

Springsure Creek Coal Mine Project Soils and Land Suitability Assessment

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INTRODUCTION

GT Environmental Services Pty Ltd (GTES) was commissioned by Springsure Creek Coal Pty Ltd to complete a soil and land suitability assessment as part of the Environmental Impact Statement (EIS) for development of the proposed Springsure Creek Coal Mine Project (the Project).

1.1 Project Description

The project involves the construction and operation of a greenfield underground mine using the longwall mining method. The project is located in the Bowen Basin approximately 47 kilometres (km) south east of the town of Emerald, Central Queensland (refer Figure 1). The project proponent is Springsure Creek Coal Pty Ltd. Access to the project site will be via both State and Local Government roads. From Emerald, the project will be accessed via the Gregory Highway, Glenorina Road, Wyntoon Road and Kilmore Road.

The mine is expected to be in operation for approximately 40 years with thermal coal to be mined using the longwall method producing up to 11 million tonnes per annum (Mtpa).

The project area Mining Lease Application (MLA) 70486 is 10,736 hectares (ha) in size and located across seven separate allotments, six properties owned by five separate landholders (herein known as the 'project area'), summarised below in Table 1.

Table 1: Project Area Summary

Lot Plans	Property Identification
Lot 2 DSN856	Den-Lo Park
Lot 2 SP141314	Springton Limited
Lot 5 DSN856	Springton
Lot 6 DSN708	Cowley
Lot 7 on RP620355	Arcturus Downs
Lot 8 on RP620355	
Lot 11 RP619636	Cedar Park

It comprises flat to gently undulating plains traversed by the ephemeral Springsure Creek, Station Creek and their tributaries. The project site is shown on Figure 2.

Coal would be transported from the mine to the train load out facility along a transport and infrastructure corridor. The corridor would be approximately 200 metres (m) wide and 40 km long, heading eastwards from the mine. The infrastructure corridor would contain a haul road or potentially an overland conveyor, power and water supply, and telecommunication lines. The train load out facility would include a coal stockpile area, train loading bin and rail loop.

An EIS is required for the project in support of approvals under the Environmental Protection Act 1999 (EP Act).

1.2 Scope of Report

This report provides an assessment of the soil and land suitability for the project site and includes:

- Description of the regulatory requirements relevant to the project;
- A review of available background material;
- Identification and description of soil types within the project site;
- Assessment of existing land suitability (LS) for rain fed cropping, beef cattle grazing and Good Quality Agricultural Land (GQAL);
- Description of soils stripping and reuse for rehabilitation; and
- Assessment of Strategic Cropping Land (SCL).

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1.3 Regulatory Requirements

A range of guidance and standards is applicable to the description and classification of soils in Queensland. GTES has applied these requirements in line with best practice and as recommended by the Department of Natural Resources and Mines (DNRM) as follows:

- A soil survey was scoped and conducted in accordance with the *Guidelines for Surveying Soils and Land Resources* (McKenzie *et al.*, 2008). Soil characteristics and soil profiles were described in accordance with the *Australian Soil and Land Survey Handbook* (National Committee on Soil and Terrain, 2009 and Gunn *et al.*, 1988);
- 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 one's being *Lands of the Isaac - Comet Area, Queensland* (Story *et al.*, 1967) and an unpublished QDPI report (G.A. Tuck 1993) *Major Soils of the Raingrown Cropping Area at Emerald*;
- Collection of soil samples for laboratory analysis was undertaken in line with the *Land Suitability Assessment Techniques* (LSAT Guidelines) within the *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Mines and Energy, 1995); and
- Agricultural Land Classes and the presence of GQAL across the project site was completed with reference to the now expired *State Planning Guideline: The Identification of Good Quality Agricultural Land 1/92* (Qld Department of Primary Industries and Department of Housing, Local Government and Planning (1993).

2 BACKGROUND

2.1 Land Use

The Project is located within the Central Bowen Basin coalfields, approximately 47 km south east of Emerald and 37 km north east of Springsure in Central Queensland. According to the Central Highlands Development Corporation (2012), the Central Highlands region spans an area of almost 60,000 square kilometres (km²) and is located near the Tropic of Capricorn. The region includes a large proportion of the Bowen Basin coal fields, mineral and sapphire producing areas, and a large and diverse agricultural and pastoral industry (including cattle, cotton, grain, citrus and grapes).

The project site (MLA 70486) comprises 10,736 hectares of flat to gently undulating plains which are currently being used primarily for raingrown and irrigated cash cropping. Apart from active drainage pathways and related floodplains, most of the project site has been extensively cleared of original vegetation which consisted of Brigalow, Mountain Coolibah, Bloodwood, Silver leaf Ironbark, flooded Coolibah and open bluegrass downs country.

Bourne and Tuck (1993) summarised overall agricultural production in the area in, *Understanding and Managing Soils in the Central Highlands*. Bourne and Tuck state that the unreliable tendency of early summer rain together with higher probability of heatwaves means that late summer (i.e. January to late February) is the preferred planting time for summer crops. The reverse applies to winter crops as unreliability of winter rain means that early April and May plantings are favoured should the opportunity be presented with a hope of subsequent follow-up rain later for secondary root establishment. In addition, the early planted crop is at risk of July frosts.

The evaporation rate in the area is often more than twice annual rainfall and a significant amount of the annual rainfall occurs in high intensity, short duration events resulting in water loss in runoff. It is therefore important that cropping regimes are managed such that conditions favouring infiltration are maximised and runoff is reduced.

Apart from periods of prolonged dry weather, droughts are a feature of the area. Droughts are described by Bourne and Tuck as an occasion when climatic variations are so severe that the risks of crop failure greatly exceed what would be considered an acceptable, manageable level of commercial risk. Existing records suggest that such events occur about once every 10 years.

2.2 Topography and Hydrology

The project site is situated within the Nogoia- Mackenzie River system in the Fitzroy Region. Springsure Creek flows through the Project area and enters the Comet River to the east which enters the upstream portion of the Mackenzie River.

Bourne and Tuck (1993) describe the land within the project area and level alluvial plains and gently undulating to undulating plains and rises comprising Brigalow scrub soils and open downs country. Slope gradients for most parts of the Project area range between 0 - 3% with isolated rises up to 10% gradient.

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3 METHODOLOGY

3.1 Desktop Review

GTES reviewed available published and unpublished soils and land resources information for the project site. This information was used to develop preliminary soils mapping units and distribution for the project site which assisted in the development of the field investigation.

3.1.1 Geomorphology and Geology

Surface geological mapping from the Geological Survey of Queensland (1:250,000 Series) for the Project area indicates the area to be dominated by unconsolidated Cainozoic sediments and basalts, underlain by the Permian to Triassic Denison Trough basin fill. Three major geological units occur;

- Quaternary channel and flood plain alluvium; gravel, sand, silt, clay,
- Quaternary soil, sand, gravel, scree, alluvium. May include some residual alluvium; sand dominant, with gravel and,
- Tertiary basalt flows, olivine basalt, trachy basalt, trachyandesite, leucitite, basanite, nephelinite, limburgite, rhyolite minor agglomerate and tuff. High level intrusives; rare volcanoclastic sediments.

Galloway, R.W in Story *et al* (1967) also states that a wide variety of basalt rocks are represented. Soil types are influenced mainly from source rock in addition to widespread erosion and accumulation of clays, sand and gravels which occurred throughout the Tertiary period.

3.1.2 Regional Soils Reports and Available Documentation

The CSIRO and Queensland Government have undertaken a variety of soil mapping and assessment work over the cropping areas of the Central Highlands region. The following references have been utilized to varying extents in the development of this report :

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

This report mapped land systems which are landscape patterns comprised of generally uniform geology but with variable landforms, soils and vegetation. Within each land system are individual 'units' which describe the range of individual soil types and vegetation. In addition, the relative proportion of each unit in the land system is provided although they have not been mapped. The report also contains detailed geological information and discusses geomorphological processes and influence on existing soil types and landscapes.

Story *et al* described the area as undulating plains and lowlands with clay soils and Softwood scrub and floodplains. This summary is an accurate portrayal of soil types found in this survey.

The main value of the CSIRO reports in this survey is that it was possible to refine soil types which may be expected to occur from the land systems mapping. The presence of land systems and 'expected' soil types which Story identified proved to be basically correct however too broad a basis for soil type boundary delineation at a 1:50,000 scale. Land systems described across the project area are shown in Figure 7.

- *Springsure Creek Coal Mine Project. Environmental Impact Statement Chapter 5 – Land.*

The initial EIS for the project included a Soils and Land Suitability report however it did not meet sampling requirements of the Terms of Reference for the project due to limited access at the time of the survey. Nevertheless, it includes directly relevant data which has been incorporated into this report.
- *Understanding and Managing Soils of the Central Highlands* (Bourne and Tuck, 1993);

Agricultural Management Units (AMU's) are described which focus on land management requirements. It is a relevant reference in the assessment of land suitability and management of soil types described.
- *Major Soils of the Raingrown Cropping Lands at Emerald.* (G.A. Tuck 1993 unpublished).

Graham Tuck (pers comm) completed soils mapping of the Emerald 1:100000 map sheet in the late 1980's however the work has not been published to date. Another Land Resources Officer with the QDPI at that time, Mr Peter Shields, coordinated the development of this 1993 report. However, while specific soil types described by Tuck are presented, mapping in the report is restricted to broad geomorphological land units.

The soil types described by G.A. Tuck (1993) have been used in the current report.
- *Land Resource Survey and Evaluation of the Kilcummin Area, Queensland* (Shields and Williams, 1991);

This survey is located north of Clermont in an area dominated by basaltic soils which are comparable with those found in the Project Area. In addition, it provides a practical application of the Land Resources Branch (1989) land suitability assessment techniques which have been used in this report.
- *Soil survey reports of the Emerald Irrigation Area from 1970 to 2003*

Officers of the QDPI produced a range of reports which mapped and described soils and land management within the Emerald Irrigation Area. This data includes detailed evaluations of soil attributes relevant to the Project area including soil water relationships and morphology.
- *Site Characterisation Report – Gindie Sustainable Farming Group* (Irvine, S.A. 1999)

This report presents detailed information, including laboratory data, for basaltic soil type *Ronnoc* which forms a major component within the Project area. The work was done on Juanita property located approximately 15 kilometres to the west of the Project area.

Cross-references to relevant regional soil types identified within Story et al (1967), Bourne and Tuck (1993) and Tuck (1993) are provided within Section 4.

3.1.3 Aerial Photography

Aerial photography was reviewed as part of the desktop evaluations. Initial map units and boundaries were marked up on available Google Earth™ imagery. The aerial photography reviewed included;

- Department of Environment and Heritage Protection (EHP) Land Centre, Brisbane
 - 12/05/1973
 - 11/06/1983
 - 15/12/1990
 - 19/11/1998
- Google Earth™
 - 22/10/2012

3.1.4 Preliminary Soils Mapping

After the detailed review of reports and aerial photography, and 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.

3.2 Field Work

A detailed field survey was undertaken over two separate dates. The fieldwork dates included 29 April to 7 June, 2013 and 30 to 31 June, 2013 using 'free survey' techniques (Gunn 1988) to collect observational and sampling data. This data was used to confirm and refine the preliminary mapping.

A mapping scale of 1:50,000 was applied across the MLA area. This scale has been recommended by DNRM to provide an appropriate scale for investigation and mapping of study areas which may contain both potential cropping and grazing land. This scale of mapping requires a minimum of 2 sites per 100 hectares of which approximately 20% should be detailed and approximately 80% of which are observation sites.

Within the project area there were 75 detailed sites and 176 observation sites; and overall, the field work included a total of 251 investigation sites over the project site of approximately 10,991 ha. A further 13 sites from the CDM Smith Soil Survey conducted between 29 November to 3 December 2011, within and outside the area have being included within this assessment for a total of 88 detailed sites. The total number of sites exceeds the minimum sampling requirements by McKenzie, 2008.

Detailed site descriptions and surface observations are presented within Attachment A and Attachment B.

3.2.1 Observation Sites

A total of 176 surface observation sites were recorded during the field investigation. Surface observation sites provided basic information for indicative soil type, slope, surface condition and landscape characteristics and were used to refine mapped soil boundaries.

3.2.2 Detailed Sites

Detailed soil profile information was collected at the 66 detailed sites using a 50 mm diameter hand auger. This method is well established and is appropriate for sub-surface assessment and sampling for this survey. Detailed sites were augered to 1.0 m for a majority of the sites however some profile cuttings observed allowed sites to be recorded up to 3.0 m.

The location of detailed sites is presented in Figure 2. The specific locations of the detailed sites were determined in the field based on the location being a sound representation of the soil unit being described, available site access and preliminary mapping.

The information collected from detailed sites included:

- Location (GDA94) and type of soil observation (e.g. erosion exposed cutting or hand auger);
- Major vegetation types and land use;
- 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 (as per *Munsell Soil Colour Charts*) and mottling of each horizon;
- For each horizon, observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence and pedality, pH and moisture content;
- Presence of organic matter, roots and prevalence of biological activity; and
- Photographs of the soil profile and surrounding landscape.

Samples were collected from those detailed soil profiles considered most representative of the major soil units at the project site. A total of 33 samples were collected during field investigations from nine (9) detailed sites. Soil sampling of profiles was conducted as per Gunn et al (1988) Guidelines for Surveying Soil and Land Resources with samples taken from the surface (0.0-0.1m) and every horizon change within the soil profile. Samples were not collected across horizon or sub-horizon boundaries.

3.2.3 Laboratory Analysis

Samples of soils considered to be most representative of mapped soil units were submitted for laboratory analysis. Laboratory analysis was undertaken to assist in determining the overall soils characterisation and agricultural suitability of the soils and to establish the physical and chemical limitations of surface and near-surface soils for use in rehabilitation works. Laboratory testing was also used to identify soils that may require specific management measures.

Samples were analysed at Australian Laboratory Services (ALS), Brisbane, accredited by National Association of Testing Authorities (NATA).

The soil samples selected from within the project area were analysed for the following parameters:

- pH (1:5);
- Electrical conductivity (EC [1:5]);
- Total N, Nitrates;
- Bicarbonate Extractable P;
- Organic matter content;
- Exchangeable Cations, CEC, Ca/Mg Ratio, ESP;
- Metals - Total (Mn, B, Cu, Fe, Zn);
- Sulfur (Total as S);
- Chloride;
- Particle Size Distribution - Hydrometer Method; and
- Emerson aggregate test.

Subsoil from the project area were analysed for a limited suite of parameters (pH, EC, cation exchange capacity and exchangeable ions and chloride) due to the low likelihood of these soils being disturbed by the project and used in rehabilitation.

In addition, calculations were undertaken to determine the exchangeable sodium percentage and the calcium to magnesium ratio. 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 suitability of the soil for agricultural use as well as the depth of soil material that is suitable for stripping and reuse during rehabilitation. The laboratory results are summarised in Section 3 and detailed in Attachment C (Laboratory Certificates).

