob160	646036 mE 7539624 mN	S2 – S2/C2 Boundary	Poplar Box, Blackbutt, firm sandy surface with cracking clays to the immediate west.
Ob161	645725 mE 7538968 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes to the west
Ob162	645377 mE 7538707 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob163	644823 mE 7538319 mN	C1	Cracking surface, melon holes <0.40 deep, <50% coverage, Brigalow
Ob164	644310 mE 7537833 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Poplar box observed to the east.
Ob165	644402 mE 7537847 mN	S1	Frim to hard setting, isolated Brigalow patch
Ob166	644132 mE 7538041 mN	C2 – C2/S1 Boundary	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Poplar Box to the north/east.
Ob167	643739 mE 7538575 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob168	644478 mE 7538905 mN	C1	Cracking surface, melon holes <0.40 deep, <50% coverage, Brigalow

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob169	643485 mE 7538923 mN	S1	Frim to hard setting sandy surface. Cracking clay surfaces observed to the south.
Ob170	643165 mE 7539350 mN	S1	Frim to hard setting sandy surface.
Ob171	643923 mE 7539477 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob172	642867 mE 7538013 mN	S1	Frim to hard setting sandy surface. Cracking surface to the west.
Ob173	642046 mE 7538256 mN	C2 – C2/S1 Boundary	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Red sandy surface north with Black Butt than clay surface returns.
Ob174	640351 mE 7538345 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob175	639764 mE 7538448 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob176	639211 mE 7538555 mN	C1/C2/S1 Boundary	Dam, melon holes to the north, normal gilgai to the east and Poplar Box to the west
Ob177	638861 mE 7538520 mN	S1	Hard setting brown sandy surface, Poplar Box
Ob178	638042 mE 7538570 mN	S2	Firm – hard setting sandy surface, Black butt
Ob179	638202 mE 7538826 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob180	638554 mE 7538939 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob181	637408 mE 7538705 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob182	636917 mE 7538763 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob183	636507 mE 7539040 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob184	635799 mE 7538890 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage. Brigalow regrowth
Ob185	635851 mE 7538289 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage. Brigalow regrowth
Ob186	635829 mE 7538054 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob187	636670 mE 7537857 mN	A1	Drainage line, depression, Paperbark 
Ob188	636551 mE 7538527 mN	C2	Cracking surface to the north
Ob189	637020 mE 7537712 mN	L2	Poplar Box wood land observed

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob190	637357 mE 7537472mN	C2	Cracking surface, Brigalow regrowth
Ob191	637209 mE 7537353 mN	L2	Dense Poplar Box wood lands
Ob192	636859 mE 7537329 mN	A1	Drainage line, depression
Ob193	637411 mE 7536481 mN	S1	Poplar Box wood land observed
Ob194	637905 mE 7537190 mN	S1/C2 Boundary	Cracking surface to the north, poplar box to the south
Ob195	637764 mE 7537804mN	C2	Minor cracking clay surface, Brigalow
Ob196	637714 mE 7537977 mN	C2/S1 Boundary	Cracking surface to the south and Poplar Box to the north
Ob197	637680 mE 7538138 mN	C2/S1 Boundary	Cracking surface to the north and Poplar Box to the north
Ob198	637651 mE 7538362 mN	C2	Cracking surface, Brigalow woodlands
Ob199	638272 mE 7537344 mN	C2/S2 Boundary	Boundary Depression and cracking to the south west, Blackbutt to the north east
Ob200	638400 mE 7537435 mN	S2	Poplar Box and Blackbutt
Ob201	639534 mE 7537534 mN	R1/S1/S2 Boundary	Red surface to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob202	639423mE 7538056 mN	S1	Poplar Box, Blackbutt and Ironbark
Ob203	639784 mE 7537993 mN	R1/ C2	Firm no cracking surface to the south, cracking clay surface to the north
Ob204	639941 mE 7537488 mN	R1/ C2	Firm no cracking surface to the west, cracking clay surface to the east
Ob205	640463 mE 7537726 mN	C2	Cracking surface, minor gilgai observed
Ob206	641283 mE 7537652 mN	C2	Cracking surface, normal gilgai observed
Ob207	640562 mE 7537335 mN	C2	Cracking surface, normal gilgai observed to the north
Ob208	642075 mE 7537481 mN	C2	Cracking surface, normal gilgai observed
Ob209	642313 mE 7536589 mN	C2	Cracking surface, normal gilgai observed
Ob210	642109 mE 7536460 mN	S2/R1	Red sandy surface to the west, brown sandy surface to the east
Ob211	641923 mE 7536231 mN	C1/R1	Melon holes to the east, red sandy surface to the west
Ob212	641734 mE 7536093 mN	R1/S2	Red surface to the north, brown surface to the south
Ob213	641330 mE 7536067 mN	C2	Isolated Brigalow patch with clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob214	641160 mE 7535666 mN	R1/S2 Boundary	Red surface to the north, brown sandy surface to the south.
Ob215	640768 mE 7535197 mN	S1	Poplar Box, sandy surface 
Ob216	641052 mE 7534837 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob217	640546 mE 7535223 mN	S1	Poplar Box woodlands present, creek/depression to the south
Ob218	640416 mE 7535259 mN	A2	Body of water leading to the dam
Ob219	640412 mE 7535476 mN	A2	Swamp/Depression, Eucalypts
Ob220	640892 mE 7535976 mN	R1	Red sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob221	640153 mE 7535160 mN	L2	Sparse regrowth, Poplar Box and Moreton Bay Ash 
Ob222	640000 mE 7535342 mN	L2	Minor depression with Brigalow
Ob223	640079 mE 7535059 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob224	639890 mE 7535353 mN	S1	Poplar Box woodlands, firm to hard setting sandy surface
Ob225	639535 mE 7535376 mN	B2	Cattle Yard
Ob226	639431 mE 7535246 mN	B2/ S1 Boundary	Minor depression with cracking surface and Brigalow. Areas outside are firm with Poplar Box
Ob227	639273 mE 7535208 mN	S1	Poplar Box, firm sandy surface
Ob228	639340 mE 7535437 mN	B2	Wide Depression with Dam
Ob229	638931 mE 7535381 mN	L2	Poplar Box, firm loamy sand surface
Ob230	638829 mE 7535664 mN	S1	Poplar Box, Blackbutt, Loamy sand surface
Ob231	638965 mE 7535884 mN	B2	Alluvial depression
Ob232	638574 mE 7535447 mN	A2/ L2 Boundary	Drainage line to the north with Paperbark and Eucalypts
Ob233	638568 mE 7535364 mN	L2	Poplar Box woodlands to the east
Ob234	638270 mE 7535766 mN	A1	Drainage line
Ob235	638438 mE 7535978 mN	C2	Isolated Brigalow patch with clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob236	638311 mE 7536066 mN	S1/C2 Boundary	Brigalow to the east, sandy surface to the west
Ob237	637799 mE 7535433 mN	L2	Tall woodlands of Poplar Box
Ob238	637707 mE 7536050 mN	A1	Drainage line, Moreton Bay Ash
Ob239	637142 mE 7535864 mN	L2	Tall woodlands of Poplar Box
Ob240	637145 mE 7535389 mN	L2/C2 Boundary	Poplar Box to the east, cracking clay surfaces to the west
Ob241	636773 mE 7535693 mN	L2	Poplar Box wood lands, hard setting with minor cracking
Ob242	636289 mE 7535417 mN	L2	Poplar Box wood lands
Ob243	636314 mE 7535783 mN	C2	Extensive cleared, cracking clay surface
Ob244	636127 mE 7535780 mN	S2	Poplar Box wood lands present with cracking soils to the north
Ob245	635750 mE 7535297 mN	L2	Poplar box woodland
Ob246	635712 mE 7533914 mN	C2	Minor gilgai, Brigalow regrowth
Ob247	635668 mE 7533610 mN	L1	Poplar box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob248	635160 mE 7533591 mN	L1	Hard setting surface, Poplar box
Ob249	635370 mE 7533716 mN	L1/C2 Boundary	Clay surface and minor gilgai to the north
Ob250	634883 mE 7533770 mN	C2	Normal gilgai, cracking clay surface
Ob251	634532 mE 7533634 mN	L1/C2 Boundary	Light sandy surface to the south, clay with shrubs to the north
Ob252	634082 mE 7533937 mN	C2	Normal gilgai, Brigalow regrowth
Ob253	634211 mE 7534505 mN	C2	Normal gilgai, Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob254	635054 mE 7534753 mN	C2	Normal gilgai, Brigalow regrowth 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob255	634506 mE 7535378 mN	S2	Depression to the north, Poplar Box 
Ob256	634063 mE 7535925 mN	S2/C2 Boundary	Poplar Box to the south, cracking clay to the north
Ob257	634093 mE 7536291 mN	C2	Cracking clay surface, minor gilgai.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob258	634657 mE 7536638 mN	L2	Poplar Box wood lands 
Ob259	634757 mE 7536245 mN	C2/S2 Boundary	Cracking clay to the south
Ob260	634549 mE 7535854 mN	C2	Cracking clay surface, minor gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob261	634970 mE 7535802 mN	C2	Cracking clay surface to the west, minor gilgai
Ob262	635182 mE 7535677 mN	C2/S2 Boundary	Poplar Box to the north and clay, minor gilgai to the south
Ob263	635424 mE 7536341 mN	S1	Poplar Box woodlands
Ob264	635564 mE 7537080 mN	S1	Poplar Box woodlands
Ob265	635485 mE 7537098 mN	L2	Dense Poplar Box woodlands
Ob266	634813 mE 7537171 mN	L2	Bloodwood, Ironbark to the east, Poplar Box to the west
Ob267	636005 mE 7537468 mN	S1	Poplar box woodlands
Ob268	636275 mE 7537753 mN	S1/L2 Boundary	Poplar box woodlands, thinner to the west
Ob269	636241 mE 7537361 mN	L2	Poplar box
Ob270	636769 mE 7537289 mN	L2/C2 Boundary	Cracking clay surface to the south
Ob271	636575 mE 7536882 mN	C2	Cracking clay surface, minor gilgai.
Ob272	636802 mE 7536547 mN	C2	Cracking clay surface to the north.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob273	636213 mE 7536564 mN	L2	Dense Poplar box woodlands 
Ob274	636216 mE 7536282 mN	L2/C2 Boundary	Poplar box to north, cracking clay to the south
Ob275	637172 mE 7536479 mN	A1	Edge of drainage line