Table 2: Analytical Program and Number of Samples

Test	Number of Samples Tested	Application	Justification
Field pH and EC using portable TPS instrument	pH – 189	Indication of possible limitations from salinity and pH.	Used for 'on the spot' estimates of possible salinity or pH problems and to confirm the effective soil depth.
pH	33	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) and if lime application is a required as a management measure.
Electrical Conductivity	33	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts	The measure of electrical conductivity is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.

Test	Number of Samples Tested	Application	Justification
Chloride Content	33	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	8	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.
Available Nitrogen	9	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.
Cation Exchange Capacity (CEC), Exchangeable Ca, Mg, Na, K, (Cations), Ca/MG ratio and Exchangeable Sodium Percentage (ESP)	33	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.
Organic Matter	9	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.
Particle Size Distribution (<2 mm)	9	Nutrient retention, exchange properties, erodibility, doughiness, 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 types and water holding capacity.
Aggregate Stability Emerson Aggregate Test	8	Susceptibility to surface sealing under rainfall or irrigation, effect of raindrop impact and slaking, permeability, infiltration, aeration, seedling emergence and correlation	An Emerson Aggregate Class number is determined using the results of this test. The method for this test is provided in Australian Standard (AS) 1289.3. 8.1 - 1997. Soils are divided into seven classes on the basis of their coherence in water, with a further class distinguished by the presence of calcium-rich

Test	Number of Samples Tested	Application	Justification
		with other properties	minerals. This test provides an indication of dispersivity and slaking behavior of soil and its preponderance to becoming erosive under natural conditions. Therefore it is a useful test in assessing options for ongoing management for excavated and stockpiled materials.
Selected Metals (Mn, B, Cu, Fe and Zn)	8	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.
Sulfur	9	Measurement of total Sulfur in soil	Total levels of S help identify where organic matter or gypsum are present in a profile.

3.3 Land Suitability Assessment

Land suitability in Central Queensland is primarily based upon the classifications provided within the LSAT Guidelines within the Department of Mines and Energy's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Mines and Energy, 1995), as shown in Table 3.

Table 3: Land Suitability Classes

Land Suitability Class	Definition
Class 1	Suitable land with negligible limitations that is highly productive and requires only simple management to maintain economic production.
Class 2	Suitable land with minor limitations which either reduce production or require more than the simple management practices of Class 1 to maintain economic production.
Class 3	Suitable land with moderate limitations which either further lower production or require more than those management practices of Class 2 to maintain economic production.
Class 4	Currently unsuitable land with severe limitations which make it doubtful whether benefits of the activity will outweigh the inputs/costs required to achieve and maintain production in the long term under current environmental and economic conditions. A change in future conditions may induce a change to Class 3.
Class 5	Unsuitable land with extreme limitations that preclude its use.

Notes:

1. Adapted from LSAT Guidelines (DME, 1995)

The LSAT Guidelines provide general criteria and threshold values for assessment of a range of soil limitations to rainfed cropping and beef cattle grazing land use. GTES has used field and laboratory data collected to assess the severity of any limitations and the land suitability class of the 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.

3.4 Agricultural Land Classes and GQAL

GQAL is land which is capable of sustainable use for agriculture, with a reasonable level of inputs, and without causing degradation of land or other natural resources.

GQAL is assessed using agricultural land classes (ALCs) presented in the *Planning Guideline: The Identification of Good Quality Agricultural Land* (Department of Primary Industries, 1993) (Table 4). GQAL for the project site is defined in the Bauhinia Shire Planning Scheme (2007) as three ALC's (A, C1 and C2). Class A is Crop land and Class C is grazing land but has been further subdivided into sub classes (C1, C2 and C3) of decreasing quality.

Table 4: Agricultural Land Classes

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
A	1-3	1-3	Crop land - Land that is suitable for current and potential crops with limitations to production that range from none to moderate.
B	4	1-3	Limited crop land - Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
C1	5	1-2	Pasture land - Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
C2	5	3	Land suitable for native pastures.
C3	5	4	Land suitable for limited grazing of native pastures.
D	5	5	Non-agricultural land - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

Notes:

1. Sourced from *Planning Guideline: The Identification of Good Quality Agricultural Land* (Department of Primary Industries, 1993)

4 SOIL MAPPING UNITS

4.1 Summary

Eight soil mapping units (SMUs) have been identified across the project site. The SMUs have been grouped according to basic soil morphology, position in the landscape and parent material and are summarized in Table 5. Individual soil types have been classified in accordance with the *Australian Soil Classification* (Isbell, 2002). In some instances, mapped SMU's may include other associated soil types. Comparable soil types described by Story et al (1967) and AMU's of Bourne and Tuck (1993) are cross-referenced.

Figure 2 illustrates the spatial distribution of all mapped soil units within the study area and detailed descriptions of each SMU are provided in the following sections.

Table 5: Soil Types

SMU	Concept	Land System (Story et al (1967))	AMU (Bourne and Tuck (1993))	Soil Type of Story et al (1967)	Major Vegetation	Detailed sites (* laboratory site)
Recent alluvial channels and floodplains						
Mv Minerva	A grey to black cracking clay with coarsely self mulching surface	Funnel	Adelong	Vermont	Flooded coolibah, Black tea tree, Queensland bluegrass	14, 35, 57, 58, 60, 61*, 65, 71 73, 74, SB7.
Gently undulating plains with soils overlying Tertiary volcanics						
Rn Ronnoc	A self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m.	Oxford	Orion	Arcturus May Downs	Mostly cleared. Previous bluegrass downs with mountain coolabah and bloodwood.	15, 20, 22, 23, 24, 25, 26, 27, 28, 33, 34, 39, 40, 44, 48, 49, 50, 53, 54, 56, 59, SB10*, SB11*.
Undulating plains and rises with soils overlying deeply weathered Tertiary basalt						
Ka Kammel	A deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth	Oxford	Picardy	Glenora	Mostly cleared. Previous brigalow, yellowwood and Dawson gum scrub.	36*,38, 45, 47, 51.
Lx Lexington	A shallow, firm, red to brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth.	Oxford	Jimbaroo	Gindie	Mostly cleared. Previous Bonewood mixed scrub	18,19, 62*, 66, 67, 69.
Level to undulating plains with soils overlying Cainozoic sediments						

SMU	Concept	Land System (Story et al (1967))	AMU (Bourne and Tuck (1993))	Soil Type of Story et al (1967)	Major Vegetation	Detailed sites (* laboratory site)
Tf Talafa	A firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth.	Arcadia / Monteagle	Duckponds	Taurus	Mostly cleared. Previous silver leaf ironbark and bloodwood.	6, 16, 17, 37*, 46, 52, 75
Km Kilmore	A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m	Arcadia / Racecourse	Glen Idol	Springwood	Mostly cleared. Previous brigalow and Dawson gum scrub.	9, 12, 31*
Sv Sullivan	A deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth.	Arcadia / Racecourse	Picardy	Rolleston	Mostly cleared. Previous Brigalow Dawson gum and yellowwood scrub.	1, 3, 4, 5, 10, 11, 13, 21, 29, 30,32, 63, 64, 70, 72, SB1*,SB4*
SvDv Sullivan duplex variant	An intermittent, non mappable variant with a thin sandy clay loam surface layer overlying deep, moderately well structured medium clay subsoils.	Arcadia / Funnel	Turkey Creek	Gindie / Rolleston	Mostly cleared. Previous thick brigalow scrub.	32, 41, 42*, 43, 55
Sv-Gp Sullivan gilgai phase	Normal or linear gilgai complexes, Mounds are brown self mulching cracking clay (similar to Sv). Depressions are grey to black, cracking deep clay.	Arcadia	Rolleston	Rolleston	As above	7*, 8*

4.2 Soils of recent alluvial channels and floodplains

4.2.1 Minerva (Mv)

Overview

This SMU is associated with the floodplains and active drainage lines of major channels of creek landforms throughout the project site. Landforms are flat to very gently undulating plains with soils that are typically deep grey to black cracking clay often with coarsely self mulching surface. Soil water storage potential is high and would exceed 120mm soil water storage in most situations.

Within this SMU, 11 detailed sites were described with all exceeding 1.0m soil depth. Two (2) sites were submitted for laboratory analysis, site 61 and SB7. A possibility for elevated salinity exists as one site (61) was highly saline by 0.6m depth while the other site (SB7) was non saline throughout,


Much of the area remains uncleared of the original vegetation and is in good condition. It has not been developed for cropping due to susceptibility for flooding but has been used for grazing beef cattle.

Table 6: Land Summary

Representative site number	Site 61		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Moreton Bay Ash, Flooded coolibah, Black tea tree, Queensland bluegrass
Location	640306mE 7348931mN	Disturbance	No effective disturbance
Landform element and pattern	Flat Plain	Micro relief	None
		Permeability	Moderate
Slope	< 0.5%	Drainage	Well drained
Surface coarse fragments	No surface coarse fragments observed.	Surface condition	Surface is dry at time of investigation, granular with weak cracking.
ASC Order (s) present in SMU	Black vertosol	Land use	Low intensity grazing.
Land System (Story et al (1967)	Funnel	Substrate	Unknown. Assume weathered basalt.
AMU (Bourne and Tuck (1993)	Adelong	Soil Type of Story et al (1967)	Vermont
Land suitability summary	Effective soil depth : 1.0m + Est. soil water storage: 120mm+ (from DERM 2011 – SCL Guideline: Table 9 ‘Look-up’ soil water storage) Rain fed Cropping class: class 5 (susceptibility to flooding) Beef Cattle Grazing class: class 2 Agricultural Land Class: C1		
Erosion potential (Bourne and Tuck 2003)	High erosive flooding risk and medium water runoff hazard on slopes >0.5%		
Soil quality for mine rehabilitation	<u>Recommended topsoil Strip Depth:</u> 0.3m <u>Recommended subsoil strip depth:</u> 0.3 – 1.0m <u>Potential subsoil use:</u> Recommended for all rehabilitation situations however the heavy clay texture		

	may present problems in initial establishment of fine seeded pasture species which could predispose areas of sloping rehabilitation to erosion in initial stages. Once pastures establish they can be expected to be dense and resilient.
Land condition	Good condition
Total area (ha)	1657

Table 7: Soil Profile Morphology

Site 61	HORIZON NAME AND DEPTH (m) BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.00-0.22 Abrupt change to;	10YR3/1	Humid 0.05 – pH 8.0 Well drained	Light medium clay Weak polyhedral, soft	No surface rocks No segregations. Roots common
	B21 0.22 -1.00+	10YR3/1	Moist 0.35 – pH 7.5 0.65 – pH 7.0 0.90 – pH 8.0 Moderately well drained.	Medium clay (silty) Moderate polyhedral smooth faced peds, firm.	No segregations. Roots common to 1.0m.

Soil Chemistry

The laboratory data for Site 61 and SB7 is presented below in Table 8 and Table 9. The major chemistry trends from the available data indicate:

- Neutral pH in surface becoming moderately alkaline with depth;
- Moderate clay content throughout profile with prominent silt fraction;
- Electrical conductivity and Chloride was very low throughout the profile in site SB7 but was extremely high from 0.6m at site 61;
- Moderately high cation exchange capacity throughout profile dominated by calcium;
- Non sodic to moderate sodicity levels with depth in the soil profile; and
- High Ca to Mg ratios slightly increasing with depth.

This soil unit is a reasonable quality soil with a desirable range of chemical attributes. Its main limitation is from harder subsoils with reduced infiltration.

Table 8: Soil Chemistry Results for Site 61

Site, Horizon, Sample Depth (m)	61-0.00-0.10	61-0.30-0.40	61-0.60-0.70	61-0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	7.2	8.7	8.8	8.1
EC (uS/cm)	57	506	1060	2410
PSA-Clay (%)	42	-	-	-
PSA-Silt (%)	51	-	-	-
PSA-Sand (%)	7	-	-	-
PSA-Gravel (%)	<1	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	26.1	10	20.8	25.1
Exch. Mg (meq/100g)	15.0	7.1	16.7	16.4
Exch. K (meq/100g)	1.2	0.3	0.4	0.3
Exch. Na (meq/100g)	0.3	2.3	6.0	4.2
CEC (meq/100g)	42.7	19.7	43.9	46

Site, Horizon, Sample Depth (m)	61-0.00-0.10	61-0.30-0.40	61-0.60-0.70	61-0.90-1.00
ESP (%Na/CEC)	0.6	11.7	13.6	9.2
Ca/Mg (ratio)	1.7	1.4	1.2	1.5
Sulfur – Total as S (%)	0.04	-	-	-
Chloride (mg/kg)	20	560	1400	1870
Boron (mg/kg)	<0.2	-	-	-
Copper (mg/kg)	1.21	-	-	-
Iron (mg/kg)	34.8	-	-	-
Manganese (mg/kg)	39.8	-	-	-
Zinc (mg/kg)	1.25	-	-	-
Nitrite N (mg/kg)	0.1	-	-	-
Nitrate N (mg/kg)	5.8	-	-	-
Nitrite + Nitrate as N (mg/kg)	5.9	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	3070	-	-	-
Total Nitrogen as N (mg/kg)	3080	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	3.52	-	-	-
Organic Matter (%)	2.6	-	-	-

Table 9: Soil Chemistry Results for Sites SB7

Site, Horizon, Sample Depth (m)	Site SB7	
	0-0.1	0.2-0.3
Lab pH (1:5 water)	7.3	8.5
EC (dS/cm)	31	24
Chloride (mg/kg)	<10	<10
Total P Olsen (mg/kg)	-	-
Exch. Ca (meq/100g)	30.8	30.6
Exch. Mg (meq/100g)	11.4	10.7
Exch. K (meq/100g)	0.7	0.5
Exch. Na (meq/100g)	0.2	0.2
CEC (meq/100g)	43.1	42
Ca/Mg (ratio)	2.7	2.9
ESP (%Na/CEC)	0.4	0.6
Total S (%)	0.01	-
Total Kjeldahl as N (mg/kg)	830	-
Nitrate N (mg/kg)	830	-
Organic Carbon (%)	1.16	-
PSD Sand (%)	19	18
PSD Silt (%)	27	30
PSD Clay (%)	46	38
Sulfate-S (mg/kg)	170	-
Iron (mg/kg)	42200	-

4.3 Soils overlying Tertiary volcanics

4.3.1 Ronnoc (Rn)

This SMU is widespread across the southern portion of the project area. The area is gently undulating, extensively cleared and cultivated for winter and summer cash cropping. Broad based contour banks are maintained across the cultivation areas for erosion protection and the SMU is in good condition with no indication of any significant soil degradation.

Soils are generally deep well structured cracking clays which overlie weathered basalt or calcareous sediments. Based on measured soil water storages measured for *Ronnoc* soils in this area by Irvine (1999), soil water storage potential is 17 – 18mm / 0.1m of soil depth. It is therefore assumed that a minimum of 0.6m soil depth is required for >100mm soil water storage.

Within this SMU, 23 detailed sites were described and of this number, 85% exceeded 0.7m soil depth with over half 1.0m or deeper. All sites exceeded 0.6m depth. Two (2) sites were submitted for laboratory analysis, SB11 and SB10. The representative site for the soils profile morphology is Site 53.

Laboratory data indicates good overall fertility in the surface horizon and subsoils show no evidence of salinity or sodic conditions to 1.0m depth. If necessary, *Ronnoc* offers significant topsoil and subsoil volumes for reuse in mine rehabilitation.


A land summary is presented below in Table 9, soil profile morphology in Table 10 and major laboratory data in Table 10.

Table 10: Land Summary

Representative site number	Site SB11		
Site type	Detailed, 50 mm hand auger.	Main vegetation	Completely cleared of original vegetation.
Location	646073mE 7341875mN	Disturbance	Complete clearing of original vegetation. Area under cultivation with broad based contour banks.
Landform element and pattern	Upper slope of gently undulating plain	Micro relief	None
		Permeability	Moderate
Slope	1 - 1.5 %	Drainage	Moderate
Surface coarse fragments	nil	Surface condition	Soft, strong self mulching and cracking.
ASC Order (s) present in SMU	Black Vertosol	Land use	Cropping
CSIRO soil type	May Downs	Substrate	Assumed weathered basalt
AMU (Bourne and Tuck 1993)	Orion		
Land suitability summary	<p>Effective soil depth : Site 27 is 1.0m+ (overall, variable 0.6 - 1,1m+)</p> <p>Est. soil water storage: >150mm (overall 100 – 150mm+)*</p> <p>(* based on Irvine (1999) measuring storage of 17.5mm / 0.1m depth for nearby <i>Ronnoc</i> soils.</p> <p>Rain fed Cropping class: 2</p>		

	<p>Beef Cattle Grazing class: 2</p> <p>Agricultural Land Class: A</p> <p>Bourne and Tuck (1993): Suitable for irrigated, dryland and forage cropping. In particular sorghum, sunflower, cotton, wheat, chickpea, safflower. Highly productive grazing of either native bluegrass or sown pastures, particularly purple pidgeon grass.</p>
Erosion potential and land conservation (Bourne and Tuck 2003)	Moderate to high erosion hazard. Broad based contour banks over 0.5% slope are recommended as is consideration to crop rotation and use of minimum tillage techniques.
Soil quality for mine rehabilitation	<p>Laboratory and morphological data show no limiting attributes to 1.1m depth. The profile is non saline and non sodic throughout.</p> <p><u>Recommended topsoil Strip Depth:</u> 0.3m</p> <p><u>Recommended subsoil strip depth:</u> 0.3 – 0.8m</p> <p><u>Potential subsoil use:</u> Recommended for all rehabilitation situations however the heavy clay texture may present problems in initial establishment of fine seeded pasture species which could predispose areas of sloping rehabilitation to erosion in initial stages. Once pastures establish they can be expected to be dense and resilient.</p>
Total area (ha)	3630

Table 11: Soil Profile Morphology – Site 53

Site	HORIZON DEPTH (m) NAME BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	Ap 0.00-0.12 Abrupt change to;	10YR3/2	Dry pH 8.0 (0.10m) Well drained	Light clay. Polyhedral Weak	Nil fragments or segregations. Roots common.
	B21 0.12-1.00+	10YR3/1	Humid pH 8.0 (0.30m) 8.0 (0.80m at Well drained	Medium clay. Strong sub angular blocky, moderate.	Nil fragments or segregations. Roots common.

Soil Chemistry

Two sites were submitted for laboratory analysis, SB10 which is a shallower (0.6m deep) site and SB11 which exceeds 1.2m depth. Both sites returned a similar range of chemical attributes. Laboratory data for these sites is presented below in Table 12.

The major chemistry trends from the available data indicate:

- High nitrogen and phosphorus. No significantly limiting fertility attributes.
- High clay content ranging from 55% in the surface to 60% in subsoils
- Neutral surface reaction trend becoming moderately alkaline with depth;
- Very low chloride, electrical conductivity and sodium throughout the profile;
- High cation exchange capacity dominated by calcium;
- Organic carbon is moderately low but adequate, possibly a reflection of long term cultivation; and
- High Ca to Mg ratios throughout the profile indicates good soil stability.

This soil unit is a good quality soil with a desirable range of chemical attributes.

Table 12: Soil Chemistry Results for Sites SB10 and SB11

Site, Horizon, Sample Depth (m)	Site SB11					Site SB10		
	0-0.1	0.2-0.3	0.5-0.6	0.8-0.9	1.1-1.2	0-0.1	0.2-0.3	0.5-0.6
Lab pH (1:5 water)	6.5	8.0	8.1	8.2	8.5	7.1	7.5	7.3
EC (dS/cm)	46	91	84	95	119	34	36	30
Chloride (mg/kg)	20	<1-	<10	<10	<10	<10	<10	10
Total P Olsen (mg/kg)	204	-	99	-	-	419	-	313
Exch. Ca (meq/100g)	31.7	-	43.3	-	-	46.5	-	46.1
Exch. Mg (meq/100g)	18.1	-	20.6	-	-	20.8	-	21.4
Exch. K (meq/100g)	0.7	-	0.2	-	-	1.1	-	0.7
Exch. Na (meq/100g)	<0.1	-	0.6	-	-	<0.1	-	0.3
CEC (meq/100g)	50.6	-	64.7	-	-	68.5	-	68.5
Ca/Mg (ratio)	1.8	-	2.1	-	-	2.2	-	2.2
ESP (%Na/CEC)	0.2	-	0.9	-	-	0.1	-	0.4
Total S (%)	<0.01	-	<0.01	-	-	0.01	-	0.01
Total Kjeldahl as N (mg/kg)	880	-	360	-	-	1630	-	1010
Nitrate N (mg/kg)	2.6	-	0.3	-	-	6.2	-	1.8
Organic Carbon (%)	1.02	-	0.66	-	-	1.6	-	0.9
PSD Sand (%)	17	-	15	-	-	10	-	15
PSD Silt (%)	28	-	21	-	-	25	-	27
PSD Clay (%)	55	-	61	-	-	65	-	57
Emerson class		-	5	-	-		-	5
Sulfate-S (mg/kg)	150	-	<100	-	-	270	-	<100
Iron (mg/kg)	<1	-	<1	-	-	<1	-	<1

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4.4 Soils overlying Cainozoic sediments

4.4.1 Kilmore (Km)

Km is a scrub soil which, prior to clearing, probably comprised mixed Brigalow, Dawson Gum, Silver leaf ironbark with associated softwood scrub species such as Ooline and Bonewood. It occurs along upper slope positions and crests associated with mixed Cainozoic sediments and is restricted to a single polygon located in the north of the project area.

Soils are a firm red to brown duplex soil with a thin sandy clay loam layer over light clay subsoil. They have a firm to hard setting sandy surface and are generally deep to moderately deep profiles with well structured subsoils which may overlie mottled and gravelly layers below 0.7m depth. Within this SMU, four (4) detailed sites were described which includes two (2) sites which were submitted for laboratory analysis.

Infiltration and permeability may be restricted below 0.6m and effective soil depth may vary from 0.6 to 1.0m. In the past the area has been used for cropping which may have been spray irrigated in the past.

Laboratory data indicates reasonable overall fertility in the surface horizon and subsoils show no evidence of salinity or sodic conditions to 1.0m depth. If necessary, *Km* offers significant topsoil resources for mine rehabilitation.

Table 13: Land Summary

Representative site number	Site 31		
Site type	Detailed, 50 mm hand auger.	Main vegetation	Nil - cultivation
Location	638695mE 7352857mN	Disturbance	Completely cleared of original vegetation. Originally mixed brigalow scrub. Area under cultivation with broad based contour banks.
Landform element and pattern	Upper slope of gently undulating plain	Micro relief	None
		Permeability	Moderate to 0.65m then very slow.
Slope	1%	Drainage	Imperfect
Surface coarse fragments	Mixed gravels <5% at <60mm	Surface condition	Firm, sandy, minor surface flake
ASC Order (s) present in SMU	Reddish Brown Dermosol	Land use	Cropping. Possible spray irrigation in the past.
CSIRO soil type	Springwood	Substrate	Unconsolidated mixed sediments
AMU (Bourne and Tuck 1993)	Glen Idol		
Land suitability summary	<p>Effective soil depth: Representative sites 31 and lab site SB3 have 0.65m and 0.60m respectively of freely drained soil to harder mottled layers. While effective soil depth extends to 1.0m, below about 0.6m physical restrictions to root exploitation increase.</p> <p>Est. soil water storage: 75-85mm. Based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 4</p> <p>Beef Cattle Grazing class: 3</p> <p>Agricultural Land Class: B</p> <p>Bourne and Tuck (1993): Dryland farming is restricted due to possible water stress and only recommended for winter crops wheat, chickpea and safflower. Suitable for irrigated and forage</p>		

	cropping, in particular oats. Very productive grazing with sown pastures of buffel, Rhodes and green panic.
Erosion potential and land conservation (Bourne and Tuck 2003)	Medium erosion hazard. Narrow based contour banks over 0.5% slope are recommended.
Soil quality for mine rehabilitation	Laboratory and morphological data show infiltration and permeability is restricted below 0.6m depth however the profile is non saline and non sodic throughout. <u>Recommended topsoil Strip Depth:</u> 0.3m. The surface 0.2m is recommended for all rehabilitation situations and has physical attributes suited to rapid pasture cover (with rain). <u>Recommended subsoil strip depth:</u> 0.3 – 0.6m <u>Potential subsoil use:</u> The harder clay subsoil material may be suited to dam embankment construction as it is hard setting, slowly permeable and non dispersive. Further engineering tests would be required to verify this.
Total area (ha)	637

Table 14: Soil Profile Morphology – Site 31

Site	HORIZON DEPTH (m) NAME BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	Ap 0.00-0.15 Abrupt change to;	5YR3/3	Dry 7.0 (0.10m) Well drained	Sandy Clay loam Polyhedral Weak soft	Nil fragments or segregations. Fine roots common.
	B21 0.15-0.65 Clear change to;	5YR3/4	Dry 8.0 (0.30m) Moderate drained	Light clay Sub angular Weak soft	Nil fragments or segregations. Fine roots common.
	B22 0.65 – 1.0+	5YR3/4 Mottle 5YR6/6 <10% below 0.65m <40% below 0.85m	Dry 8.0 (0.7m) Slow drainage	Light sandy clay Weak sub angular blocky, firm to hard	Few, Very fine roots

Soil Chemistry

Two sites were submitted for laboratory analysis, SB3 and 31. Both sites are good representations of Kilmore with mottled and harder subsoils below 0.65m depth. Both sites returned a similar range of chemical attributes. Data for these sites is presented below in Table 15 and Table 16.

The major chemistry trends from the available data indicate:

- High nitrogen and phosphorus. This may be a result of added fertiliser as the area has been cropped. No significantly limiting fertility attributes;
- Lower clay content in the surface, increasing in subsoils;
- Neutral surface reaction trend becoming moderately alkaline with depth;
- Low chloride, electrical conductivity and sodium throughout the profile;
- Moderate cation exchange capacity in the surface layer, increasing with depth;
- Organic carbon is moderately low but adequate, possibly a reflection of long term cultivation; and
- High Ca to Mg ratios in the surface decreasing with depth.

This soil unit is a reasonable quality soil with a desirable range of chemical attributes. Its main limitation is from harder subsoils with reduced infiltration.

Table 15: Soil Chemistry Results for Sites SB3

Site, Horizon, Sample Depth (m)	Site SB3				
	0-0.1	0.2-0.3	0.5-0.6	0.9-1.0	1.0-1.1
Lab pH (1:5 water)	7.4	7.6	7.9	8.3	8.6
EC (dS/cm)	38	35	53	213	170
Chloride (mg/kg)	<10	<10	20	60	80
Total P Olsen (mg/kg)	249	-	143	-	206
Exch. Ca (meq/100g)	20.7	-	24.7	-	37.3
Exch. Mg (meq/100g)	8.4	-	17.9	-	22.9
Exch. K (meq/100g)	0.8	-	0.3	-	0.4
Exch. Na (meq/100g)	<0.1	-	0.9	-	1.3
CEC (meq/100g)	30	-	43.8	-	61.8
Ca/Mg (ratio)	2.5	-	1.4	-	1.6
ESP (%Na/CEC)	0.2	-	2	-	2
Total S (%)	0.01	-	0.01	-	0.01
Total Kjeldahl as N (mg/kg)	840	-	520	-	400
Nitrate N (mg/kg)	9.7	-	2.9	-	2.9
Organic Carbon (%)	1.1	-	1.1	-	0.9
Sand (%)	51	-	34	-	27
Silt (%)	10	-	9	-	5
Clay (%)	37	-	57	-	66
Emerson class		-	5	-	
Sulfate-S (mg/kg)	140	-	160	-	160

Table 16: Soil Chemistry Results for Site 31

Site, Horizon, Sample Depth (m)	0.00-0.10	0.20-0.30	0.60-0.70	0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	6.5	6.5	6.5	6.6
EC (uS/cm)	53	24	25	22
PSA-Clay (%)	28	-	-	-
PSA-Silt (%)	11	-	-	-
PSA-Sand (%)	52	-	-	-
PSA-Gravel (%)	9	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	7.1	8.5	7.8	7.3
Exch. Mg (meq/100g)	2.8	3.2	3.2	3.2
Exch. K (meq/100g)	0.4	0.1	<0.1	<0.1
Exch. Na (meq/100g)	<0.1	<0.1	<0.1	<0.1
CEC (meq/100g)	10.3	11.8	11.1	10.6
ESP (%Na/CEC)	0.1	0.1	<0.1	<0.1
Ca/Mg (ratio)	2.5	2.7	2.4	2.3
Sulfur – Total as S (%)	<0.01	-	-	-
Chloride (mg/kg)	10	<10	<10	<10
Boron (mg/kg)	<0.2	-	-	-
Copper (mg/kg)	<1.00	-	-	-
Iron (mg/kg)	21.3	-	-	-
Manganese (mg/kg)	63.2	-	-	-
Zinc (mg/kg)	<1.00	-	-	-
Nitrite N (mg/kg)	0.2	-	-	-
Nitrate N (mg/kg)	21.4	-	-	-
Nitrite + Nitrate as N (mg/kg)	21.6	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	660	-	-	-
Total Nitrogen as N	680	-	-	-

Site, Horizon, Sample Depth (m)	0.00-0.10	0.20-0.30	0.60-0.70	0.90-1.00
(mg/kg)				
Bicarbonate Extractable P (Olsen) (mg/kg)	0.38	-	-	-
Organic Matter (%)	1.2	-	-	-

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4.4.2 Sullivan (Sv)

A scrub soil with sandy self mulching brown to dark cracking clay overlying buried layers and possibly gravel below 0.7m depth.

This SMU is widespread across the central portion of the project area. The area is gently undulating, mostly cleared of the original Brigalow mixed scrub and cultivated for winter and summer cash cropping. Broad based contour banks are maintained across the cultivation areas for erosion protection and the SMU is in good condition with no indication of any significant soil degradation.

Included in this SMU is a soil variant which has a thin sandy loam surface layer over dark and well structured clay. This soil (described by Bourne and Tuck, 1993 as Turkey Creek AMU), is very minor in distribution within the Sv SMU and cannot be mapped out at this scale.