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob276	637533 mE 7536800 mN	C2	Cracking clay surface, minor gilgai
Ob277	637696 mE 7536464 mN	S1/C2 Boundary	Cracking clays to the north, poplar box to the south
Ob278	637752 mE 7536951 mN	S1	Poplar box woodlands
Ob279	638020 mE 7536314 mN	C2	Cracking clay surface
Ob280	638713 mE 7536204 mN	C2/S2 Boundary	Cracking clay surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob281	638873 mE 7536754 mN	C2	Cracking clay surface 
Ob282	639027 mE 7537001 mN	S2	Brown, firm clayey sand surface
Ob283	639232 mE 7536823 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob284	639609 mE 7536609 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south
Ob285	640042 mE 7536247 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south
Ob286	639939 mE 7535946 mN	C2	Cracking clays, minor gilgai microrelief
Ob287	639886 mE 7535860 mN	S1/C2 Boundary	Poplar box to the south, cracking clays to the north
Ob288	640571 mE 7536256 mN	R1	Red loamy sand surface to the south
Ob289	640009 mE 7537024 mN	S2	Cracking clay surface to the north
Ob290	640547 mE 7537132 mN	S2/R1 Boundary	Red loamy sandy surface to the east
Ob291	640836 mE 7536628 mN	S2/R1 Boundary	Red loamy sandy surface to the east
Ob292	641318 mE 7537090 mN	C2/R1 Boundary	Red loamy sandy surface to the south, clay surface to the north
Ob293	643789 mE 7536987 mN	C2	Patch of Brigalow, minor gilgai
Ob294	644519 mE 7537219 mN	C2	Cracking clays, normal gilgai microrelief
Ob295	645953 mE 7537683 mN	C2	Cracking clays, normal gilgai microrelief extending to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob296	646717 mE 7538082 mN	C2/B1 Boundary	Cracking clays to the west
Ob297	646670 mE 7538320 mN	C2	Sparse Brigalow to the west, <30% normal gilgai
Ob298	646182 mE 7538055 mN	C2	Normal gilgai microrelief
Ob299	646558 mE 7537448 mN	C2	Cracking clay, normal gilgai microrelief
Ob300	645209 mE 7537461 mN	S1	Poplar box, tall woodlands, new regrowth to the west
Ob301	644872 mE 7536503 mN	R1	Red surface to the south
Ob302	645765 mE 7536749 mN	C2/S1 Boundary	Clay surface starts to the west, sandy surface to the east
Ob303	645391 mE 7536210 mN	S1	Poplar box woodlands with sandy firm to hard setting surface
Ob304	645559 mE 7535815 mN	C2/S1 Boundary	Clay surface starts to the west, sandy surface to the east
Ob305	645321 mE 7535662 mN	S1	Poplar box woodlands with sandy firm to hard setting surface
Ob306	644283 mE 7535402 mN	S2	Poplar box woodlands with clayey sand firm to hard setting surface
Ob307	643788 mE 7535356 mN	R1	Red loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob308	643713 mE 7535359 mN	A2	Swamp, open depression of water, Eucalypts
Ob309	643344 mE 7535045 mN	A2	Swamp, open depression of water to the east, Eucalypts
Ob310	642785 mE 7535003 mN	R1	Red surface 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob311	641867 mE 7535387 mN	R1/S2 Boundary	Red surface to the north
Ob312	642740 mE 7535710 mN	R1/C1 Boundary	Poplar box/red surface to the south, cracking clays to the north
Ob313	643098 mE 7535992 mN	R1/S1 Boundary	Red surface to north, brown to the north.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob314	642944 mE 7536282 mN	C1	Brigalow, cracking clays with melon hole relief, boundary with start of Poplar Box 100M= away at the east 
Ob315	643586 mE 7536222 mN	R1	Red firm loamy sand surface
Ob316	643775 mE 7536259 mN	R1	Red firm loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob317	643358 mE 7535654 mN	A2	Wide depression, moist/wet surface, Eucalypts
Ob318	644681 mE 7536133 mN	R1	Red firm loamy sand surface
Ob319	644031 mE 7536500 mN	R1/S2 Boundary	Red firm loamy sand surface to the south, brown sandy surface to the north
Ob320	645881 mE 7535125 mN	C2	Brigalow, minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob321	645881 mE 7535125 mN	C2	Brigalow, minor normal gilgai 
Ob322	645632 mE 7534621 mN	S1/C2 Boundary	Brigalow to the east, Poplar box to the west
Ob323	645428 mE 7534309 mN	S1	Poplar box wood lands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob324	645909 mE 7533983 mN	S1/C2 Boundary	Brigalow regrowth to the east, Poplar box to the west
Ob325	646332 mE 7533575 mN	C2	Gilgai <0.2m deep
Ob326	645603 mE 7533537 mN	S1	Poplar box wood lands
Ob327	644511 mE 7533499 mN	C2	Cracking clays, minor gilgai observed to the south west
Ob328	644307 mE 7532844 mN	C2	Cracking clay surface, minor gilgai
Ob329	643943 mE 7533311 mN	C2	Cracking clay surface, minor gilgai
Ob330	643366 mE 7533339 mN	S1/C2 Boundary	Poplar box and Brigalow vegetation interfingering
Ob331	642914 mE 7533273 mN	C2	Brigalow regrowth, cracking gilgai
Ob332	644164 mE 7532647 mN	A1	Drainage line, gradually comes to an end
Ob333	643415 mE 7532732 mN	A1	Drainage line
Ob334	642542 mE 7533239 mN	A1	Drainage line
Ob335	642329 mE 7533667 mN	C2	Brigalow regrowth, cracking gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob336	643340 mE 7533622 mN	S1	Poplar box wood lands
Ob337	643017 mE 7534198 mN	S1	Poplar box wood lands
Ob338	643885 mE 7534095 mN	S1	Poplar box wood lands
Ob339	643949 mE 7534459 mN	A2/S1 Boundary	Poplar box to the west, Eucalypts and moist surface to the east
Ob340	644173 mE 7534488 mN	A2/S1 Boundary	Poplar box to the east, Eucalypts and moist surface to the west
Ob341	644738 mE 7534618 mN	S1	Poplar Box, starting to change to red surface to the west
Ob342	643847 mE 7534654 mN	R1/A2 Boundary	Depression, Gums, Moreton Bay Ash, long grass with moist surface, Poplar Box to the north
Ob343	644182 mE 7534685 mN	R1/S1 Boundary	Red surface to the north, light brown to the south, poplar Box all around area
Ob344	641995 mE 7534017 mN	S1	Poplar Box, hard setting surface
Ob345	642228 mE 7534342 mN	A2	Depression, swamp with white gums

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob346	641617 mE 7534316 mN	A1	Drainage line, Paperbark and Gums 
Ob347	641536 mE 7534375 mN	A1/A2 Boundary	Area prone to flooding, moist surface
Ob348	641713 mE 7534721 mN	A2	Very wide depression, gums, moist surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob349	641840 mE 7534826 mN	S1	Poplar Box, Brigalow patch 100m to west, gums 100m to south
Ob350	641417 mE 7534841 mN	S1	Isolated small Brigalow patch, <30 x 30m, Poplar Box all around this area
Ob351	641886 mE 7533241 mN	C2	Cracking surface (cracks <5mm)
Ob352	641492 mE 7532741 mN	S1/L1 Boundary	Very gradual boundary, only Poplar Box all around area
Ob353	641398 mE 7532349 mN	S1	Lower slope, gums and Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob354	641433 mE 7531699 mN	S1	Poplar Box, firm light brown surface, gently undulating plain 
Ob355	642723 mE 7532496 mN	C2	Cracking surface, cleared, minimal microrelief
Ob356	644333 mE 7532134 mN	C2	Cracking surface, minimal microrelief