Soils differ from *Rn* in that they may have lighter and sandier surface horizons and more variable subsoil horizons. But they are generally deep well structured cracking clays which overlie buried layers, gravel or calcareous sediments.

Within this SMU, 22 detailed sites were described and of this number, 70% exceeded 1.0m soil depth. The remaining 30% of sites were clay which overlies buried sandy or gravelly layers below 0.6m depth. The thin duplex variant (*SvDv*) provides five (5) of these sites.

Three (3) sites were submitted for laboratory analysis to cover the situations of a buried sandy layer, deeper uniform clay and the thin duplex variant.

Laboratory data indicates good overall fertility in the surface horizon and subsoils show no evidence of salinity or sodic conditions to 1.0m depth. If necessary, *Sv* offers significant topsoil and subsoil volumes for reuse in mine rehabilitation.


A land summary is presented below in Table 17 and soil profile morphology in Table 18. Major laboratory data for SB1 and SB4 is presented in Table 19.

Table 17: Land Summary – Representative morphological site

Representative site number	Site 20		
Site type	Detailed, 50 mm hand auger.	Main vegetation	Some Brigalow regrowth. Mainly native grasslands.
Location	642058mE 7346729mN	Disturbance	Complete clearing or minor clearing of original vegetation. Nearby broad based contour banks.
Landform element and pattern	Mid slope of gently undulating plain	Micro relief	None
		Permeability	Moderate
Slope	<2.0 %	Drainage	Well drained
Surface coarse fragments	Coarse fragments <2% at 10-100mm	Surface condition	Minor sandy crust, self mulching and cracking.
ASC Order (s) present in SMU	Black Vertosol	Land use	Previous cropping indicated. Minor areas being grazed by beef cattle at time of survey.
CSIRO soil type	Rolleston	Substrate	Unconsolidated sandy material.

AMU (Bourne and Tuck 1993)	Picardy		
Land suitability summary	<p>Effective soil depth: Site 20 is 1.0m+ (lighter clay loam layer from 0.7m depth). In SMU overall, 70% of sites exceed 1.0 depth and remaining 30% have buried lighter layers below 0.6m depth. Site 20 is considered a typical representation of morphology of this SMU.</p> <p>Est. soil water storage: 100 - 120mm.* * based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 2 Beef Cattle Grazing class: 2 Agricultural Land Class: A</p> <p>Bourne and Tuck (1993): Suitable for irrigated, dryland and forage cropping. In particular sorghum, sunflower, cotton, wheat, chickpea, safflower. Highly productive grazing of either native bluegrass or sown pastures, particularly purple pidgeon grass.</p>		
Erosion potential and land conservation (Bourne and Tuck 2003)	High erosion hazard due to undulating nature of the soil unit. Broad based contour banks over 0.5% slope are recommended as is consideration to crop rotation and use of minimum tillage techniques.		
Soil quality for mine rehabilitation	<p>Laboratory and morphological data show possibility of elevated exchangeable sodium percentage below 0.6m depth. Otherwise no other significant limiting attributes to 1.0m depth. The profile is non saline throughout.</p> <p><u>Recommended topsoil Strip Depth:</u> 0.3m <u>Recommended subsoil strip depth:</u> 0.3 – 0.6m <u>Potential subsoil use:</u> Recommended for all rehabilitation situations. Lighter sandier material preferred to higher sloping areas than Romoc soil.</p>		
Total area (ha)	3665		

Table 18: Soil Profile Morphology – site 20

Site	HORIZON NAME DEPTH (m) and BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.0 – 0.22 Abrupt change to;	10YR3/1 No mottles	Dry 7.0 (0.05m) Well drained	Light sandy clay. Granular to weak polyhedral.	Nil fragments or segregations. Roots common.
	B21 0.22 – 0.70 Clear change to;	10YR3/2 No mottles	Dry 8.0 (0.3m) 8.0 (0.6m) Moderate to well drained	Medium clay (sandy). Firm polyhedral to sub-angular blocky.	No coarse fragments Minor soft carbonate / small nodules Roots common
	D1 0.70 – 1.0+	10YR4/3 No mottles	Dry 7.0 (0.9m) Well drained.	Sandy clay loam. Weak polyhedral	Some roots observed.

Soil Chemistry

Two sites were submitted for laboratory analysis, SB1 which has a sandy buried layer below 0.9m depth and SB4 which is uniform clay to 1.1m. Data for these sites is presented below in Table 17. The major chemistry trends from the available data indicate:

- Neutral pH in surface becoming strongly alkaline with depth;
- High nitrogen and phosphorus. No significantly limiting fertility attributes;

- High clay content;
- Organic carbon is low in the surface and decreasing with depth;
- Very low chloride and electrical conductivity throughout the profile;
- Elevated ESP below 0.6m depth reaching moderate levels by 0.9m;
- Cation exchange capacity is lower than *Ronnoc* but still moderately high and dominated by calcium; and
- Ca to Mg ratios throughout the profile indicates good soil stability.

This soil unit is a quality soil with a desirable range of chemical attributes apart from a possible sodic tendency at depth.

Table 19: Soil Chemistry Results for Sites SB1 and SB4

Site, Horizon, Sample Depth (m)	Site SB1					Site SB4			
	0-0.1	0.2-0.3	0.5-0.6	0.8-0.9	0.9-1.0	0-0.1	0.2-0.3	0.5-0.6	0.8-0.9
Lab pH (1:5 water)	7.2	8.1	8.4	8.6	8.8	7.7	8.2	8.0	8.4
EC (dS/cm)	74	79	99	154	265	97	94	106	132
Chloride (mg/kg)	<10	<10	<10	20	40	20	10	<10	<10
Total P Olsen (mg/kg)	316	-	142	-	132	210	-	108	-
Exch. Ca (meq/100g)	34.6	-	37.7	-	43	25.2	-	23.8	-
Exch. Mg (meq/100g)	18.3	-	24.2	-	24.9	14.5	-	18.5	-
Exch. K (meq/100g)	2.1	-	0.8	-	0.8	0.6	-	0.2	-
Exch. Na (meq/100g)	0.2	-	3.8	-	5.2	0.6	-	1.9	-
CEC (meq/100g)	55.2	-	66.5	-	73.9	40.9	-	44.4	-
Ca/Mg (ratio)	1.9	-	1.6	-	1.7	1.7	-	1.3	-
ESP (%Na/CEC)	0.3	-	5.8	-	7.1	1.4	-	4.3	-
Total S (%)	0.01	-	0.01	-	0.02	0.01	-	0.01	-
Total Kjeldahl as N (mg/kg)	1320	-	500	-	440	460	-	280	-
Nitrate N (mg/kg)	15.7	-	2.2	-	1.2	29.8	-	1.3	-
Organic Carbon (%)	1.2	-	0.7	-	0.7	0.85	-	0.5	-
PSD Sand (%)	11	-	10	-	11	16	-	10	-
PSD Silt (%)	30	-	17	-	11	27	-	24	-
PSD Clay (%)	59	-	73	-	69	57	-	64	-
PSD gravel (%)	<1	-	<1	-	9	<1	-	2	-
Emerson class	-	-	-	-	4	-	-	4	-
Sulfate-S (mg/kg)	240	-	120	-	360	130	-	<100	-
Soluble Iron (mg/kg)	<1	-	<1	-	<1	<1	-	<1	-
Total iron (mg/kg)	-	-	-	-	-	26100	-	22800	-

4.4.3 Sullivan Duplex variant (SvDv)


Overview

This SMU is located within the broader Sv SMU and are texture contrast soils with a thin sandy clay loam surface layer overlying deep, moderately well structured medium clay subsoils. They are minor in distribution and cannot be mapped separately at this scale. Within SvDv, five (5) detailed sites were described, one of which was submitted for laboratory analysis, (site 42). A land summary is presented below in Table 20, soil profile morphology in Table 21 and major laboratory data in Table 22.

Table 20: Land Summary

Representative site number	Site 42		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mostly cleared. Previous brigalow Dawson gum and yellowwood scrub.
Location	646453mE 7345905mN	Disturbance	Minimal disturbance within areas
Landform element and pattern	Wide gully	Micro relief	None
		Permeability	slow
Slope	<1.0 %	Drainage	Well
Surface coarse fragments	No coarse fragments	Surface condition	Firm, dry, minor crusting
ASC Order (s) present in SMU	Grey chromosol	Land use	Areas being used for grazing
Land System (Story et al (1967)	Arcadia	Substrate	
AMU (Bourne and Tuck (1993)	Turkey creek	Soil Type of Story et al (1967)	Gindie
Land suitability summary	<p>Effective soil depth : >1.0m Est. soil water storage: * >120mm * based on DERM (2011) SCL estimation for soil water storage. Rain fed Cropping class: 3 Beef Cattle Grazing class: 2 Agricultural Land Class: A Bourne and Tuck (1993): Suited to all crops and pastures. Potential for plough pan development</p>		
Erosion potential (Bourne and Tuck 2003)	Generally long sloping areas with fine sandy surface predisposes high water erosion hazard.		
Soil quality for mine rehabilitation	<p><u>Recommended topsoil Strip Depth:</u> 0.2m (to isolate lighter textured material) <u>Recommended subsoil strip depth:</u> 0.2 – 0.8m <u>Potential subsoil use:</u> Heavy clay material best suited to flatter areas due to problems in initial plant establishment. Evidence of increasing salinity below 0.8m depth.</p>		
Land condition	Good condition. No evidence of plough pan development or erosion.		

Table 21: Soil Profile Morphology

Site 42	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.00-0.23 abrupt	7.5YR3/2	Dry 8.5 (0.05m) Well drained	Sandy clay loam Polyhedral Weak	Fine roots No surface rock No segregations
	B21 0.23-1.00	7.5YR3/2 No mottles.	Dry 7.5 (0.30m) 8.0 (0.60m) 8.0 (0.90m) Well drained	Light medium clay Polyhedral. very strong and firm	No segregations

Soil Chemistry

The laboratory data for Site 42 presented below in Table 30. It is followed with results of 'field' 1:5 soil water pH tests conducted using a portable TPS instrument in Table 31. The major chemistry trends from the available data indicate the following:

- Slightly neutral to alkaline pH reaction trends;
- Very low increasing to moderate levels of chloride throughout the B horizon;
- Electrical conductivity is very low to moderate throughout the profile;
- Very high CEC rating throughout the soil profile;
- Particle size distributions confirm a clay dominated profile;
- Non sodic levels reported in the soil profile;
- Topsoil and subsequent subsoils Ca to Mg ratio indicates very high to high ratings throughout the soil profile; and
- High nitrogen but low available phosphorus levels.

Overall, the soils do not have any major limitations with overall fertility status reported through the CEC as very high and soil is not acidic or affected by salinity. Non sodic levels within the soils with high Ca to Mg ratings would favour multiple applications within rehabilitation.

Table 22: Soil Chemistry Results for Site 42

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	7.6	8.3	8.5	8.4
EC (uS/cm)	119	183	280	446
PSA-Clay (%)	56	-	-	-
PSA-Silt (%)	30	-	-	-
PSA-Sand (%)	8	-	-	-
PSA-Gravel (%)	6	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	43.9	48	42	37.7
Exch. Mg (meq/100g)	10.4	20.4	26.6	26.9
Exch. K (meq/100g)	1.6	0.5	0.3	0.4
Exch. Na (meq/100g)	<0.1	0.3	1.9	3.0
CEC (meq/100g)	56.0	69.2	70.8	67.9

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
ESP (%Na/CEC)	<0.1	0.5	2.7	4.4
Ca/Mg (ratio)	4.2	2.4	1.6	1.4
Sulfur – Total as S (%)	0.04	-	-	-
Chloride (mg/kg)	40	70	240	600
Boron (mg/kg)	<0.2	-	-	-
Copper (mg/kg)	1.94	-	-	-
Iron (mg/kg)	26.2	-	-	-
Manganese (mg/kg)	15.9	-	-	-
Zinc (mg/kg)	3.25	-	-	-
Nitrite N (mg/kg)	0.6	-	-	-
Nitrate N (mg/kg)	18.9	-	-	-
Nitrite + Nitrate as N (mg/kg)	19.5	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	5610	-	-	-
Total Nitrogen as N (mg/kg)	5630	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	1.93	-	-	-
Organic Matter (%)	2.0	-	-	-

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4.4.4 Sullivan gilgai phase (Sv-Gp)

Overview

Soils are essentially Sullivan with a gilgai phase. It is likely that significantly greater areas of surface gilgai existed prior to cultivation across the Sv SMU. The extent of the gilgai is not sufficient to significantly affect land suitability apart from possible localised effects with soil water availability. Soil morphology and chemistry at depression and mound positions of the land surface are very similar.

Within this SMU, two (2) detailed sites were described, both being submitted for laboratory analysis. A land summary is presented below in Table 23, soil profile morphology in Table 24 and Table 25 and major laboratory data in Table 26.

Table 23: Land Summary

Representative site number	Site 7 (Depression) Site 8 (mound / inter – gilgai areas)		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Wooded regrowth with mixed Acacia and Bauhinia
Location	637411mE 7354576mN	Disturbance	Complete clearing or minor clearing of original vegetation.
Landform element and pattern	Flat plain	Micro relief	Normal gilgai – depression position. Depressions are 0.15 – 0.20m deep, 2 – 3 m wide and comprise on average 20% of land surface.
		Permeability	Moderate
Slope	<0.5 %	Drainage	Well drained
Surface coarse fragments	No coarse fragments	Surface condition	Weak sandy crust, self mulching and cracking in depression and mounds.
ASC Order (s) present in SMU	Black Vertosol	Land use	Minor areas being grazed by beef cattle at time of survey.
Land System (Story et al (1967)	Arcadia	Substrate	Unidentified gravels
AMU (Bourne and Tuck (1993)	Rolleston	Soil Type of Story et al (1967)	Rolleston
Land suitability summary	<p>Effective soil depth: Site 7 is clay textured to 0.54m where it assumes a clayey sand texture to 1.0m. Site 8 is 0.75m+ (clayey sand layer from 0.75m depth)</p> <p>Est. soil water storage: *clay to 0.6m is 75mm. clayey sand 0.6 – 1.0m is 20mm. Assume total PAWC potential 95-100mm</p> <p>* based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 2</p> <p>Beef Cattle Grazing class: 2</p> <p>Agricultural Land Class: A</p> <p>Bourne and Tuck (1993): Suitable for irrigated, dryland and forage cropping. In particular sorghum, sunflower, cotton, wheat, chickpea, safflower. Highly productive grazing of either native bluegrass or sown pastures, particularly purple pidgeon grass.</p>		
Erosion potential (Bourne and Tuck 2003)	Low to medium as slope gradient increases.		
Soil quality for mine rehabilitation	<p>Laboratory and morphological data show possibility of elevated exchangeable sodium percentage below 0.6m depth. Otherwise no other significant limiting attributes to 1.0m depth. The profile is non saline throughout.</p> <p><u>Recommended topsoil Strip Depth:</u> 0.3m</p> <p><u>Recommended subsoil strip depth:</u> 0.3 – 0.55m</p> <p><u>Potential subsoil use:</u> Recommended for all rehabilitation situations. Lighter sandier material</p>		

	preferred to higher sloping areas than <i>Ronnoc</i> soil.
Land condition	Good condition
Total area (ha)	48

Table 24: Soil Profile Morphology – Site 7 (depression position of normal gilgai)



Site 7	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	0.00-0.13 A1 abrupt	10YR3/1	Dry 0.05 – pH 7.0 Well drained	Light medium clay Sub angular, weak	Fine roots, few No surface rock No segregations
	0.13-0.40 B21 abrupt	10YR3/1	Dry 0.30 – pH 7.0 Well drained	Medium clay Sub angular, moderate	Fine roots, few No surface rock No segregations
	0.40-0.54 B22 abrupt	10YR2/2	Dry 0.50 – pH 7.5 Moderate drained	Medium clay Sub angular, moderate	Calcium carbonate <10% concretions
	0.54-1.00 BC	10YR4/2	Dry 0.70 – pH 8.0 0.90 – pH 8.0 Imperfect drained	Clayey sand Sub angular, weak	Unidentified gravels

Table 25: Soil Profile Morphology – Site 8 (inter-gilgai 'mound' areas)

Site 8	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	0.00-0.10 A1 abrupt	10YR3/1	Dry 0.05 – pH 7.0 Well drained	Light medium clay Sub angular, weak	Fine roots, few No surface rock No segregations
	0.10-0.23 B21 clear	10YR3/1	Dry 0.30 – pH 7.0 Well drained	Medium clay Sub angular, moderate	Fine roots, few No surface rock No segregations
	0.23-0.75 B22 abrupt	10YR2/2	Dry 0.50 – pH 7.5 Moderate drained	Medium clay Sub angular, moderate	Calcium carbonate <10% concretions
	0.74-1.00 BC	10YR4/2	Dry 0.70 – pH 8.0 0.90 – pH 8.0 Imperfect drained	Clayey sand Sub angular, weak	Unidentified gravels

Soil Chemistry

The laboratory data for Site 7 (depression) and Site 8 (mound) is presented below in Table 26 and Table 27. The major chemistry trends from the available data indicate the following:

- As with morphological attributes, soil chemistry is very similar in mound and depression positions;
- Slightly acidic to alkaline reaction trends with depth;
- Very low chloride throughout profile;
- Electrical conductivity is very low throughout the profile;
- High CEC ratings throughout the depression soil profile however CEC ratings decrease from high to moderate in mound profile;
- Particle size distributions confirm a clay dominated profile;
- Non sodic levels reported throughout profile;
- Topsoil and subsequent subsoils Ca to Mg ratio indicates very high ratings increasing throughout the soil profile; and
- Very low available phosphorus levels.

Similar to the SMU Sullivan, this soil unit is a quality soil with a desirable range of chemical attributes however is considered to be higher dispersive.

Table 26: Soil Chemistry Results for Site 7

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.40-0.50	0.60-0.70	0.90-1.00
Analysis (Unit)					
Lab pH (1:5 water)	6.2	7.1	7.8	8.3	8.3
EC (uS/cm)	34	38	114	91	103
PSA-Clay (%)	61	15.9	13.8	6.2	6.5
PSA-Silt (%)	26	-	-	-	-
PSA-Sand (%)	13	-	-	-	-
PSA-Gravel (%)	<1	-	-	-	-
PSA-Cobbles (%)	<1	-	-	-	-
Exch. Ca (meq/100g)	24	24.4	29.3	19.2	25
Exch. Mg (meq/100g)	12.2	11.2	9.3	4.1	5
Exch. K (meq/100g)	0.7	0.2	0.1	<0.1	<0.1
Exch. Na (meq/100g)	<0.1	<0.1	<0.1	<0.1	<0.1
CEC (meq/100g)	36.9	36.0	38.8	23.4	30.2
ESP (%Na/CEC)	0.1	0.2	<0.1	<0.1	<0.1
Ca/Mg (ratio)	2.0	2.2	3.1	4.7	5.0
Sulfur – Total as S (%)	0.02	-	-	-	-
Chloride (mg/kg)	<10	<10	<10	<10	<10
Boron (mg/kg)	<0.2	-	-	-	-
Copper (mg/kg)	1.75	-	-	-	-
Iron (mg/kg)	84.3	-	-	-	-
Manganese (mg/kg)	65.0	-	-	-	-
Zinc (mg/kg)	<1.00	-	-	-	-
Nitrite N (mg/kg)	0.1	-	-	-	-
Nitrate N (mg/kg)	3.8	-	-	-	-
Nitrite + Nitrate as N (mg/kg)	3.9	-	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	1490	-	-	-	-
Total Nitrogen as N (mg/kg)	1490	-	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	0.60	-	-	-	-
Organic Matter (%)	0.8	-	-	-	-

Table 27: Soil Chemistry Results for Site 8

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.50-0.60	0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	7.3	7.6	7.5	8.4
EC (uS/cm)	25	21	20	74
PSA-Clay (%)	53	7.5	8.6	5..2
PSA-Silt (%)	22	-	-	-
PSA-Sand (%)	25	-	-	-
PSA-Gravel (%)	<1	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	25.4	12.7	13.4	12.4
Exch. Mg (meq/100g)	12.6	6.0	6.4	3.8
Exch. K (meq/100g)	0.8	<0.1	0.1	<0.1
Exch. Na (meq/100g)	<0.1	<0.1	<0.1	<0.1
CEC (meq/100g)	38.9	18.7	20.0	16.2
ESP (%Na/CEC)	0.1	<0.1	<0.1	<0.1
Ca/Mg (ratio)	2.0	2.1	2.1	3.3
Sulfur – Total as S (%)	<0.01	-	-	-
Chloride (mg/kg)	<10	<10	<10	<10
Boron (mg/kg)	-	-	-	-
Copper (mg/kg)	-	-	-	-
Iron (mg/kg)	-	-	-	-
Manganese (mg/kg)	-	-	-	-
Zinc (mg/kg)	-	-	-	-
Nitrite N (mg/kg)	0.2	-	-	-
Nitrate N (mg/kg)	3.7	-	-	-
Nitrite + Nitrate as N (mg/kg)	3.9	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	930	-	-	-
Total Nitrogen as N (mg/kg)	930	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	-	-	-	-
Organic Matter (%)	0.9	-	-	-

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4.4.5 Talafa (Tf)

Overview

This SMU is of very limited distribution and occurs within the range of scrub soils associated with Cainozoic sediments. The area is gently undulating, extensively cleared and in some areas has been cultivated for winter and summer cash cropping. Broad based contour banks are maintained across the cultivation areas for erosion protection and the SMU is in good condition with no indication of any significant soil degradation.

Soils are generally firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth.


Within this SMU, seven (7) detailed sites were described; two sites were submitted for laboratory analysis, Site 16 and 37. A land summary is presented below in Table 28, soil profile morphology in Table 29 and major laboratory data in Table 30.

Table 28: Land Summary

Representative site number	Site 37		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mostly cleared with native and improved grasses. Previous brigalow Dawson gum and yellowwood scrub.
Location	646073mE 7347672mN	Disturbance	Complete clearing
Landform element and pattern	Upper slope of a wide ridge in gently undulating plain	Micro relief	None
		Permeability	high
Slope	2.0 %	Drainage	Moderate
Surface coarse fragments	No coarse fragments	Surface condition	Firm, dry.
ASC Order (s) present in SMU	Kandosol	Land use	Areas being used for grazing and some cultivation
Land System (Story et al (1967)	Monteagle	Substrate	Mixed sediments
AMU (Bourne and Tuck (1993)	Duckponds	Soil Type of Story et al (1967)	Taurus
Land suitability summary	<p>Effective soil depth : >1.0m</p> <p>Est. soil water storage:* 50mm</p> <p>* based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 5</p> <p>Beef Cattle Grazing class: 4</p> <p>Agricultural Land Class: C3</p> <p>Bourne and Tuck (1993): Best suited to grazing improved pastures and opportunist forage production.</p>		
Erosion potential (Bourne and Tuck 2003)	Medium		
Soil quality for mine rehabilitation	<p><u>Recommended topsoil Strip Depth:</u> 0.3m</p> <p><u>Recommended subsoil strip depth:</u> 0.8m</p> <p><u>Potential subsoil use:</u> Sandy well drained and highly porous material is suited to higher erosion prone areas within rehabilitated areas.</p>		
Land condition	Good condition. No degradation.		

Total area (ha)	209
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Table 29: Soil Profile Morphology

Site 37	HORIZON NAME DEPTH (m) BOUNDARY	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.00-0.10 abrupt	5YR3/4	Dry 0.05 – pH 8.0 Moderate drainage	Sandy Loam Single grain firm	No surface rock No segregations
	A12 0.10-0.88 abrupt	5YR3/4	Dry 0.30 – pH 8.0 0.60 – pH 8.0 Moderate drainage	Sandy Loam Massive Firm	No surface rock No segregations
	D1 0.88-1.00	5YR4/4	Dry 0.90 – pH 8.0 Moderate drainage	Clayey sand Massive Firm	Very thin gravel pan at 0.80m

Soil Chemistry

The laboratory data for Sites 16 and 37 is presented below in Table 30 and Table 31. The major chemistry trends from the available data indicate the following:

- Neutral to alkaline pH reaction trends;
- Very low chloride throughout profile;
- Electrical conductivity is very low to low throughout the profile;
- Moderate to high CEC rating throughout the soil profiles;
- Particle size distributions confirm a sandy loam dominated profile;
- Non sodic levels in the soil profile;
- Topsoil and subsequent subsoils Ca to Mg ratio indicates very high ratings throughout the soil profile; and
- Very low available phosphorus levels.

The SMU has overall fertility status indicating average fertility conditions. These soils are better suited to supporting both native and improved grasses.

Table 30: Soil Chemistry Results for Site 16

Site, Horizon, Sample Depth (m)	0.00-0.10	0.20-0.30
Analysis (Unit)		
Lab pH (1:5 water)	6.7	7.6
EC (uS/cm)	96	65
PSA-Clay (%)	42	-
PSA-Silt (%)	18	-
PSA-Sand (%)	31	-
PSA-Gravel (%)	9	-
PSA-Cobbles (%)	<1	-
Exch. Ca (meq/100g)	14.2	9.9
Exch. Mg (meq/100g)	3.3	2.1
Exch. K (meq/100g)	1.9	1.7
Exch. Na (meq/100g)	<1.0	<0.1
CEC (meq/100g)	19.5	13.6
ESP (%Na/CEC)	<0.1	<0.1

Site, Horizon, Sample Depth (m)	0.00-0.10	0.20-0.30
Ca/Mg (ratio)	4.3	4.7
Sulfur – Total as S (%)	0.04	-
Chloride (mg/kg)	20	10
Boron (mg/kg)	<0.2	-
Copper (mg/kg)	1.28	-
Iron (mg/kg)	55.6	-
Manganese (mg/kg)	20.6	-
Zinc (mg/kg)	4.95	-
Nitrite N (mg/kg)	0.3	-
Nitrate N (mg/kg)	37.1	-
Nitrite + Nitrate as N (mg/kg)	37.4	-
Total Kjeldahl Nitrogen as N(mg/kg)	3890	-
Total Nitrogen as N (mg/kg)	3930	-
Bicarbonate Extractable P (Olsen) (mg/kg)	4.45	-
Organic Matter (%)	2.7	-

Table 31: Soil Chemistry Results for Site 37

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	8.2	8.3	8.4	8.5
EC (uS/cm)	134	108	114	128
PSA-Clay (%)	46	-	-	-
PSA-Silt (%)	25	-	-	-
PSA-Sand (%)	22	-	-	-
PSA-Gravel (%)	7	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	33.6	31.4	32.4	30.2
Exch. Mg (meq/100g)	3.2	2.2	3.4	6.1
Exch. K (meq/100g)	2.0	0.3	0.1	0.1
Exch. Na (meq/100g)	<0.1	<0.1	<0.1	<0.1
CEC (meq/100g)	38.8	33.8	35.9	36.4
ESP (%Na/CEC)	<0.1	<0.1	<0.1	0.2
Ca/Mg (ratio)	10.5	14.3	9.6	5.0
Sulfur – Total as S (%)	0.03	-	-	-
Chloride (mg/kg)	20	<10	<10	30
Boron (mg/kg)	<0.2	-	-	-
Copper (mg/kg)	2.72	-	-	-
Iron (mg/kg)	21.4	-	-	-
Manganese (mg/kg)	24.8	-	-	-
Zinc (mg/kg)	1.87	-	-	-
Nitrite N (mg/kg)	0.8	-	-	-
Nitrate N (mg/kg)	1.7	-	-	-
Nitrite + Nitrate as N (mg/kg)	2.5	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	2760	-	-	-
Total Nitrogen as N (mg/kg)	2760	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	1.79	-	-	-
Organic Matter (%)	2.7	-	-	-

4.5 Soils overlying deeply weathered Tertiary basalt

4.5.1 Kammel (Ka)

Overview

This SMU is located within three small areas located within the central east and south east areas of the project area. The area is gently undulating areas with cropping disturbance.


Soils are generally a deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth. Within this SMU, 4 detailed sites were described, one site was submitted for laboratory analysis, (site 36).

A land summary is presented below in Table 32, soil profile morphology in Table 33 and major laboratory data in Table 34.

Table 32: Land Summary

Representative site number	Site 36		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mostly cleared. Previous Brigalow Dawson gum and yellowwood scrub.
Location	644276mE 7347252mN	Disturbance	Cropping/cleared disturbance
Landform element and pattern	Gently undulating plain Midslope	Micro relief	None
		Permeability	Moderate
Slope	1.5%	Drainage	Well
Surface coarse fragments	Coarse fragments <2% at <60mm	Surface condition	Self mulching, soft
ASC Order (s) present in SMU	Reddish brown Vertosol	Land use	Areas being used for cultivation
Land System (Story et al (1967)	Oxford	Substrate	Ferruginised basalt
AMU (Bourne and Tuck (1993)	Picardy	Soil Type of Story et al (1967)	Glenora
Land suitability summary	<p>Effective soil depth : 1.0m+</p> <p>Est. soil water storage: 120mm.*</p> <p>* based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 3</p> <p>Beef Cattle Grazing class: 2</p> <p>Agricultural Land Class: A</p> <p>Bourne and Tuck (1993): Suitable for irrigated, dryland and forage cropping. In particular sorghum, sunflower, cotton, wheat, chickpea, safflower. Highly productive grazing of either native bluegrass or sown pastures, particularly purple pidgeon grass.</p>		
Erosion potential (Bourne and Tuck 2003)	High erosion hazard due to undulating nature of the soil unit. Broad based contour banks over 0.5% slope are recommended as is consideration to crop rotation and use of minimum tillage techniques.		
Soil quality for mine rehabilitation	<p><u>Recommended topsoil Strip Depth</u>: 0.3m</p> <p><u>Recommended subsoil strip depth</u>: 0.8m</p> <p><u>Potential subsoil use</u>: AS for <i>Sullivan</i></p>		
Land condition	Under cultivation and no evidence of any degradation (e.g plough pans, erosion)		
Total area (ha)	702		

Table 33: Soil Profile Morphology

Site 36	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH (m) DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	0.00-0.10 Ap abrupt	5YR3/2	Dry 0.05 – pH 8.0 Well drained	Light clay Polyhedral Weak	Fine roots few No surface rock No segregations
	0.10-1.00 B21	5YR3/3	Dry 0.35 – pH 8.0 0.65 – pH 8.0 0.95 – pH 8.0 Well drained,	Medium clay Angular moderate, firm	Fine roots few No segregations

Soil Chemistry

The laboratory data for Site 36 presented below in Table 34. The major chemistry trends from the available data indicate the following:

- Alkaline pH reaction trends increase very slightly with depth;
- Very low chloride throughout the profile;
- Electrical conductivity is very low throughout the profile;
- Moderately high CEC rating throughout the soil profile;
- Particle size distributions support field texture ratings of clay dominated profile;
- Non sodic levels reported throughout the soil profile;
- Topsoil and subsequent subsoils Ca to Mg ratio indicates very high ratings decreasing throughout the soil profile; and
- Very low available phosphorus levels.