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob357	644259 mE 7531930 mN	L1	Loamy sand surface, Poplar Box
Ob358	643516 mE 7531698 mN	L1	Eroded area, minor drainage line, loamy sand surface, Poplar Box 
Ob359	640670 mE 7533043 mN	C2	Brigalow patch starts to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob360	641211 mE 7533224 mN	C2/L1 Boundary	Depression, clay soils with cracking surface, some Brigalow regrowth nearby
Ob361	640560 mE 7533218 mN	C2/S1 Boundary	Cracking surface to the east
Ob362	640929 mE 7533548 mN	C2/L1 Boundary	Cracking surface to the west, mixed vegetation 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob363	641639 mE 7533640 mN	A1/L1 Boundary	Poplar Box starts towards south west, drainage line to north east
Ob364	641327 mE 7533759 mN	C2/L1 Boundary	Cracking surface to the north, Poplar Box to the south
Ob365	640982 mE 7533991 mN	C2	Cracking surface, minor gilgai <0.2m deep
Ob366	639761 mE 7533701 mN	R1/L1 Boundary	Poplar Box, red surface colour towards south, light brown to the north
Ob367	639292 mE 7533567 mN	R1	Red surface, firm, sandy, Poplar Box
Ob368	639238 mE 7533828 mN	R1/L1 Boundary	Poplar Box, red surface colour towards south, light brown to the north
Ob369	640013 mE 7534158 mN	C2	Cracking surface, Brigalow regrowth
Ob370	639673 mE 7534382 mN	L1	Poplar Box, wide depression
Ob371	639271 mE 7534330 mN	L1	Poplar Box, sandy firm surface
Ob372	639208 mE 7534816 mN	C2	Cleared, some Brigalow regrowth in area
Ob373	639190 mE 7535008 mN	A1	Drainage line, Gums
Ob374	639841 mE 7534632 mN	C2/L1 Boundary	Cracking surface to the west, Poplar Box to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob375	640437 mE 7534580 mN	L1	Poplar Box
Ob376	640492 mE 7534350 mN	C2/L1 Boundary	Cracking surface to the west, Poplar Box to the east
Ob377	647006 mE 7536728 mN	C2	Cracking surface, normal gilgai 0.2m deep
Ob378	647219 mE 7536532 mN	B1	Firm light brown surface – loamy sand
Ob379	647533 mE 7536361 mN	C2/B1 Boundary	Cracking surface starts to the south, minor depression
Ob380	646354 mE 7536071 mN	C2	Cracking surface, normal gilgai 0.3m deep
Ob381	648164 mE 7536309 mN	S2	Poplar Box
Ob382	647645 mE 7535812 mN	C2	Cracking surface, normal gilgai 0.2m deep, Brigalow regrowth
Ob383	646220 mE 7535437 mN	C2	Cracking surface, normal gilgai 0.2m deep
Ob384	646251 mE 7535197 mN	C2	Cracking surface, normal gilgai 0.2m deep
Ob385	647147 mE 7535387 mN	C2	Cracking surface, normal gilgai 0.2m deep, Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob386	648239 mE 7534928 mN	A2	Poplar Box to west, Blackbutt to east 
Ob387	648499 mE 7534135 mN	A2	Inundated depression
Ob388	648492 mE 7533859 mN	A2	Poplar Box to east, mixed veg and Paperbark to west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob389	648733 mE 7533489 mN	A2	Poplar Box to the east, Blackbutt and some Paperbark to west
Ob390	648676 mE 7533483 mN	A2	Surface cracking, gums, depression
Ob391	648446 mE 7533499 mN	C2/A2 Boundary	Cracking surface to the west
Ob392	648162 mE 7533363 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth
Ob393	647857 mE 7534102 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth, cleared
Ob394	647857 mE 7534671 mN	C2	Normal gilgai 0.2 – 0.3m deep, 30% coverage, cracking surface
Ob395	647054 mE 7534178 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth, cleared
Ob396	646366 mE 7534567 mN	C2	Cracking surface
Ob397	648557 mE 7535811 mN	S2	Firm sandy surface, Blackbutt and Poplar Box
Ob398	648596 mE 7535664 mN	A2	Firm surface with minor cracking
Ob399	648772 mE 7534738 mN	A2	Brigalow regrowth, minor cracking, nearby Poplar Box
Ob400	649149 mE 7534004 mN	A2	Some small surface cracking

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob401	649569 mE 7533815 mN	A2	Some small surface cracking and crusting, Poplar Box
Ob402	649894 mE 7533990 mN	A2	Drainage line 
Ob403	650184 mE 7534146 mN	S2/A2 Boundary	Poplar Box only and non-cracking surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob404	650714 mE 7534358 mN	S2/C2 Boundary	Brigalow starts towards east
Ob405	650786 mE 7534114 mN	C2	Brigalow and cracking surface
Ob406	650630 mE 7533886 mN	A2	Depression, gums, cracking surface
Ob407	650953 mE 7533634 mN	C2	Brigalow and cracking surface, small area
Ob408	650907 mE 7534438 mN	S2/C2 Boundary	Brigalow starts to west, Poplar Box to east
Ob409	650604 mE 7534812 mN	S2	Very small isolated area of Brigalow, Poplar Box in surrounding areas
Ob410	650316 mE 7534976 mN	S2	Poplar Box only
Ob411	651629 mE 7534947 mN	S2	Poplar Box only

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob412	651590 mE 7535098 mN	S2	Poplar Box and Gums 
Ob413	651076 mE 7535957 mN	S2	Gums, sandy surface
Ob414	649422 mE 7536276 mN	S2	Ironbark, Blackbutt, Gums, sandy light brown surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob415	648911 mE 7536218 mN	S2	Blackbutt, Gums, sandy light brown surface
Ob416	649115 mE 7533129 mN	A2	Gums, depression, moist surface
Ob417	649239 mE 7533052 mN	A2	Gums, Blackbutt, depression, moist surface
Ob418	649371 mE 7533153 mN	A2	Cracking surface, gums, depression
Ob419	649445 mE 7533037 mN	B2	sandy surface with some minor cracking to east
Ob420	650355 mE 7533169 mN	B2/A2 Boundary	Poplar Box starts towards east, small cracks in surface towards west
Ob421	650524 mE 7533438 mN	B2	Poplar Box, gently undulating plain, light brown firm surface non-cracking
Ob422	650760 mE 7533509 mN	A2	Depression, cracking surface, tall Gums
Ob423	650933 mE 7532627 mN	B2/A2 Boundary	Alluvial, wide depressions to north, Poplar Box and firm non-cracking surface to south
Ob424	650237 mE 7532997 mN	A2	Cracking, wide depression, area prone to flooding, some Polar Box and mainly Gums
Ob425	651503 mE 7532930 mN	S2	Poplar Box with gums appearing to the east, firm sandy surface
Ob426	651540 mE 7532303 mN	S2	Some gums, lots of Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob427	651849 mE 7532131 mN	S2	Gums starting to the east, mainly Poplar Box though, light brown non-cracking sandy surface
Ob428	650779 mE 7532109 mN	A2	Cracking, wide depression, area prone to flooding, mainly Gums
Ob429	651397 mE 7531570 mN	B2	Gums, Poplar Box, Moreton bay Ash, top 50mm soil profile is Clayey Sand
Ob430	651208 mE 7531360 mN	B2	Poplar Box
Ob431	651564 mE 7530942 mN	B2	Surface soil texture – Silty Loam, Poplar Box only
Ob432	651952 mE 7530335 mN	S2	Poplar Box, firm light brow surface, non-cracking
Ob433	651896 mE 7530053 mN	A2	Alluvial area, wide depression, prone to flooding, minor surface cracking, Gums
Ob434	651347 mE 7530096 mN	B2/A2 Boundary	Depressions with Gums to the south, Poplar Box to the north
Ob435	650970 mE 7530074 mN	B2/C2 Boundary	Cracking surface to the north, non-cracking surface to the south
Ob436	650614 mE 7530143 mN	B2/C2 Boundary	Cracking surface to the north, non-cracking surface to the south
Ob437	650444 mE 7530754 mN	C2	Cracking surface, normal gilgai 0.2m deep, 20% coverage
Ob438	651166 mE 7530604 mN	B2/C2 Boundary	Cracking surface to the south, Poplar Box to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob439	650834 mE 7530892 mN	B2/C2 Boundary	Cracking surface to the south, non-cracking surface to the north with Poplar Box
Ob440	650275 mE 7531260 mN	B2/C2 Boundary	Cracking surface to the south with normal gilgai 0.1 – 0.2m deep 30% coverage, non-cracking surface to the north with Poplar Box
Ob441	650083 mE 7531475 mN	B2/C2 Boundary	Cracking surface to the west, non-cracking surface to the east with Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob442	650354 mE 7531677 mN	B2	Mixed vegetation, silty loam texture for surface soil horizon 
Ob443	650265 mE 7531683 mN	B2	Cracking surface with Poplar Box
Ob444	649875 mE 7531765 mN	B2	Cracking surface to the south, Poplar Box to north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob445	649817 mE 7531850 mN	C2	Land cleared, with normal gilgai 40% coverage 0.25m deep, some Brigalow regrowth in area
Ob446	649189 mE 7531595 mN	C2	Land cleared, with normal gilgai 30% coverage 0.2m deep, some Brigalow regrowth in area
Ob447	649709 mE 7532348 mN	C2	Land cleared, with normal gilgai 30% coverage 0.2m deep, some Brigalow regrowth in area
Ob448	649954 mE 7532534 mN	B2/C2 Boundary	Cracking surface to the south west, very minor cracking surface to the north east with Poplar Box
Ob449	649429 mE 7532806 mN	B2/C2 Boundary	Cracking surface to the south, Poplar Box to the north
Ob450	647839 mE 7532936 mN	C2	Cracking surface with minor normal gilgai <20% coverage
Ob451	648693 mE 7532907 mN	B2/C2 Boundary	Surface features thick (5mm+) cracks to the south and minor <3mm cracks to the north
Ob452	648950 mE 7532358 mN	C2	Cracking surface with minor normal gilgai <20% coverage
Ob453	648132 mE 7532172 mN	C2	Depression with long green grass, cracking surface with minor normal gilgai <20% coverage
Ob454	647823 mE 7531778 mN	C2	Cracking surface with minor normal gilgai 40% coverage
Ob455	648395 mE 7531796 mN	C2	Cracking surface with minor normal gilgai 40% coverage
Ob456	652372 mE 7531880 mN	L1	Sandy firm surface, cleared

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob457	651720 mE 7531430 mN	S2	Gums, sandy surface
Ob458	651901 mE 7530856 mN	S2	Gums, sandy surface
Ob459	652356 mE 7531100 mN	S2	Gums and some Poplar Box, sandy surface
Ob460	652953 mE 7531209 mN	L1	Sandy firm surface, cleared
Ob461	652668 mE 7530777 mN	L1	Sandy firm surface, cleared
Ob462	652631 mE 7530405 mN	S2/C2 Boundary	Cracking surface starting towards south east
Ob463	653359 mE 7530665 mN	L1	Firm sandy firm surface, cleared
Ob464	652778 mE 7530016 mN	C2	Hard setting, cracking surface with very minor normal gilgai present