Overall, the soils do not have any major limitations with overall fertility status reported similar to Kammel SMU chemistry conditions. Non sodic levels within the soils with high CEC levels, albeit high Ca to Mg ratings would favour multiple applications within rehabilitation and reuse.

Table 34: Soil Chemistry Results for Site 36

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Analysis (Unit)				
Lab pH (1:5 water)	8.1	8.3	8.4	8.5
EC (uS/cm)	137	132	150	194
PSA-Clay (%)	59	-	-	-
PSA-Silt (%)	25	-	-	-
PSA-Sand (%)	15	-	-	-
PSA-Gravel (%)	1	-	-	-
PSA-Cobbles (%)	<1	-	-	-
Exch. Ca (meq/100g)	36.9	40.2	33.6	31.9
Exch. Mg (meq/100g)	6.4	9.6	12.3	15.1
Exch. K (meq/100g)	1.0	0.2	0.2	0.2
Exch. Na (meq/100g)	<0.1	0.1	0.4	1.0
CEC (meq/100g)	44.3	50.2	46.5	48.2
ESP (%Na/CEC)	<0.1	0.2	1.0	2.1

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Ca/Mg (ratio)	5.8	4.2	2.7	2.1
Sulfur – Total as S (%)	0.01	-	-	-
Chloride (mg/kg)	<10	<10	<10	<10
Boron (mg/kg)	<0.2	-	-	-
Copper (mg/kg)	1.78	-	-	-
Iron (mg/kg)	12.4	-	-	-
Manganese (mg/kg)	10.1	-	-	-
Zinc (mg/kg)	<1.00	-	-	-
Nitrite N (mg/kg)	<0.1	-	-	-
Nitrate N (mg/kg)	32.6	-	-	-
Nitrite + Nitrate as N (mg/kg)	32.6	-	-	-
Total Kjeldahl Nitrogen as N(mg/kg)	1300	-	-	-
Total Nitrogen as N (mg/kg)	1330	-	-	-
Bicarbonate Extractable P (Olsen) (mg/kg)	0.56	-	-	-
Organic Matter (%)	1.0	-	-	-

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4.5.2 Lexington (Lx)

Overview

This SMU is minor associate of the larger *Sullivan* SMU and located within the central area of the project area. The area is gently undulating plains which have been significantly cleared for grazing and cropping use.


Soils are generally a shallow, firm, red to dark brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth. Within this SMU, 5 detailed sites were described, one site was submitted for laboratory analysis, (site 62).

A land summary is presented below in Table 35, soil profile morphology in Table 36 and major laboratory data in Table 37.

Table 35: Land Summary

Representative site number	Site 62		
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mostly cleared. Previous mixed scrub
Location	640765mE 7347930mN	Disturbance	Completely cleared
Landform element and pattern	Gently undulating plain Upper slope	Micro relief	None
		Permeability	Moderate
Slope	1.5 - 2.0%	Drainage	Well
Surface coarse fragments	Coarse fragments large pebbles <5% at <20mm	Surface condition	Self mulching, cracking with minor crust
ASC Order (s) present in SMU	Black vertosol	Land use	Areas being used for grazing. Evidence of previous cultivation
Land System (Story et al (1967)	Oxford	Substrate	Ferruginised basalt
AMU (Bourne and Tuck (1993)	Jimbaroo	Soil Type of Story et al (1967)	Gindie
Land suitability summary	<p>Effective soil depth : 0.45m</p> <p>Est. soil water storage:* 60mm *based on DERM (2011) SCL estimation for soil water storage.</p> <p>Rain fed Cropping class: 5</p> <p>Beef Cattle Grazing class: 4</p> <p>Agricultural Land Class: C3</p> <p>Bourne and Tuck (1993): Suited to grazing of native and improved pastures. Not recommended for cropping due to soil depth restriction.</p>		
Erosion potential (Bourne and Tuck 2003)	High due to long slopes generally >1.5%		
Soil quality for mine rehabilitation	<p><u>Recommended topsoil Strip Depth:</u> 0.4m</p> <p><u>Recommended subsoil strip depth:</u> nil subsoil.</p> <p><u>Potential subsoil use:</u> Weathered or fresh basalt may have applications in rehabilitation programs</p>		
Land condition	Good condition		
Total area (ha)	188		

Table 36: Soil Profile Morphology

Site 62	HORIZON NAME AND DEPTH (m)	COLOUR MOTTLES BLEACH	MOISTURE FIELD pH DRAINAGE	TEXTURE STRUCTURE CONSISTENCE	COARSE FRAGMENTS, SEGREGATIONS ROOTS
	A1 0.00-0.15 Sharp	5YR3/2	Dry 0.10 – pH 7.0 Well drained	Silty clay loam Strong granular firm	Fine roots few No segregations
	B2 0.15-0.45 abrupt	5YR3/3	Dry 0.30 – pH 7.5 Well drained	Light clay Strong angular blocky, firm	Fine roots few No segregations
	0.45 C	-	-	Fresh basalt. Very hard	Refusal at 0.45m

Soil Chemistry

The laboratory data for Site 62 presented below in Table 37. The major chemistry trends from the available data indicate the following:

- Neutral pH throughout the profile;
- Dominate clay content throughout profile;
- Electrical conductivity and Chloride was low throughout the profile;
- Very high cation exchange capacity throughout profile;
- Non sodic levels throughout profile; and
- Very high Ca to Mg ratios.

Table 37: Soil Chemistry Results for Site 62

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40
Analysis (Unit)		
Lab pH (1:5 water)	7.1	7.6
EC (uS/cm)	88	33
PSA-Clay (%)	64	-
PSA-Silt (%)	30	-
PSA-Sand (%)	6	-
PSA-Gravel (%)	<1	-
PSA-Cobbles (%)	<1	-
Exch. Ca (meq/100g)	31	32.8
Exch. Mg (meq/100g)	15.1	15.3
Exch. K (meq/100g)	1	0.6
Exch. Na (meq/100g)	<0.1	0.3
CEC (meq/100g)	47.2	48.9
ESP (%Na/CEC)	0.2	0.6
Ca/Mg (ratio)	2.0	2.2
Sulfur – Total as S (%)	0.02	-
Chloride (mg/kg)	90	<10
Boron (mg/kg)	<0.2	-
Copper (mg/kg)	1.35	-
Iron (mg/kg)	28.7	-
Manganese (mg/kg)	64	-
Zinc (mg/kg)	<1.00	-
Nitrite N (mg/kg)	<0.1	-
Nitrate N (mg/kg)	16.5	-

Site, Horizon, Sample Depth (m)	0.00-0.10	0.30-0.40
Nitrite + Nitrate as N (mg/kg)	16.5	-
Total Kjeldahl Nitrogen as N(mg/kg)	1360	-
Total Nitrogen as N (mg/kg)	1380	-
Bicarbonate Extractable P (Olsen) (mg/kg)	1.67	-
Organic Matter (%)	2.2	-

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4.6 Topsoil management

Measures to manage topsoil during the construction and operation of the project are discussed below.

4.6.1 Discussion

Areas of the site will be subject to ground disturbance due to subsidence of underground longwall panels, as well as construction and operations activities associated with the project. Apart from land subsidence, areas of significant land disturbance will include the land clearing and preparation for construction of access roads, MIA (bathhouse, administration, workshop, warehouse, fuelling facilities, rescue and emergency complex), environmental dams and underground entrance.

Areas to be significantly disturbed as a result of mining and support facilities will require stripping of topsoil and possibly subsoil for reuse in rehabilitation programs. Therefore, all soils within the study area have been assessed to determine their suitability for stripping and reuse in rehabilitation of these areas.

The project area includes significant topsoil reserves with beneficial material for rehabilitation within one metre (1.0m) depth in many areas. Recommendations have been provided for 'Double' stripping which refers to the removal of the best quality 'topsoil' layer followed by subsequent removal of suitable quality 'subsoil'. This practice can enhance the volumes of materials available for rehabilitation and return a soil profile similar to that which existed before disturbance. The upper soil layer should be stockpiled and managed separately from the lower material as the upper layer is generally:

- more fertile;
- finer (better) structured and drained; and
- includes pasture seeds and higher organic content.

It is recommended that the 'subsoil' and 'topsoil' materials be placed in the original layering when reused for mine site rehabilitation.

The basic principle in determining useable depths of topsoil and subsoil for rehabilitation is its quality in comparison to the mine waste material requiring rehabilitation. As a rule of thumb, the quality of the topsoil must exceed that of the mine waste. While this may seem obvious, there are situations where additional problems have been created with the inappropriate use of topsoil (e.g. sandy duplex soil on a slope). In addition to significant topsoil reserves, some soils have subsoil materials which are marginal as topsoil but may be stockpiled for capping of mine waste. In instances where topsoil and subsoil are stripped, they will be stockpiled separately.

The following comments are included to assist management decisions for topsoil and subsoil. The soils used in rehabilitation will be applied at a depth of no less than 0.25 m. This provides sufficient depth for re ripping, should follow-up maintenance work be required.

4.6.2 **Specific soil type recommendations**

The area is dominated by clay soil types and when used in mine rehabilitation programs, potential problems may be encountered in the initial establishment of fine seeded pastures due to poor soil to seed contact as a result of potential shrinking / swelling soil attributes. However, once establishment has been achieved, the high water storage potential of these soils will maintain strong and robust pasture coverage.

Deep self mulching clays greater than 1.0m deep (*Mv, Ka*)

These soils would be useful on a range of rehabilitation applications. Both SMUs consist of deep light to medium clays of over a 1.0m in depth with very high CEC ratings, neutral to alkaline pH levels and rated as non-sodic. Evidence of high subsoil salinity was found in one of two laboratory sites in the Mv SMU.

Self mulching clays, less than 1.0m deep (*Sv, Rn*)

As with the deeper cracking clays, these soil types are useful on a range of rehabilitation applications. They feature good quality topsoil and subsoil however soil depth to buried layers, weathered, fresh basalt or gravel may vary. Sites SB1 and SB4 show deep clays to 0.9m and 1.1m respectively however Site 20 reports the horizon change between medium clay and sandy clay at 0.70m. Assessing against the '70/30 purity rule' finds the majority extend to 1.00m.

Topsoil consisting of light clay featuring sandy and silty elements extends to depths of 0.05 to 0.3m. Light medium to medium clays extend to 0.70+m. Both horizons show very high levels of CEC, neutral pH and generally non sodic conditions favour a range of rehabilitation applications.

Rn is another clay dominate profile which would be favourable in rehabilitation reuse. The SMU has high nitrogen and phosphorous levels, very low salinity and non sodic conditions. The SMU is similar to *Sv* however the soil may be restricted due to shallower depth of the clay horizon above weathered or fresh basalt. Basically, all *Rn* soil may be stripped above the parent material.

The thin texture contrast variant of *SvDv* should be treated in a similar manner to *Sv*.

Self mulching clays less than 0.45m deep (*Lx*)

Lexington is essentially a shallow *Rn* with soil depth restricted by basalt and gravel layers by 0.45m depth. Therefore, the conservative soil stripping depth is recommended at 0.45m.

Gilgaied cracking clays (*SvGp*)

The clay horizons overlies buried layers of gravel with depth varying between 0.55 and 0.75 m below ground level pending the depression and mound positions. Laboratory data indicates potentially higher dispersive tendency than other clay soils so a conservative maximum subsoil stripping depth of 0.55m is recommended.

Gradational and duplex sandy to loamy earths (Tf, Km)

Soil origin contributes to these soils exhibiting generally coarser textured (i.e. sandier) surface layers overlying either deep clayey sands or hard subsoils. Stripping depth for Km varies with the depth of the sandy upper horizon, however the topsoil may be stripped 0.30m with underlying subsoils stripped to 0.6m.

Tf encompasses red earths consisting of generally firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below. Overall fertility status ranges from average to favourable. Stripping depth may be taken to 0.80m.

Excluding the clay horizons of Km, these sandy loam soils are better suited to supporting both native grasses and vegetation with application on lower sloping sites for rehabilitation due to the high erosion potential.

4.6.3 Stripping Depth Volumes

Table 38 presents the recommended stripping depths for each SMU and total estimated available topsoil and subsoil reserves within the proposed disturbance footprint of the project site. Only two (2) SMU's occur within the disturbance footprint; *Kilmore* and *Sullivan*.

The total area of proposed active mining disturbance requiring rehabilitation is 60 hectares (approx.). At a recommended average placement depth of topsoil over rehabilitation of 0.25 m (i.e 2,500 m³/ha), the minimum required volume of topsoil is 150,000 m³.

Table 38 shows that an estimated total volume of 180,000m³ high quality topsoil material from the disturbance footprint of the project site is available for rehabilitation. A further 233,000 m³ of suitable subsoil material is available for additional capping of structures or as general enhancement of the replaced soil profile.

Volumes of topsoil and capping materials available from within the project's disturbance area significantly exceed expected requirements for complete rehabilitation.

Table 38: Recommended Stripping Depths and Volumes Available – Proposed Disturbance Footprint

SMU	Recommended Topsoil Stripping Depth (mbgl)	Recommended Subsoil Stripping Depth	Proposed Disturbance Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³)
Mv Minerva	0.3	0.3-1.0	0	-	-
Rn Ronnoc	0.3	0.3-0.8	0	-	-
Ka Kammel	0.3	0.3-0.8	0	-	-
Lx Lexington	0.4	nil	0	-	-
Tf Talafa	0.3	0.3-0.8	0	-	-
Km Kilmore	0.3	0.3-0.6	7	21,000	21,000
Sv	0.3	0.3-0.7	53	159,000	212,000

SMU	Recommended Topsoil Stripping Depth (mbgl)	Recommended Subsoil Stripping Depth	Proposed Disturbance Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³)
Sullivan					
Sv-Gp Sullivan gilgai phase	0.3	0.3-0.7	0		
TOTAL FOR DISTURBANCE AREA			60	180,000	233,000

4.6.4 Soil Stripping Management Measures

The following soil handling techniques will be employed in stripping, handling and storing topsoil resources to prevent excessive soil deterioration:

Stripping of topsoil and subsoil

- Prior to the commencement of stripping, areas will be cleared of vegetation;
- Earthmoving plant operators will be trained and/or supervised to ensure that stripping operations are conducted in accordance with stripping plans and in situ soil conditions. This will ensure that all suitable topsoil and subsoil material resources are salvaged and that the quality of the stripped soil is not reduced through contamination with unsuitable soils; and
- Care will be taken to ensure soil moisture conditions are appropriate, i.e. neither too wet or dry, during stripping, stockpiling, and respreading to ensure that structural degradation of the soil is avoided and that excessive compaction does not occur during placement or through stockpiling.

Stockpiling topsoil and subsoil

- Stripped soil shall be stored in stockpiles until it is used;
- Soil material stockpiles will be located in areas that are outside the construction footprint area and away from drainage lines;
- Drainage from higher areas will be diverted around stockpiles to prevent erosion;
- Sediment control (hay bales or sediment traps) will be installed downstream of the stockpiles to collect any washed sediment;
- Topsoil stockpiles will be formed in low mounds up to a maximum height of approximately 3 m and subsoil stockpiles up to a maximum height of approximately 6 m, consistent with the storage area available. Long term stockpiles, not used for over 6 months will be deep ripped and sown with local grass seed-stock and legumes in order to keep the soil healthy and maintain biological activity;
- Soil stockpiles will be clearly sign-posted for easy identification and to avoid any inadvertent losses;
- Establishment of weeds on the stockpiles will also be monitored and controlled; and
- An inventory of available material, including soil types, will be maintained to ensure adequate materials are available for planned rehabilitation activities.

Re-spreading

Mine rehabilitation planning will include topsoil and subsoil material respreading considerations including:

- Balancing required rehabilitation topsoil and subsoil quantities against stored stockpile inventories; and
- Selective placement of more erodible soil materials on flatter areas and not on steeper slopes, to minimise erosion.

During the removal of soils from the stockpiles, care will be taken to minimise structural degradation of the soils. The respreading process will result in some mixing of the upper and lower sections of the stockpiles, promoting the spread of the seed stock and microfauna through the lower sections of the stockpile. Soil material will be respread in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated and volume of soil available. The mine rehabilitation strategy will include the following measures that are designed to minimise the loss of soil material respread on rehabilitated areas:

- Contour ripping to encourage rainfall infiltration and minimise runoff;
- Reseeding soon after respreading to establish a vegetation cover as early as possible;
- Installation of slope drainage control to limit slope lengths and runoff velocities; and
- Installation of collection drains and catches dams to collect runoff and remove suspended sediment.

Erosion Control Measures

Many of the soil types within the study area include soil horizons which exhibit a slight potential for dispersion and may be subject to sheet, rill and gully erosion if left exposed and unprotected during mine construction or mining operations. Proposed erosion and sediment control measures for the mine construction and mining operations are as follows:

- Mine infrastructure construction erosion and sediment controls, which will be implemented during mine infrastructure construction, are as follows:
 - Vegetation clearing will be conducted progressively so that the minimum area necessary for construction is cleared at any time;
 - Runoff from higher areas will be directed around construction sites;
 - Runoff from bare earthworks areas will be collected in drains and directed through sediment traps and settling ponds to remove suspended sediment prior to discharge from the site;
 - Stockpiles of topsoil and any excess cut material will be sown with grass seed and have side slopes reduced to at least a 4:1 gradient;
 - Earthworks batters will be constructed to stable slopes and vegetated soon after construction; and
 - Earthworks areas will be landscaped and vegetated as soon as possible after construction is completed.
- Mining operations erosion and sediment controls, which will be implemented during mining operations, are as follows:
 - Vegetation clearing will be conducted progressively so that the minimum area necessary for mining operations is cleared at any time;
 - Runoff from higher undisturbed areas will be directed around mining areas;
 - Runoff from disturbance and bare earthworks areas will be collected in drains and directed through sediment traps and settling ponds to remove suspended sediment prior to discharge from the site;
 - Stockpiles of topsoil material will be sown with grass seed and have side slopes reduced to at least a 4:1 gradient;

- The disturbance areas will be rehabilitated progressively to minimise the total extent of disturbed area on the site at any time;
- Rehabilitated disturbance areas will be deep ripped along the contour to maximise rainfall infiltration and minimise runoff;
- Rehabilitated slopes will have contour drains to minimise slope lengths and runoff velocities;
- Runoff from rehabilitated areas will be collected in contour drains and collection drains and directed to sediment dams and settling ponds to remove suspended sediment prior to draining from the site; and
- A maintenance program will be implemented to ensure the proper functioning of drainage and sediment control structures.

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5 AGRICULTURAL LAND SUITABILITY ASSESSMENT

Land suitability in Queensland is primarily based upon the classifications provided within the Land Suitability Assessment Techniques (LSAT) Guidelines within the Department of Mines and Energy (DME) Technical Guidelines for Environmental Management of Exploration and Mining in Queensland (DME, 1995).

Relevant to the LSAT guidelines are the Queensland Government's State Planning Policies (SPPs) on Good Quality Agricultural Land (GQAL), SPP 1/92 Development and Conservation of Agricultural Land, and accompanying Planning Guideline: The Identification of Good Quality Agricultural Land (Department of Primary Industries, 1993). This policy requires that future land use planning in the State should not alienate or diminish areas designated as GQAL unless there is an overriding community benefit.

5.1 Land Suitability Classes

The LSAT Guidelines (DME, 1995), as shown in Table 39, were employed to assist in determination of land suitability across the study area.

Table 39: Land Suitability Classes

Land Suitability Class	Definition
Class 1	Suitable land with negligible limitations that is highly productive and requires only simple management to maintain economic production.
Class 2	Suitable land with minor limitations which either reduce production or require more than the simple management practices of Class 1 to maintain economic production.
Class 3	Suitable land with moderate limitations which either further lower production or require more than those management practices of Class 2 to maintain economic production.
Class 4	Currently unsuitable land with severe limitations which make it doubtful whether benefits of the activity will outweigh the inputs/costs required to achieve and maintain production in the long term under current environmental and economic conditions. A change in future conditions may induce a change to Class 3.
Class 5	Unsuitable land with extreme limitations that preclude its use.

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.

The cropping classification evaluates the broad acre potential for growing non-irrigated cash and forage crops which would be mainly sorghum, wheat and sunflower. Only major limiting factors have been considered, including:

- Plant Available Water Capacity (m)
- Nutrient deficiency (n)
- Soil Physical Factors (p)
- Salinity (s)

- Rockiness (r)
- Microrelief (g)
- Susceptibility to Water erosion (e)
- Topography (t)
- Flooding (f)

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

Field and laboratory data collected was used to assess the severity of any limitations and the land suitability class of the 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.

The suitability of each SMU for rainfed cropping and beef cattle grazing has been assessed and presented in Table 40. Suitability classes and major limiting factors of each soil type for rainfed cropping and grazing is shown in Figure 4 and Figure 5.

Table 40: Suitability classes for rainfed broadacre crops and grazing for SMUs

Soil Unit	Description	Cropping		Grazing	
		Major Limitations and Severity	Class	Major limitations and severity	Class
Mv Minerva	A grey to black cracking clay with coarsely self mulching surface	moisture – m3 nutrients - n1 physical factors – p2 salinity – s4 rockiness – r1 microrelief – g1 topography – t2 erosion - e2 flooding – f5	5	moisture – m2 nutrients – n2 physical factors – p2 salinity – s2/3 rockiness – r1 microrelief – g1 pH – 2 ESP – 1 erosion - e1 flooding – f2	2
Rn Ronnoc	A self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m.	moisture – m2 nutrients – n1 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e2 flooding – f1	2	moisture – m1/2 nutrients – n1 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 pH – 2 ESP – 1 erosion - e1 flooding – f1	2
Ka Kammel	A deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth	moisture – m3 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e3 flooding – f1	3	moisture – m2 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 pH – 3 ESP – 1 erosion - e1 flooding – f1	3
Lx Lexington	A shallow, firm, red to brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth.	moisture – m5 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e3 flooding – f1	5	moisture – m4 nutrients – n2 physical factors – p2 salinity – s rockiness – r1 microrelief – g1 pH – 3 ESP – 1 erosion - e1 flooding – f1	4
Tf	A firm to hard setting red	moisture – m5	5	moisture – m4	4

Soil Unit	Description	Cropping		Grazing	
		Major Limitations and Severity	Class	Major limitations and severity	Class
Talafa	to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth.	nutrients – n3 physical factors – p1 salinity – s1 rockiness – r1 microrelief – g1 topography – t erosion - e2 flooding – f1		nutrients – n3 physical factors – p1 salinity – s1 rockiness – r1 microrelief – g1 pH – 2 ESP – 1 erosion - e1 flooding – f1	
Km Kilmore	A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m	moisture – m4 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e3 flooding – f1	4	moisture – m3 nutrients – n2 physical factors – p3 salinity – s1 rockiness – r1 microrelief – g1 pH – 1 ESP – 1 erosion - e1 flooding – f1	3
Sv Sullivan	A deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth.	moisture – m2 nutrients – n1 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 topography – t1 erosion - e2 flooding – f1	2	moisture – m2 nutrients – n1 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g1 pH – 2 ESP – 1 erosion - e1 flooding – f1	2
Sv-Gp Sullivan gilgai phase	Normal or linear gilgai complexes, Mounds are brown self mulching cracking clay (similar to Sv). Depressions are grey to black, cracking deep clay.	moisture – m3 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g2 topography – t1 erosion - e2 flooding – f1	3	moisture – m2 nutrients – n2 physical factors – p2 salinity – s1 rockiness – r1 microrelief – g2 pH – 2 ESP – 1 erosion - e1 flooding – f1	2

5.1.1 Rainfed Broadacre Cropping Plant Available Water Capacity (m)

Plant available water capacity (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 (Land Resources Branch, QDPI 1989).

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 bar). In addition, field assessments of effective soil depth, and subsequently soil water storage, was undertaken which followed the method used by Burgess (2003) in the Windeyers Hill survey. This involved estimates of field texture combined with field pH, electrical conductivity and depths to hard soil horizons.

Table 41 shows the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in the Kilcummin area. Table 42 shows PAWC limitation severity for each SMU.

The deep clay soil types have an effective soil depth often exceeding 1.0m and are favourable for cropping soils, however SMUs containing shallow earths and clay loams overlying gravel and weathered basalt horizons were deemed not suitable for cropping.

Table 41: Criteria for PAWC limitations for cropping (Shields and Williams 1991)

LIMITATION LEVEL	PAWC (MM)	EFFECTIVE ROOTING DEPTH	PREDICTED CROPPING SUCCESS
2	>130	900 mm	70-75%
3	100-130	600 mm	40-70%
4	75-100	400 mm	<40%
5	<75	<400mm	<30%

Table 42: PAWC limitation levels for SMUs

Soil Unit	Concept	Est. effective rooting depth (m)	PAWC (mm)*	Dryland cropping limitation level	Grazing limitation level
Mv Minerva	A grey to black cracking clay with coarsely self mulching surface	1.00	120-130	3	2
Rn Ronnoc	A self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m.	1.00+	130+	2	2
Ka Kammel	A deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth	1.00	110-130	3	3
Lx Lexington	A shallow, firm, red to brown clay loam overlying ferruginised basalt or other gravel by 0.5m depth.	0.45	50-60	5	4
Tf Talafa	A firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth.	0.90	50	5	4
Km Kilmore	A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m	1.00	90 - 100	4	3
Sv Sullivan	A deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth. Minor texture contrast variant included. (SvDv)	1.00+	120 - 140	2	2
Sv-Gp Sullivan gilgai phase	Normal or linear gilgai complexes, Mounds are brown self mulching cracking clay (similar to Sv). Depressions are grey to black, cracking deep clay.	0.7 – 0.9	90-120	3	2

* Deduced from SCL Act Guidelines Table 9 in addition to comments / findings of Burgess (2003) and Irvine (1999).

Nutrient deficiency (n)

Laboratory data related to nutrients for this project shows quite wide variation in some attributes, particularly phosphorus. According to DME (1995), levels of nutrient deficiency found in this survey fluctuate between favourable, reasonable and not favourable. SMUs *Ka*, *Tf*, *Km*, and *SvGp* reported the lowest levels of nutrient deficiency.

Given that the area has been extensively cropped for many years and any nutrient deficiencies has been, or may be managed with fertiliser and crop rotation / tillage practices, conservative limitation levels have been adopted for nutrient limiting levels for the Project area. For this reason, no SMU's have been significantly downgraded in land suitability as a result of nutrient deficiency.

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. In this survey, no significant limitations of this nature were found with *Mv*, *Rn*, *Ka*, *Lx*, *Km*, *Sv*, and *SvGv*, having minor levels of limitation.

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. The only SMU which indicated high salinity was *Mv* where one of the two sites tested for chloride was highly saline from 0.6m depth. The other site tested was non saline throughout the profile. *SvDv* indicated moderate salinity however the levels are not considered sufficient to restrict effective soil depth.

Rockiness

This refers to the amount of coarse fragments located on the surface of the soil profile, the size and percentage. Surface rockiness was not observed in excess of the criteria, '<10% coarse surface gravel (>6 cm dia) and rock outcrop' in all of the SMUs within the project area.

Microrelief (g)

Microrelief (commonly referred to as gilgai or melon holes) refers to localised depressions along the land surface (McDonald et al., 1984). In the project area, only one small area was identified containing normal gilgai. The SMU Sullivan Gilgai phase (*SvGp*) contains normal gilgai of approximately 0.2 - 0.3m deep and at an average 20% cover of the surface area. All other SMUs did not show signs of microrelief.

It is likely that a greater area was originally gilgaied to some extent prior to development of cropping land however not at levels which constitute a significant limitation to a cropping use.

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.

The better soils occur along gently undulating plains generally less than 2% slope but sufficient to increase soil erosion risk under a cropping use.

During this survey, only minor evidence of erosion washout was observed throughout the majority of the site with SMU *Sv* and *Rn*. Assessment against the water erosion criteria reported SMUs *Ka*, *Lx*, *Km*, *Sv* reporting the highest limitations.

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 flood areas.

5.1.2 Grazing

Class 1 to 3 grazing land is considered suitable for significant pasture improvement, class 4 offers marginal potential for pasture improvement, and class 5 is not suitable for improvement and restricted to grazing of native pastures with low productivity.

The SMUs with gradational, duplex and shallow clays *Tf* and *Lx* may be least productive due to severe limitations from restricted soil water availability. Nutrient deficiency also impacts on SMUs *Ka*, *Km* and *SvGp* however all other land suitability classes were very favourable with no significant limitations to a grazing use.

5.2 Agricultural Land Classes and GQAL

GQAL is assessed using the agricultural land classes (ALCs) presented in the *Planning Guideline: The Identification of Good Quality Agricultural Land* (Qld Department of Primary Industries and Department of Housing, Local Government and Planning, 1993).

Table 43 describes ALC's and their relationship with Land Suitability Classes for grazing and cropping.