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob465	653229 mE 7530049 mN	L1	Firm light brown surface, non-cracking 
Ob466	653551 mE 7529879 mN	L1/C1 Boundary	Cracking surface and melon holes 0.4-0.5m deep (50% coverage) start towards south
Ob467	652841 mE 7529653 mN	C2	Cracking surface with minor gilgai to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob468	652446 mE 7529359 mN	B2	Surface texture silty loam, with fine cracking
Ob469	652394 mE 7529669 mN	B2	Surface texture silty loam, with fine cracking
Ob470	651959 mE 7529616 mN	S2	Sandy firm surface with no cracks, gums and Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob471	651447 mE 7529708 mN	S2	Sandy soft surface, gums and Poplar Box 
Ob472	651047 mE 7529419 mN	S2	Light brown sandy surface, gums
Ob473	651786 mE 7529295 mN	S2	Sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob474	651631 mE 7529525 mN	S2	Surface texture loamy sand, with Polar Box only
Ob475	651968 mE 7529457 mN	B2	Surface texture – silty loam
Ob476	652238 mE 7528843 mN	B2	Surface texture – silty loam, with fine cracking <2mm
Ob477	652615 mE 7528607 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob478	652623 mE 7528966 mN	B2	Silty loam surface, uncleared area to the south with mixed vegetation 
Ob479	653085 mE 7528870 mN	B2	Silty loam surface, uncleared area to the south with mixed vegetation
Ob480	653214 mE 7528689 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob481	653236 mE 7528397 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west
Ob482	653574 mE 7529653 mN	C1	Cracking surface and melon holes 0.4-0.5m deep (50% coverage)
Ob483	654130 mE 7529775 mN	C2	Cracking surface, 20% normal gilgai 0.1-0.3m deep
Ob484	654111 mE 7529194 mN	C1	Melon Holes, 0.35m deep
Ob485	653375 mE 7529141 mN	C2	Normal gilgai 0.2m deep, 40% coverage, cracking surface
Ob486	653709 mE 7529049 mN	C1	Melon holes, mostly 0.3m deep, some up to 0.5m deep, 50% coverage
Ob487	653386 mE 7528963 mN	C2	Slight depression with Brigalow
Ob488	653913 mE 7528699 mN	C1/C2 Boundary	Melon Holes to the north
Ob489	654013 mE 7528608 mN	C2	Cracking surface
Ob490	654332 mE 7528661 mN	C2	Mostly normal gilgai <0.3m deep
Ob491	653640 mE 7528217 mN	C2	Brigalow, cracking surface, minor gilgai 0.1m deep, 20% coverage
Ob492	653781 mE 7528116 mN	C2	Cracking surface, very minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob493	653637 mE 7527781 mN	C2	Cracking surface, very minor normal gilgai, Brigalow
Ob494	654443 mE 7528027 mN	C2	Cracking surface, 50% coverage of normal gilgai 0.2m deep
Ob495	654783 mE 7527702 mN	C2	Cracking surface, very minor normal gilgai
Ob496	654449 mE 7527419 mN	C2	Cracking surface, very minor normal gilgai, Brigalow
Ob497	655367 mE 7527283 mN	C2	Cracking surface
Ob498	654414 mE 7529620 mN	L2/C2 Boundary	Firm light brown surface to east, cracking surface to west
Ob499	655056 mE 7529629 mN	S2	Firm light brown surface, texture clayey sand
Ob500	655348 mE 7529612 mN	S2	Poplar Box, firm non-cracking surface
Ob501	655324 mE 7529315 mN	S2	Poplar Box, firm non-cracking surface
Ob502	655007 mE 7529088 mN	S2	Poplar Box, firm non-cracking surface
Ob503	654621 mE 7528606 mN	S2	Depression, loamy sand surface texture, soft, gums and Poplar Box
Ob504	654447 mE 7529012 mN	S2	Depression, soft loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob505	654859 mE 7528460 mN	L2	Firm light brown sandy surface, non-cracking
Ob506	654957 mE 7528101 mN	S2	Firm loamy sand surface
Ob507	655040 mE 7527857 mN	C2	Cracking surface with occasional normal gilgai <0.2m deep
Ob508	655301 mE 7527813 mN	S2	Sandy non-cracking surface
Ob509	655500 mE 7527722 mN	S2	Lower slope, loamy sand surface with Poplar Box and gums
Ob510	655950 mE 7527949 mN	L2/S2 Boundary	Very diffused boundary, interfingering subsoils
Ob511	656138 mE 7528098 mN	S2	Firm light brown sandy surface, no coarse fragments, cleared
Ob512	655469 mE 7528010 mN	L2	Loamy sand surface, light brown, lower slope leading into open depression
Ob513	655437 mE 7528596 mN	S2	Poplar Box
Ob514	655703 mE 7528771 mN	C1/S2 Boundary	Melon holes and cracking surface to the north, firm non-cracking surface to the south
Ob515	655616 mE 7529156 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, firm non-cracking surface to the north
Ob516	656128 mE 7529421 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob517	656669 mE 7529106 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob518	656777 mE 7529569 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide, Brigalow 
Ob519	657284 mE 7529615 mN	C1	Melon holes, 50% coverage 0.4m deep, 3m wide

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob520	657853 mE 7529592 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob521	657081 mE 7528927 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 7-15m wide
Ob522	656706 mE 7528612 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 7-15m wide to the north and east
Ob523	656058 mE 7527590 mN	S2/R2 Boundary	Loamy sand, red surface to the east
Ob524	655544 mE 7527075 mN	S2	Firm, sandy surface with no cracking, Poplar box woodlands
Ob525	655752 mE 7526458 mN	S2	Firm, sandy surface with no cracking, Poplar box woodlands
Ob526	655326 mE 7525970 mN	S2	Firm, sandy surface with no cracking, Poplar box woodlands
Ob527	656163 mE 7525777 mN	R1	Wide depression with minor water
Ob528	656082 mE 7525641 mN	R1	Swamp, water starts to the north
Ob529	656270 mE 7525645 mN	R1	Dark reddish loamy sand, Eucalypts
Ob530	655875 mE 7525481 mN	S2	Poplar boxwood lands
Ob531	656931 mE 7525770 mN	R1	Red loamy sand surface to the south, Eucalypts

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob532	656585 mE 7526079 mN	S2/R1 Boundary	Red surface to the south, light brown to the north
Ob533	657426 mE 7526064 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob534	657147 mE 7526375 mN	R2	Loamy sand surface, reddish brown
Ob535	657441 mE 7526649 mN	C1	Brigalow and melon holes to the south
Ob536	657644 mE 7526687 mN	R2	Minor patch of Poplar box, cracking clays to the south.
Ob537	657432 mE 7526892 mN	R2	Loamy sand surface, reddish brown
Ob538	658199 mE 7526909 mN	R2	Loamy sand surface, reddish brown to the west and south
Ob539	657075 mE 7527192 mN	C1/R2 Boundary	Loamy sand surface, reddish brown to the west, cracking clays to the east
Ob540	657469 mE 7527264 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob541	656820 mE 7527390 mN	R2	Poplar box woodlands, firm loamy red sand surface
Ob542	657450 mE 7527758 mN	C1	Cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob543	658242 mE 7528625 mN	C1	Cracking clays, melon holes, 50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob544	658761 mE 7529218 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob545	659908 mE 7529508 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob546	660561 mE 7528805 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob547	661505 mE 7528937 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob548	659524 mE 7527815 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob549	659798 mE 7527296 mN	R2/C1 Boundary	Melon holes and cracking surface to north west, firm to hard setting non0cracking surface to south east
Ob550	658835 mE 7527273 mN	C1	Cracking clays, melon holes, <50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob551	658520 mE 7526807 mN	C1	Cracking clays, melon holes, <50% coverage 0.5m+ deep 
Ob552	658904 mE 7526748 mN	S1/C1 Boundary	Cracking clays to the north, sands to the south
Ob553	659133 mE 7526224 mN	S1	Firm loamy sand surface, Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob554	659254 mE 7526080 mN	S1/R2 Boundary	Diffused boundary, red surface to the east.
Ob555	658699 mE 7525940 mN	S1	Brown loamy sand surface, Blackbutt
Ob556	658333 mE 7526018 mN	S1	Brown loamy sand surface, Blackbutt, Melon holes to the west
Ob557	658089 mE 7526341 mN	S1/C1 Boundary	Melon holes to the south west, firm non-cracking surface to north east
Ob558	658068 mE 7525755 mN	C1/C2 Boundary	Melon holes to the north, gilgai to the south
Ob559	658384 mE 7525354 mN	C1/C2 Boundary	Melon holes to the north, gilgai to the south
Ob560	658661 mE 7525138 mN	C1	Cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob561	658277 mE 7525026 mN	C2	Cracking surface with occasional normal gilgai <0.2m deep
Ob562	657812 mE 7525046 mN	S2	Light brown surface, upper slope, 2.5%, Moreton bay Ash and Poplar Box
Ob563	657591 mE 7525339 mN	R1/C2 Boundary	Red surface to west, cracking light brown surface to east
Ob564	657482 mE 7524364 mN	R1	Small open depression, reddish brown surface with Paperbark and Poplar Box nearby
Ob565	657213 mE 7524182 mN	S2/R1 Boundary	Red surface starts to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob566	656946 mE 7524022 mN	S2	Light brown, firm sandy surface with Poplar Box
Ob567	656770 mE 7524508 mN	R1	Red surface, Poplar Box
Ob568	657054 mE 7524940 mN	R1	Red surface, Poplar Box
Ob569	656325 mE 7524870 mN	R1	Red surface, Poplar Box
Ob570	655890 mE 7524514 mN	S2	Light brown, firm sandy surface with Poplar Box
Ob571	659741 mE 7526693 mN	R2/C1 Boundary	Reddish brown firm surface to the east, cracking surface with melon holes to the west
Ob572	659597 mE 7526770 mN	C1	Brigalow regrowth, cracking clays, melon holes, <40% coverage 0.4m+ deep
Ob573	659961 mE 7527224 mN	R2	Red-brown firm non-cracking surface, mixed vegetation
Ob574	660196 mE 7527439 mN	C1	Brigalow regrowth, cracking clays, melon holes, <40% coverage 0.4m+ deep
Ob575	659888 mE 7526142 mN	R2	Reddish brown firm surface, non-cracking, cleared
Ob576	661933 mE 7527518 mN	C1	Melon holes 50% coverage, 0.3-0.5m deep, <3m wide
Ob577	661505 mE 7528937 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob578	662088 mE 7529331 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob579	662774 mE 7528857 mN	C1	Cracking surface and melon holes - 50% coverage
Ob580	662198 mE 7528410 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south
Ob581	662293 mE 7528147 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the south, red firm non-cracking surface to the north
Ob582	662380 mE 7528266 mN	R1	Interfingering boundary, becoming red surface colour to the south east
Ob583	662506 mE 7528268 mN	R1	Completely red surface colour
Ob584	662647 mE 7528066 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the south, red firm non-cracking surface to the north
Ob585	663154 mE 7527953 mN	R1	Red firm non-cracking sandy surface, Poplar Box
Ob586	663644 mE 7527945 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob587	662794 mE 7527799 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob588	663518 mE 7527613 mN	R1	Red sandy surface
Ob589	663816 mE 7527596 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob590	664631 mE 7527556 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south
Ob591	665094 mE 7527745 mN	R1/S2 Boundary	Light brown surface to east, red sandy surface to west
Ob592	665654 mE 7527963 mN	S2	Firm, light brown surface
Ob593	665120 mE 7528147 mN	C1/S2 Boundary	Melon holes and cracking surface to the north
Ob594	665637 mE 7528530 mN	C1/S2 Boundary	Melon holes and cracking surface to the north
Ob595	666273 mE 7528676 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob596	665942 mE 7528929 mN	S2	Firm light brown non-cracking sandy surface, melon holes start approx. 100m to the north
Ob597	665968 mE 7529073 mN	C1/S2 Boundary	Firm light brown non-cracking sandy surface, melon holes start to the north
Ob598	666307 mE 7529263 mN	S2	Firm light brown non-cracking sandy surface
Ob599	666205 mE 7529927 mN	S2	Firm light brown non-cracking sandy surface
Ob600	665736 mE 7530245 mN	S2	Firm light brown non-cracking sandy surface
Ob601	665377 mE 7530094 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob602	665850 mE 7529826 mN	C1/S2 Boundary	Firm light brown non-cracking sandy surface to the east, melon holes start to the west
Ob603	664905 mE 7529433 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob604	665451 mE 7528716 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob605	664451 mE 7528561 mN	C1	Isolated area of 20% coverage of melon holes, all around area coverage is uniformly 50%, 0.3-0.5m deep
Ob606	664307 mE 7528997 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.4m+ deep
Ob607	663944 mE 7529531 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.4m+ deep
Ob608	662985 mE 7528547 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob609	666741 mE 7529236 mN	S2	Minor depression, firm sandy surface, light brown, cleared
Ob610	667412 mE 7529172 mN	S2	Firm sandy surface, light brown, cleared
Ob611	668042 mE 7528803 mN	S2	Wide depression, loamy sand light brown surface
Ob612	667581 mE 7528655 mN	S2	Firm sandy surface, light brown, cleared
Ob613	666862 mE 7528689 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob614	667179 mE 7528367 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob615	666486 mE 7527873 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob616	666228 mE 7528320 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep, 2-5m wide
Ob617	665879 mE 7527858 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob618	665468 mE 7527166 mN	R1/C1 Boundary	Red sandy firm surface to the south, cracking surface with 3m wide melon holes to the north
Ob619	663945 mE 7527278 mN	R1	Red sandy surface, non-cracking, poplar Box
Ob620	664972 mE 7526896 mN	R1	Red sandy surface, non-cracking, poplar Box
Ob621	660322 mE 7526826 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob622	658346 mE 7524917 mN	C1/C2 Boundary	Cracking surface, normal gilgai <0.2m deep to west, melon holes 0.3m+ deep to the east
Ob623	663225 mE 7527182 mN	R1	Red sandy surface, non-cracking
Ob624	662950 mE 7526960 mN	R1/C1 Boundary	Red surface to the east, cracking surface with melon holes to the west
Ob625	663659 mE 7527017 mN	R1/C1 Boundary	Red surface to the east, cracking surface with melon holes to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob626	663746 mE 7526611 mN	C1	Melon holes 0.4m deep, 4m wide
Ob627	664166 mE 7526554 mN	R1	Red sandy surface, non-cracking to the north
Ob628	664985 mE 7527269 mN	R1	Red sandy surface, non-cracking
Ob629	665676 mE 7526950 mN	R1	Red sandy surface, non-cracking
Ob630	665740 mE 7526817 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob631	665485 mE 7526463 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob632	665608 mE 7526428 mN	R1	Red sandy surface, non-cracking
Ob633	665911 mE 7526308 mN	R1/C1 Boundary	Melon holes to the north/north east, red sandy non- cracking surface to the south/ south west
Ob634	665819 mE 7526222 mN	R1	Red sandy surface, non-cracking
Ob635	665709 mE 7526106 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob636	666135 mE 7526563 mN	C1	Melon holes <0.5m deep, Brigalow
Ob637	665844 mE 7527086 mN	R1/S1 Boundary	Diffused boundary, red sandy surface to the west, brown sandy surface to the east.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob638	666299 mE 7527266 mN	S1	Light brown firm sandy surface
Ob639	666364 mE 7527476 mN	C1	Melon holes <0.5m deep, Brigalow regrowth
Ob640	666497 mE 7526960 mN	C1/S1 Boundary	Light brown firm sandy surface to north, melon holes to the south.
Ob641	666842 mE 7527339 mN	C1	Melon holes begin to the north east
Ob642	667210 mE 7527741 mN	C1/S1 Boundary	Light brown firm sandy surface to east, melon holes to the west.
Ob643	667332 mE 7527878 mN	S1	Light brown firm sandy surface
Ob644	667525 mE 7528102 mN	C1	Melon holes begin to the north
Ob645	667654 mE 7528218 mN	C1	Melon holes begin north west
Ob646	667839 mE 7528427 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, firm light brown surface to the north
Ob647	667745 mE 7529072 mN	S1	Light brown firm sandy surface
Ob648	667154 mE 7528924 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob649	664996 mE 7525308 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob650	664594 mE 7524854 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface 
Ob651	664022 mE 7524237 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface
Ob652	663029 mE 7523145 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob653	662362 mE 7522424 mN	C1	Melon holes <0.4 m deep, Brigalow, cracking clay surface
Ob654	662012 mE 7522032 mN	C1	Melon holes <0.4 m deep, Brigalow, cracking clay surface
Ob655	661851 mE 7521859 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands to the south.
Ob656	661376 mE 7521339 mN	R2	Frim dark reddish brown loamy sand surface with Poplar box woodlands.
Ob657	661197 mE 7521139 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob658	660925 mE 7520845 mN	R2	Wide shallow depression, frim dark brown loamy sand surface with Poplar box woodlands.
Ob659	660367 mE 7520246 mN	R2	Lower slope, frim dark brown loamy sand surface with Poplar box woodlands.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob660	660040 mE 7519880 mN	C2	Brigalow regrowth observed, cracking surface 
Ob661	659827 mE 7520193 mN	C2	Cracking clay surface with minor gilgai
Ob662	660155 mE 7520737 mN	C2	Cracking clay surface with minor gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob663	659364 mE 7520299 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the west and dark brown to the east.
Ob664	658990 mE 7520225 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob665	658781 mE 7520161 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the east and dark brown to the west.
Ob666	658788 mE 7520529 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob667	659573 mE 7520686 mN	R2	Frim dark reddish brown loamy sand surface with Poplar box woodlands.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob668	659017 mE 7521390 mN	C2	Cracking clay surface with minor normal gilgai 
Ob669	660107 mE 7521687 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the north and dark brown to the south.
Ob670	660279 mE 7521217 mN	C2	Cracking clay surface with minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob671	660631 mE 7522128 mN	C2	Cracking clay surface with minor normal gilgai
Ob672	660786 mE 7521453 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the north and dark brown to the south.
Ob673	661065 mE 7522112 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands.
Ob674	661203 mE 7522427 mN	C1/R2 Boundary	Cracking clay surface with melon holes to the east and dark brown to the west.
Ob675	660727 mE 7522584 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands.
Ob676	660584 mE 7523031 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands, minor Moreton Bay Ash
Ob677	660412 mE 7523366 mN	A2/R2 Boundary	Depression/water body to the west with Moreton Bay Ash, dark reddish brown loamy sands to the east.
Ob678	660880 mE 7523453 mN	C2/R2 Boundary	Cracking clay surface with melon holes to the east and dark brown to the west.
Ob679	660525 mE 7523781 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands, minor Moreton Bay Ash
Ob680	660877 mE 7523899 mN	C1/R2 Boundary	Minor gilgai to the east and dark brown surface to the west.
Ob681	660894 mE 7524387 mN	C1/R2 Boundary	Minor gilgai to the east and dark brown surface to the west.
Ob682	661491 mE 7524187 mN	C1	Small dam, cracking clay surface with melon holes

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob683	662055 mE 7524327 mN	C1	Melon holes present
Ob684	662857 mE 7524631 mN	C1	Melon holes present
Ob685	664079 mE 7525831 mN	C1	Melon holes <0.4 m deep, 2-4m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob686	662871 mE 7525822 mN	C1	Melon holes <0.4 m deep, 2-4m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob687	661693 mE 7525450 mN	C1	Melon holes 0.3+ m deep, 2m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob688	661322 mE 7525633 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob689	661288 mE 7525237 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob690	660905 mE 7525002 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob691	660631 mE 7525946 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob692	660762 mE 7525662 mN	R2	Firm light brown surface, changing to reddish brown 3-5cm below surface
Ob693	660440 mE 7525492 mN	R2	Firm light brown surface, changing to reddish brown 3-5cm below surface
Ob694	660274 mE 7525313 mN	R1	Firm dark reddish brown sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob695	660434 mE 7525264 mN	A2	Large wide-open depression with water present, Eucalypts
Ob696	660297 mE 7525893 mN	C1	Cracking surface, melon holes
Ob697	660179 mE 7525684 mN	C1	Lower slope, wide depression, cracking surface
Ob698	660202 mE 7524695 mN	R1	Sandy firm red surface
Ob699	659624 mE 7524373 mN	R1	Sandy firm red surface, Poplar Box
Ob700	658554 mE 7524242 mN	C1	Melon holes
Ob701	658776 mE 7524117 mN	C1/C2/S1 Boundary	Clay to the east with gilgai, melon holes to the west and firm sand surface to the south.
Ob702	658748 mE 7524074 mN	S1	Firm light brown sand surface
Ob703	659354 mE 7524056 mN	R1/C2 Boundary	Reddish brown sandy surface to the east, clay surface to the west.
Ob704	659244 mE 7523871 mN	C2	Normal gilgai, Brigalow
Ob705	658326 mE 7523404 mN	C1	Melon holes, Brigalow
Ob706	659258 mE 7523295 mN	S1/C2 Boundary	Cracking clays to the east and light brown sandy surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob707	659108 mE 7522988 mN	S1/A2 Boundary	Inundated areas to the west and south west.
Ob708	659491 mE 7522787 mN	S1	Firm light brown loamy sandy surface
Ob709	659665 mE 7522276 mN	S1/C2 Boundary	Firm light brown loamy sands to the north, cracking clays to the south.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob710	659761 mE 7522174 mN	C2	Cracking clays and normal gilgai 
Ob711	659340 mE 7521968 mN	A2/C2 Boundary	Wetland area to the west, Brigalow and clays to the east.
Ob712	658662 mE 7521599 mN	A2	Dam adjacent to alluvial plain

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob713	658540 mE 7522477 mN	A2	Inundated wetland area
Ob714	658016 mE 7522760 mN	A2	Inundated wetland area
Ob715	657745 mE 7523036 mN	C1/A2 Boundary	Inundated wetland area to the south east, cracking clays to the north west.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob716	657293 mE 7522377 mN	C2	Brigalow regrowth 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob717	656838 mE 7522708 mN	S2	Poplar box woodlands 
Ob718	657041 mE 7523412 mN	S2	Poplar box woodlands, loamy sand surface
Ob719	657757 mE 7523470 mN	C2	Cracking clays, melon holes Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob720	658475 mE 7523630 mN	S1/C1 Boundary	Cracking clays to the west, Blackbutt woodlands to the east, depression with water body
Ob721	657677 mE 7523865 mN	S2/C1 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob722	662017 mE 7520619 mN	R2#	No melon holes observed, dark brown loamy surface
Ob723	663885 mE 7520208 mN	R2#	No melon holes observed, dark brown loamy surface
Ob724	664996 mE 7520378 mN	C2#	Clay surface with gilgai, no large melon holes visible in aerial
Ob725	665967 mE 7521003 mN	C1#	Melon holes visible in aerial
Ob726	663250 mE 7521159 mN	C2#	Shape of area where site is located does not contain melon holes
Ob727	664279 mE 7521585 mN	C1#	Melon holes visible in aerial
Ob728	662561 mE 7521742mN	C2#	Shape of area where site is located does not contain melon holes
Ob729	663641 mE 7522783 mN	C1#	Melon holes visible in aerial
Ob730	666133 mE 7522384 mN	C2#	Clay with minor gilgai, no melon holes visible
Ob731	665311 mE 75224 mN	C1#	Melon holes visible in aerial

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob732	665351 mE 7523396 mN	C1#	Melon holes visible in aerial
Ob733	665730 mE 7523880 mN	C2#	Clay with minor gilgai, no melon holes visible
Ob734	664768 mE 7524040 mN	C1/C2# Boundary	Aerial imagery shows melon holes to the west, gilgai to the east.
Ob735	665843 mE 7524756 mN	C1#	Melon holes visible in aerial
Ob736	666470 mE 7526105 mN	C1#	Melon holes visible in aerial
Ob737	638787 mE 7548615 mN	B1/S2 Boundary	Poplar box to the south, Eucalypts to the north
Ob738	638708 mE 7549074 mN	B2	Skinny white Eucalypts
Ob739	638460 mE 7549815 mN	B2	Skinny white Eucalypts
Ob740	637960 mE 7549710 mN	B2	Silty loam surface, Eucalypts
Ob741	637752 mE 7549565 mN	B2/S1 Boundary	Poplar box to the south, Eucalypts to the east.
Ob742	638229 mE 7549381 mN	B2/S1 Boundary	Poplar box to the south, Eucalypts to the east.
Ob743	637772 mE 7548972 mN	S1	Poplar box woodlands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob744	638362 mE 7548711 mN	S1	Poplar box woodlands
Ob745	637698 mE 7548516 mN	S1	Poplar box woodlands
Ob746	638321 mE 7548057 mN	S1	Poplar box woodlands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob747	637980 mE 7547441 mN	S1	Poplar box woodlands 
Ob748	638047 mE 7546985 mN	S1	Poplar box woodlands
Ob749	638016 mE 7546880 mN	S1	Poplar box woodlands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob750	638275 mE 7546551 mN	C2	Minor gilgai, cracking clay surface
Ob751	638237 mE 7546752 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob752	637937 mE 7546647 mN	C2	Minor gilgai, cracking clay surface
Ob753	637656 mE 7546475 mN	C2	Minor gilgai, cracking clay surface
Ob754	637599 mE 7546675 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob755	637583 mE 7547045 mN	S1	Poplar Box, firm surface
Ob756	643868 mE 7537650 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob757	645132 mE 7537351 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob758	643605 mE 7537960 mN	C2	Gilgai, cracking clay surface 
Ob759	643638 mE 7537095 mN	S1/C2 Boundary	Cracking clays to the south east, Poplar box woodlands to the west
Ob760	642658 mE 7537588 mN	S2/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob761	643153 mE 7538266 mN	S1/C2 Boundary	Cracking clays to the north, Poplar box woodlands to the south
Ob762	645202 mE 7538166 mN	S1/C1 Boundary	Cracking clays and melon holes to the north, Poplar box woodlands to the south
Ob763	642687 mE 7537168 mN	C2	Normal gilgai, cracking clay surface
Ob764	642338 mE 7536982 mN	S2/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob765	642499 mE 7538628 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob766	642736 mE 7538459 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob767	640575 mE 7539651 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob768	639285 mE 7540134 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob769	641301 mE 7540199 mN	S1/C2 Boundary	Cracking clays to the north, Poplar box woodlands to the south
Ob770	641615 mE 7540407 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob771	643397 mE 7543387 mN	C1	Dam location
Ob772	643498 mE 7542953 mN	C1	Wide shallow depression, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob773	643522 mE 7544500 mN	C1/C2 Boundary	Inundated depression, melon holes to the west, gilgai to the east 

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob774	642855 mE 7545593 mN	C1	Depression, cracking clay surface, moist 
Ob775	642409 mE 7544171 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west
Ob776	640826 mE 7545315 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob777	643272 mE 7541641 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west
Ob778	645277 mE 7542107 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob779	645272 mE 7541519 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob780	645173 mE 7543890 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob781	639735 mE 7547887 mN	S1	Tall Eucalypt wood lands
Ob782	642482 mE 7540275 mN	S1/C1 Boundary	Cracking clays and melon holes to the east, Poplar box woodlands to the west
Ob783	643674 mE 7546234 mN	B2	Poplar Box, trampled surface with fine cracking
Ob784	644426 mE 7545432 mN	B2	Fining cracks in surface, firm, Poplar Box nearby, mostly cleared
Ob785	643879 mE 7545259 mN	S2	Gums, firm sandy surface, creek nearby
Ob786	643172 mE 7545715 mN	S2	Gums, firm sandy surface, creek nearby
Ob787	642755 mE 7547337 mN	S2	Gums, firm sandy surface, creek nearby
Ob788	644384 mE 7548098 mN	B2	Dam, cracking surfaces all around

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob789	644225 mE 7548165 mN	B2	Cracking surface, fine cracks, adjacent to dam
Ob790	643501 mE 7547722 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away
Ob791	643672 mE 7547526 mN	B2	Gums, and nearby Brigalow in depressions

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob792	643587 mE 7547438 mN	B2-DV / B2 Boundary	Depressions and wide drainage lines to north, Brigalow with cracking surface 
Ob793	644011 mE 7546650 mN	B2	Firm, fine cracking surface, field texture – silty loam
Ob794	644001 mE 7546966 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob795	644400 mE 7546620 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away
Ob796	642498 mE 7548108 mN	B2	Firm, fine cracking surface, field texture – silty loam
Ob797	643095 mE 7548215 mN	B2	Firm, fine cracking surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob798	643475 mE 7548823 mN	B2	Wide depression, with silty loam surface and very fine cracking 
Ob799	644113 mE 7549117 mN	B2	Land form moves uphill abruptly toward the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob800	644378 mE 7549246 mN	S2	Poplar Box, light brown sandy surface 
Ob801	644680 mE 7549387 mN	S2	4% slope, Ironbark, Blackbutt, some Poplar Box
Ob802	645317 mE 7549694 mN	S2	Firm, loamy sand surface, light brown, Poplar Box and Ironbark

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob803	639154 mE 7545082 mN	S2	Firm sandy surface, Poplar Box only
Ob804	637213 mE 7546895 mN	S2	Firm sandy surface, some Poplar Box
Ob805	636992 mE 7547131 mN	S2	20 x 20m depression with cracking surface, appears S2 with top sandy layer washed away – cracking surface
Ob806	636039 mE 7548170 mN	S2	Firm sandy surface, Poplar Box
Ob807	635148 mE 7549147 mN	C2 / S2 Boundary	Cracking surface to north west, firm non-cracking sandy surface to south east
Ob808	634294 mE 7550076 mN	S2	Poplar Box, Gums, firm loamy sand surface, creek nearby
Ob809	632117 mE 7552418 mN	B2	Very fine cracking surface with Poplar Box, field texture – silty loam

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob810	631352 mE 7552744 mN	B2	Fine cracking surface, small area of very rocky surface 
Ob811	630901 mE 7553420 mN	S1	Firm sandy surface, Poplar Box
Ob812	630227 mE 7553749 mN	S1	Firm sandy surface, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob813	628563 mE 7553666 mN	S1	Firm sandy surface, Poplar Box
Ob814	626215 mE 7553524 mN	S1	Polar Box and gums, loamy sand surface
Ob815	623846 mE 7553563 mN	S1	Firm sandy surface, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob816	623304 mE 7553655 mN	S1	Wide depression, 6-8m deep, Poplar Box, loamy sand surface 
Ob817	621023 mE 7553233 mN	S2	Drainage line, creek bed coarse sandy, soil profile on cuttings loamy sand throughout, gums

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob818	619185 mE 7552267 mN	S2	Drainage line with 6m+ drop-off, creek bed coarse sandy, soil profile on cuttings loamy sand throughout, gums 

Appendix C

Laboratory Certificates

ESSA Pty Ltd /Phosyn EAL NATA (ASPAC certified)

**For Info Refer ESSA Pty Ltd
PO Box 442 Sunnybank Q 4109**

Phone: 0403245560

email: e.s.s.a@bigpond.net.au

Reference: **B98961**

Sheet 1 of 4

Date Received: 17/08/2017
Date Completed: 01/09/2017

FINAL REPORT

Project:

Project - Olive Downs

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

Client Name: GTEnvironmental

Contact: Mr Reece Mc Cann

Sample Type: Soil

Number of samples: 57

Soil Analysis Report
Batch Number: B98961

Date Received: 17/08/2017
Date Completed:09/09/2017

Client: GTE Olive Downs- Results Page 1 of 2

ESSA Ref	field ref	Soil pH	Soil EC	Soil Cl	P(Olsen)	Exch.Ca	Exch. Mg	Exch.Na	Exch. K	CEC	Ca/Mg	ESP	Total N	Nitrate N	OrgMatter	Ammonia
	depth (m)		dS/m	mg/kg	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	Ratio	%Na/CEC	%	Mg/Kg	(%)	Mg/Kg
SCB0016	2-0.00-0.10 (18/6/17)	6.3	0.01	10	5	1.19	0.34	<0.08	0.16	1.7	3.5	<1	0.033	1.4	1	<20
SCB0017	2-0.3-0.4 (18/6/17)	6.9	<0.01	14		0.63	0.25	<0.08	0.12	1.1	2.5	1				
SCB0018	2-0.6-0.7 (18/6/17)	8.1	0.04	97		2.3	2.97	0.73	0.26	6.4	0.8	11				
SCB0019	2-0.9-1.0 (18/6/17)	8.6	0.11	108		2.77	4.1	1.35	0.26	8.5	0.7	16				
SCB0020	8-0.00-0.10 (19/6/17)	6.7	0.02	24	11	3.05	0.97	<0.08	0.37	4.4	3.2	<1	0.081	7.4	1.3	<20
SCB0021	8-0.3-0.4 (19/6/17)	6.8	0.01	24		1.86	0.56	<0.08	0.2	2.7	3.3	1				
SCB0022	8-0.6-0.7 (19/6/17)	7.1	<0.01	53		1.61	0.71	<0.08	0.16	2.6	2.3	1				
SCB0023	8-0.9-1.0 (19/6/17)	7.3	<0.01	39		1.69	0.97	<0.08	0.16	3.0	1.7	1				
SCB0024	12A-0.00-0.10 (19/6/17)	8.2	0.08	16	16	17.74	3.25	0.1	0.83	22.0	5.5	0	0.113	3.1	2.3	<20
SCB0025	12A-0.3-0.4 (19/6/17)	8.2	0.05	21		13.51	3.75	0.4	0.45	18.1	3.6	2				
SCB0026	12A-0.6-0.7 (19/6/17)	8.9	0.13	59		12.5	5.26	1.7	0.4	19.9	2.4	9				
SCB0027	12A-0.8-0.9 (19/6/17)	8.8	0.29	275		10.31	5.86	2.83	0.38	19.4	1.8	15				
SCB0028	12B-0.00-0.10 (19/6/17)	8	0.04	20	6	13.47	6.3	0.18	0.56	20.6	2.1	1	0.116	<1	3.1	<20
SCB0029	12B-0.3-0.4 (19/6/17)	8.8	0.48	362		10.69	8.23	3.53	0.39	22.9	1.3	15				
SCB0030	12B-0.6-0.7 (19/6/17)	8.6	0.72	611		8.02	8.66	4.21	0.37	21.3	0.9	20				
SCB0031	12B-0.9-1.0 (19/6/17)	8.6	0.81	846		7.44	8.76	5.08	0.39	21.7	0.9	23				
SCB0032	17-0.00-0.10 (20/6/17)	6.7	0.01	11	5	1.74	0.65	<0.08	0.21	2.7	2.7	1	0.05	<1	1.4	<20
SCB0033	17-0.36-0.46 (20/6/17)	6.7	<0.01	16		0.83	0.8	<0.08	0.22	2.0	1.0	3				
SCB0034	17-0.6-0.7 (20/6/17)	6.6	0.02	9		1.89	2.32	0.28	0.17	4.7	0.8	6				<20
SCB0035	17-0.9-1.0 (20/6/17)	7	0.03	16		1.95	2.38	0.47	0.1	5.0	0.8	10				
SCB0036	25A0.00-0.10(21/6/17)	8.6	0.1	21	17	23.29	5.98	0.33	1.26	30.9	3.9	1	0.128	2	4.1	<20
SCB0037	25A-0.3-0.4 (21/6/17)	8.8	0.38	274		19.68	9.33	2.86	0.82	32.7	2.1	9				
SCB0038	25A-0.7-0.8 (21/6/17)	8.6	1.11	1330		17.1	9.29	5.46	0.9	32.8	1.8	17				40
SCB0039	25A-0.9-1.0 (21/6/17)	8.7	1	944		15.88	9.15	5.42	0.78	31.2	1.7	17				
SCB0040	25B-0.00-0.10 (21/6/17)	8.6	0.11	19	13	23.47	5.27	0.39	1.37	30.5	4.5	1	0.256	2	5	<20
SCB0041	25B-0.3-0.4 (21/6/17)	8.7	1.19	1654		17.85	9.55	6.12	1.35	34.9	1.9	18				
SCB0042	25B-0.6-0.7 (21/6/17)	8.6	2.13	2678		15.32	10.22	9.97	1.74	37.3	1.5	27				
SCB0043	25B-0.9-1.0 (21/6/17)	8.6	2.32	2690		14.75	10.61	12.16	1.9	39.5	1.4	31				
SCB0044	49-0.00-0.10 (25/6/17)	6.4	0.01	2	4	1.31	0.4	<0.08	0.16	1.9	3.3	0	0.045	<1	1.4	<20
SCB0045	49-0.25-0.35(25/6/17)	6.5	<0.01	3		1.03	0.28	<0.08	0.15	1.6	3.6	1				
SCB0046	49-0.6-0.7 (25/6/17)	6.6	<0.01	13		1.08	0.32	<0.08	0.1	1.7	3.4	1				
SCB0047	49-0.9-1.0 (25/6/17)	6.7	<0.01	15		2.91	0.83	<0.08	0.09	4.2	3.5	1				
SCB0048	60-0.00-0.10 (7/7/17)	6.4	0.02	12	8	2.36	0.56	<0.08	0.19	3.2	4.2	1	0.079	<1	2.1	<20
SCB0049	60-0.3-0.4 (7/7/17)	6.9	0.03	80		1.49	0.77	0.29	0.1	2.7	1.9	11				
SCB0050	60-0.6-0.7 (7/7/17)	7.8	0.18	212		3.6	3.28	2.07	0.21	9.2	1.1	23				
SCB0051	60-0.9-1.0 (7/7/17)	8.9	0.61	622		6.79	5.15	5.14	0.35	17.5	1.3	30				
SCB0052	62-0.00-0.10 (7/7/17)	7.2	0.03	11	3	5.5	1.85	<0.08	0.29	7.7	3.0	1	0.099	<1	2.8	<20
SCB0053	62-0.3-0.4 (7/7/17)	7.5	0.03	32		3.29	1.64	0.14	0.23	5.4	2.0	3				
SCB0054	62-0.6-0.7 (7/7/17)	7.3	0.02	34		4.85	1.86	0.19	0.25	7.2	2.6	3				
SCB0055	62-0.9-1.0 (7/7/17)	7.5	0.03	26		4.64	1.97	0.13	0.29	7.1	2.4	2				
SCB0056	68-0.00-0.10 (8/7/17)	6.5	0.03	16	8	4.06	1.84	<0.08	0.44	6.4	2.2	1	0.131	1	3.9	<20
SCB0057	68-0.3-0.4 (8/7/17)	8	0.32	394		4.92	5.99	3.34	0.27	14.6	0.8	23				
SCB0058	68-0.6-0.7 (8/7/17)	9.2	0.79	898		9.84	6.89	5.46	0.29	22.5	1.4	24				
SCB0059	68-0.9-1.0 (8/7/17)	9.3	0.78	864		9.23	5.8	5.4	0.29	20.8	1.6	26				
SCB0060	96-0.00-0.4 (12/7/17)	6.2	0.03	23	6	1.61	0.49	<0.08	0.24	2.4	3.3	1	0.101	<1	3.2	<20
SCB0061	96-0.15-0.25 (12/7/17)	6.6	<0.01	24		0.41	0.21	<0.08	0.09	0.7	2.0	3				
SCB0062	96-0.4-0.5 (12/7/17)	7.3	0.03	175		2.65	4	1.24	0.64	8.7	0.7	14				
SCB0063	96-0.9-1.0 (12/7/17)	7.3	0.07	82		1.67	2.66	1.17	0.3	5.9	0.6	20				
SCB0064	106-0.00-0.10(14/7/17)	6.3	0.01	18	10	3.21	1.67	<0.08	0.27	5.2	1.9	<1	0.09	<1	2.2	<20
SCB0065	106-0.2-0.3 (14/7/17)	6.5	0.02	18		3.01	0.86	<0.08	0.25	4.2	3.5	1				
SCB0066	106-0.4-0.5 (14/7/17)	6.2	0.06	90		3.23	2.42	0.57	0.21	6.5	1.3	9				
SCB0067	106-0.6-0.7 (14/7/17)	7	0.31	398		7.38	6.1	2.22	0.46	16.2	1.2	14				
SCB0068	106-0.9-1.0 (14/7/17)	7.9	0.41	537		6.75	5.65	2.6	0.44	15.5	1.2	17				
SCB0069	131-0.00-0.1 (28/7/17)	6.5	0.01	8	4	1.58	0.41	<0.08	0.15	2.1	3.8		0.059	<1	1.3	<20
SCB0070	131-0.3-0.4 (28/7/17)	6.7	0.02	23		1.62	0.41	<0.08	0.26	2.3	3.9	0				
SCB0071	131-0.6-0.7 (28/7/17)	6.8	<0.01	22		1.65	0.61	<0.08	0.26	2.6	2.7	0				
SCB0072	131-0.9-1.0 (28/7/17)	6.6	0.01	18		2.1	1.61	<0.08	0.15	3.9	1.3	1				

Lab No	Sample No	PSA-CS	PSA-FS	PSA-Silt	PSA-Clay	Disp Ratio	ADMC	Total S	Sulfate-S	Mn	Boron	Copper	Iron	Zinc	Al	Al/CEC(%)
	Depth (m)	%	%	%	%	R1	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	meq/100g	%
SCB0016	2-0.00-0.10 (18/6/17)	75	13	6	6	0.81	0.4	0.02	3	21.8	<0.1	0.2	22	0.3	0.03	2
SCB0017	2-0.3-0.4 (18/6/17)						0.3								0.1	9
SCB0018	2-0.6-0.7 (18/6/17)						1.8								0.14	2
SCB0019	2-0.9-1.0 (18/6/17)						2.5								0.06	1
SCB0020	8-0.00-0.10 (19/6/17)	65	18	7	11	0.77	1.0	0.02	3	20.8	0.1	0.3	21	0.4	0.02	1
SCB0021	8-0.3-0.4 (19/6/17)						0.6								0.04	2
SCB0022	8-0.6-0.7 (19/6/17)						0.6								0.12	5
SCB0023	8-0.9-1.0 (19/6/17)						0.7								0.11	4
SCB0024	12A-0.00-0.10 (19/6/17)	26	10	19	45	0.88	3.7	0.02	3	8.7	0.3	1.2	25	0.4	0.07	0
SCB0025	12A-0.3-0.4 (19/6/17)						3.9								0.03	0
SCB0026	12A-0.6-0.7 (19/6/17)						3.8								0.03	0
SCB0027	12A-0.8-0.9 (19/6/17)						3.3								0.03	0
SCB0028	12B-0.00-0.10 (19/6/17)	29	7	15	49	0.72	4.3	0.02	3	7.9	0.8	1.1	10	0.3	0.05	0
SCB0029	12B-0.3-0.4 (19/6/17)						3.3								0.05	0
SCB0030	12B-0.6-0.7 (19/6/17)						3.4								0.03	0
SCB0031	12B-0.9-1.0 (19/6/17)						3.3								0.02	0
SCB0032	17-0.00-0.10 (20/6/17)	75	9	10	7	0.66	0.6	<0.01	3	27	0.2	0.3	25	0.2	0.03	1
SCB0033	17-0.36-0.46 (20/6/17)						0.6								0.07	4
SCB0034	17-0.6-0.7 (20/6/17)						1.6								0.07	2
SCB0035	17-0.9-1.0 (20/6/17)						1.7								0.05	1
SCB0036	25A-0.00-0.10 (21/6/17)	18	2	31	49	0.87	4.3	0.02	9	7.7	0.4	1.2	13	0.5	0.04	0
SCB0037	25A-0.3-0.4 (21/6/17)						3.8								0.04	0
SCB0038	25A-0.7-0.8 (21/6/17)						3.5								0.03	0
SCB0039	25A-0.9-1.0 (21/6/17)						3.3								0.02	0
SCB0040	25B-0.00-0.10 (21/6/17)	11	14	27	48	0.79	4.2	0.02	5	9.1	1	0.9	12	0.5	0.02	0
SCB0041	25B-0.3-0.4 (21/6/17)						3.6								0.02	0
SCB0042	25B-0.6-0.7 (21/6/17)						3.7								0.03	0
SCB0043	25B-0.9-1.0 (21/6/17)						3.7								0.05	0
SCB0044	49-0.00-0.10 (25/6/17)	75	9	7	9	0.60	0.5	0.02	3	26.1	<0.1	0.3	8	0.3	0.07	4
SCB0045	49-0.25-0.35 (25/6/17)						0.5								0.11	7
SCB0046	49-0.6-0.7 (25/6/17)						0.5								0.22	13
SCB0047	49-0.9-1.0 (25/6/17)						0.7								0.3	7
SCB0048	60-0.00-0.10 (7/7/17)	61	16	7	16	0.66	0.7	0.02	5	24.3	0.1	0.3	16	0.6	0.05	2
SCB0049	60-0.3-0.4 (7/7/17)						0.6								0.06	2
SCB0050	60-0.6-0.7 (7/7/17)						1.7								0.05	1
SCB0051	60-0.9-1.0 (7/7/17)						2.8								0.02	0
SCB0052	62-0.00-0.10 (7/7/17)	67	16	9	9	0.62	1.2	0.02	3	14.9	0.4	0.5	19	0.5	0.03	0
SCB0053	62-0.3-0.4 (7/7/17)						0.9								0.1	2
SCB0054	62-0.6-0.7 (7/7/17)						1.3								0.04	1
SCB0055	62-0.9-1.0 (7/7/17)						1.1								0.07	1
SCB0056	68-0.00-0.10 (8/7/17)	46	19	20	16	0.7	1.3	<0.01	4	46.8	0.4	0.6	40	1	0.03	1
SCB0057	68-0.3-0.4 (8/7/17)						2.5								0.03	0
SCB0058	68-0.6-0.7 (8/7/17)						2.3								0.03	0
SCB0059	68-0.9-1.0 (8/7/17)						2.3								0.03	0
SCB0060	96-0.00-0.4 (12/7/17)	52	19	20	11	0.61	0.8	0.02	4	17.4	0.4	0.5	144	0.6	0.02	0
SCB0061	96-0.15-0.25 (12/7/17)						0.3								0.02	1
SCB0062	96-0.4-0.5 (12/7/17)						2.2								0.18	2
SCB0063	96-0.9-1.0 (12/7/17)						1.4								0.07	1
SCB0064	106-0.00-0.10 (14/7/17)	39	32	13	16	0.72	1.1	0.02	2	24.7	<0.1	0.5	28	0.9	0.02	0
SCB0065	106-0.2-0.3 (14/7/17)						1.6								0.02	0
SCB0066	106-0.4-0.5 (14/7/17)						0.3								0.02	0
SCB0067	106-0.6-0.7 (14/7/17)						2.8								0.02	0
SCB0068	106-0.9-1.0 (14/7/17)						2.3								0.02	0
SCB0069	131-0.00-0.1 (28/7/17)	76	9	8	8	0.55	0.4	0.02	3	31.4	<0.1	0.3	10	0.6	0.02	0
SCB0070	131-0.3-0.4 (28/7/17)						0.5								0.02	1
SCB0071	131-0.6-0.7 (28/7/17)						0.6								0.05	2
SCB0072	131-0.9-1.0 (28/7/17)						1.0								0.04	1

METHOD DESCRIPTIONS

Soil

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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 NaHCO ₃ @ pH 8.5, (AA) colorimetric
Exch.Ca	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0 leach, AAS
Exch.Mg	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH ₄ OAc @ pH 7.0 leach, AAS
Exch.Na	15C1	9.6	0.09	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0 leach, AAS
Exch.K	15C1	4.8	0.02	meq/100g	Exchangeable calcium	1M NH ₄ OAc @ pH 7.0 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO ₃ + Ca(NO ₃) ₂ extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
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(H ₂ PO ₄) 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
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric
TS	ED042S		0.01	%	Total Sulfur	Leco

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

For Manager
Analytical Services:

D E Baker BSc MASSSI

QUALITY CONTROL DATA

Soil

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

			Actual Value		Acceptance Criteria	
Test Method	Units				[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	

			Actual Value		Acceptance Criteria	
Test Method	Units	Test Soil			[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	

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