Table 43: Relationship between GQAL and Land Suitability Class

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
A	1-3	1-3	Crop land - Land that is suitable for current and potential crops with limitations to production that range from none to moderate levels.
B	4	1-3	Limited crop land - Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
C	Sub categories are as follows:		Pasture land - Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	5	1-2	Land suitable for improved pastures. In some circumstances may be considered as good quality agricultural land.

Agricultural Land Class	Land Suitability (Cropping)	Land Suitability (Grazing)	Description
C2	5	3	Land suitable for native pastures.
C3	5	4	Land suitable for limited grazing of native pastures.
D	5	5	Non-agricultural land - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

Sourced from *Planning Guideline: The Identification of Good Quality Agricultural Land* (Department of Primary Industries, 1993) and *Land Resources Branch* (QDPI 1989)

Following the assessment of ALCs on the basis of this survey, GTES has classified ALC boundaries (refer Figure 6). Table 44 aligns the appropriate GQAL ALC with SMUs.

Table 44: GQAL class and SMUs

GQAL CLASS	DESCRIPTION	SMU
A	Crop land – Land suitable for current and potential crops with limitations to production which range from non to moderate levels.	<i>Rn, Sv, SvGp, Ka</i>
B	Limited Crop Land – Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.	<i>Km</i>
C1	Land suitable for improved pastures. In some circumstances may be considered as good quality agricultural land	<i>Mv</i>
C2	Land suitable for native pastures.	-
C3	Land suitable for limited grazing of native pastures	<i>Lx, Tf,</i>
D	Non-agricultural Land – Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage	-

5.3 Summary of Land Suitability Areas

Table 45 shows the area (ha) for each land suitability class together with GQAL.

Table 45: Areas (ha) for classes of cropping, grazing and GQAL land

Land Suitability – Cropping			Land Suitability – Grazing			GQAL		
Class	SMU	Area (Ha)	Class	SMU	Area (Ha)	ALC	SMU	Area (Ha)
1	-	-	1	-	-	A	<i>Rn, Sv, SvGp, Ka</i>	8045
2	<i>Rn, Sv</i>	7295	2	<i>Mv, Rn, Sv, SvGp, Ka,</i>	9702	B	<i>Km</i>	637
3	<i>Ka, SvGp,</i>	750	3	<i>Km</i>	637	C1	<i>Mv</i>	1657
4	<i>Km</i>	637	4	<i>Lx, Tf</i>	397	C2	-	-
5	<i>Mv, Lx, Tf</i>	2054	5	-	-	C3	<i>Lx, Tf</i>	397
-	-	-	-	-	-	D	-	-
TOTAL		10736			10736			10736

6 STRATEGIC CROPPING LAND ASSESSMENT

6.1 Introduction

Strategic Cropping Land is land considered to be Queensland's best cropping land and is defined and assessed in accordance with the *Queensland Strategic Cropping Land Act 2011* (SCL Act) and subordinate legislation and policies. The regulatory framework under the SCL Act is intended to protect SCL from development impacts.

SCL trigger maps, published under the SCL Act, identify the extents of potential SCL across the state. The current state wide and regional SCL trigger maps were published on 21 December 2012.

Zonal maps have also been published to show five zones of similar climate, landform or cropping systems as they relate to potential SCL. The project site is situated in the Western Cropping Zone and the applicable criteria which influences the assessment of potential SCL is shown in Table 46.

Table 46: Summary of criteria for identifying SCL (SCL Act 2011)

Criteria	Criteria and thresholds – Western Cropping Zone
1. Slope	≤3%
2. Rockiness	≤20% for rocks >60 mm diameter
3. Gilgai microrelief	<50% of land surface being gilgai microrelief of >500 mm in depth
4. Soil depth	≥600 mm
5. Soil wetness	Has favourable drainage (no waterlogged layers within 300 mm of the ground surface).
6. Soil pH	For non-rigid soils, the soil at 300 mm and 600 mm soil depth must be greater than pH 5.0. For rigid soils, the soil at 300 mm and 600 mm soil depth must be within the range of pH 5.1 to pH 8.9, inclusive.
7. Salinity	Chloride content <800 mg/kg within 600 mm of the soil surface
8. Soil water storage	≥100 mm to a soil depth or soil physico-chemical limitation of ≤1000 mm

To confirm the mapped presence of potential SCL at the project site, GTES has conducted an assessment in accordance with the current guidance document *Protecting Queensland's Strategic Cropping Land: Guidelines for applying the Strategic Cropping Land Criteria*. (DERM 2011).

The assessment included the following steps:

- Identify areas where SCL is expected in the project site based on the relevant SCL Trigger Map;

- Determine exclusion areas based upon site investigation of SCL criteria 1 to 3 (i.e. slope, rockiness and gilgai microrelief as defined in the SCL Guidelines); mapping requirements for the Western Cropping Zone; and existing landuse or disturbance;
- Map and describe soil mapping units in a manner consistent with the SCL Guidelines (DERM 2011) and;
- Assess the field validated soil type characteristics and mapping extents against the SCL criteria 4 to 8 presented in the SCL Guidelines.

6.2 Existing SCL Trigger Map

The project site lies within the Central Protection Area of SCL Regional Trigger Map C4 – Moranbah and Emerald Region. The trigger map shows an area of 8,868 ha of potential SCL within the project site, mainly distributed within the central and western areas (refer Figure 8).

6.3 Exclusion of Potential SCL

6.3.1 SCL Criteria 1-3

A total of 251 soil survey sites were described in or near to the SCL area which included 75 detailed soil survey investigations and 176 observation level soil survey sites (Refer Table 1). The location of detailed soil survey sites within the SCL area is presented in Figure 2. This represents a sampling intensity of about 1 site every 42 hectares.

All sites were measured for slope, surface rockiness and gilgai microrelief in accordance with the SCL Guidelines to assess if they should be excluded as SCL.

The data shows that no sites fall the SCL criteria for slope, rockiness and microrelief and no areas smaller than the minimum size criteria of 10 ha and 80 m width were identified from this investigation. Therefore no exclusion areas are proposed on the basis of SCL criteria 1 to 3.

6.3.2 Conflicting Land Uses

The project site contains built infrastructure and areas of existing disturbance. However, the areas of such disturbance are low so no exclusion areas on the basis of built infrastructure have been recorded.

6.3.3 Cropping History Assessment

The project area lies within the Central Protection Area of SCL Regional Trigger Map C4 – Moranbah and Emerald Region. The cropping history assessment guidelines for land in the protection area do not apply.

Therefore there is no requirement to assess the cropping history to show that at least three cropping events occurred on the property from 1 January 1999 to 31 December 2010. Land in the protection area will only need to meet the zonal criteria in order to be validated as SCL.

6.4 Assessment of Soil Types as Potential SCL

In terms of SCL assessment, areas larger than the minimum size criteria of 10 ha and 80 m width which pass the exclusion tests discussed in the previous section must be delineated as SMUs. To capture variation in each SMU, the SCL Guidelines dictate that the SCL assessment should be based upon the characteristics of the dominant soil type for each mapping unit. This assessment meets SCL Guidelines which require that a minimum of 2 detailed sites and 1 analytical site are undertaken per soil type as well as at least 2 check sites per individual map polygon.

Section 4 of this report presents the range of laboratory, soil morphology and topographic data used in the formulation of soil mapping units (SMU's) and the subsequent SCL assessment. Eight SMUs are described in the project site with all occurring within the SCL area in sufficient amounts to be considered.

Laboratory data of attributes relevant to SCL criteria assessment was obtained from nine (9) sites. This provides for an overall analytical site density of 1 site per 985 ha. Table 47 includes numbers of the types of soil survey sites undertaken in or near to the SCL area, and the area (ha) of each SMU within the SCL are as presented in Figure 8.

Table 47: Site Details of SMUs for the SCL area

SMU	Concept Description	Soil Survey sites described		Area (ha)
		Detailed	Analytical Sites	
Recent alluvial channels and floodplains				
Mv Minerva	A grey to black cracking clay with coarsely self mulching surface	14, 35, 41, 42, 43, 55, 57, 58, 60, 61, 65, 71, 73, 74, SB7.	61, SB7	283
Gently undulating plains with soils overlying Tertiary volcanics				
Rn Ronnoc	A self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m.	15, 20, 22, 23, 24, 25, 26, 27, 28, 33, 34, 39, 40, 44, 48, 49, 50, 53, 54, 56, 59, SB10, SB11.	SB10*, SB11*.	3600
Undulating plains and rises with soils overlying deeply weathered Tertiary basalt				
Ka Kammel	A deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth	36, 38, 45, 47, 51.	36	702
Lx Lexington	A shallow, firm, red to brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth.	18,19, 62, 66, 67, 69.	62	8
Level to undulating plains with soils overlying Cainozoic sediments.				
Tf Talafa	A firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth.	6, 16, 17, 37, 46, 52, 75	37	209
Km Kilmore	A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over	9, 12, 31	31	637

SMU	Concept Description	Soil Survey sites described		Area (ha)
		Detailed	Analytical Sites	
	gravel and carbonate dominated material below 0.7m			
Sv Sullivan	A deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth.	1, 3, 4, 5, 10, 11, 13, 21, 29, 30, 32, 63, 64, 70, 72, SB1, SB4	SB1, SB4	3389
SvDv Sullivan duplex variant	An intermittent, non mappable variant with a thin sandy clay loam surface layer overlying deep, moderately well structured medium clay subsoils.	32, 41, 42, 43, 55	42	-
Sv-Gp Sullivan gilgai phase	Normal or linear gilgai complexes, Mounds are brown self mulching cracking clay (similar to Sv). Depressions are grey to black, cracking deep clay.	7, 8	7, 8	40
TOTALS		73 (+2 Boundary Sites)	9	8868

The SCL assessment of dominant soil type characteristics against SCL criteria is summarised in Table 48.

Table 48: Summary of SCL Assessment

SCL Criteria	Soil Mapping Unit						
	Mv	Rn	Na	Lx	Tf	Km	Sv SvGp
1 Slope	PASS	PASS	PASS	PASS	PASS	PASS	PASS
2 Rockiness	PASS	PASS	PASS	PASS	PASS	PASS	PASS
3 Gilgai Microrelief	PASS	PASS	PASS	PASS	PASS	PASS	PASS
4 Soil Depth	PASS (>1.0m)	PASS (0.8m+)	PASS 1.0m	FAIL <0.5m	PASS 0.9m	PASS 1.0m	PASS 0.7m+ (mostly >1.0m)
5 Soil Wetness	FAIL Susceptibility of flooding	PASS	PASS	PASS	PASS	PASS	PASS
6 Soil pH	PASS Moderately alkaline <8.8	PASS Slightly alkaline <8.5	PASS Slightly alkaline <8.5	PASS Slightly alkaline <8.5	PASS Neutral to slightly alkaline <7.6	PASS Neutral – slightly alkaline <8.6	PASS Moderately alkaline <8.8
7 Salinity	FAIL Site 61 has	PASS Very low Cl	PASS Very low Cl	PASS Very low Cl	PASS Very low Cl	PASS Very low Cl	PASS Generally low

SCL Criteria	Soil Mapping Unit						
	Mv	Rn	Ka	Lx	Tf	Km	Sv SvGp
	1400 mg/kg at 0.6m depth and further increasing to 0.9m. Site SB7 is non saline throughout.	throughout	throughout	throughout	throughout	throughout	Cl throughout. SVDv tends towards saline below 0.8m depth
8 Soil Water Storage Estimated from DERM (2011) field water storage.	PASS 120-130mm	PASS 130mm+	PASS 110-130mm	FAIL 50-60mm	FAIL 50-60mm	MARGINAL PASS 90-100mm	PASS 90-140mm (mostly >100mm)
SCL Status of Soil	FAIL	PASS	PASS	FAIL	FAIL	PASS	PASS

6.5 SCL Assessment Conclusions

The following summarises the SCL assessment with the revised SCL presented on Figure 8:

- The area of potential SCL identified on the Trigger Map within the MLA is 8,862 hectares. The SCL area is shown on Figure 2;
- The cropping history requirements do not apply in the protection areas.
- Eight (8) SMUs are identified within the area identified on the Trigger Map as potential SCL
- No SMU's fail SCL exclusion criteria 1-3 for slope, microrelief or rockiness;
- Three (3) SMU's fail the SCL criteria and five (5) pass;
- The SMU's which fail SCL criteria are *Mv* (alluvia susceptible to regular flooding), *Lx* (soil depth <0.6m and low water storage) and *Tf* (low water storage);
- Of the total area of potential SCL in the project area, 8,368 hectares (94%) passes all SCL criteria and 500 hectares (6%) fails.

7 CONCLUSION

Based on the scope of the report, the following is concluded and summarised in Table 49:

- The project area comprises gently undulating plains dominated by well structured and deep clay soils generally of basaltic origins with minor areas of shallow earth, clay loams and texture contrast soils. While isolated instances of soil erosion were noted, the area as a whole remains in very good condition.
- Eight soil mapping units are present within the project area, *Minerva (Mv)*, *Ronnoc (Rn)*, *Sullivan (Sv)*, *Sullivan Gilgai Phase (SvGp)*, *Kammel (Ka)*, *Kilmore (Km)*, *Lexington (Lx)* and *Talafa (Tf)*.
- The project area has been extensively cropped for many years and any nutrient deficiencies have been, or may be managed with fertiliser and crop rotation / tillage practices.
- The deep clay soil types have an effective soil depth often exceeding 1.0m and make up 96% of the project area. The remaining 4% are shallow earths and clay loams overlying gravel and weathered basalt.
- 81% of the project area is assessed as suitable for dryland cropping; a further 15% of the area are deep clays associated with Springsure Creek alluvia but are deemed unsuitable for cropping due to flooding susceptibility and possible high salinity. The remaining 4% of the area are the shallow earths and loams which are not suitable for dryland cropping due to limited water availability.
- All of the project area is assessed as suitable for grazing with over 96% considered good quality grazing land.
- Assessment of GQAL basically follows the land suitability assessment. Four SMU's (*Rn*, *Sv*, *SvGp* and *Ka*) were considered class A crop land, *Km* was class B limited crop land, *Mv* was suitable for improved pastures (class C1) and *Lx* and *Tf* were suited for limited grazing (class C3).
- The estimated proposed area of active disturbance by infrastructure construction is 116 hectares which would require an estimated 290,000 m³ of good quality topsoil for rehabilitation. Suitable soil materials for this purpose (topsoil and subsoil) within this area are conservatively estimated at 348,000 m³ and 447,000 m³ respectively. So volumes of topsoil and capping materials available from within the project's disturbance area significantly exceed expected requirements for complete rehabilitation.

Table 49: Soil Mapping Unit Summary

SMU	Area (ha)	% of area	Description	Land Suitability Class (DME 1995)		QCAL	SCL
				Cropping	Grazing	Agric. Land Class	Pass / fail
Mv Minerva	1657	15	A grey to black cracking clay with coarsely self mulching surface	5	2	C1	Fail
Rn Ronnoc	3630	34	A self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m.	2	2	A	Pass
Ka Kammel	702	6	A deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth	3	2	A	Pass
Lx Lexington	188	2	A shallow, firm, red to brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth.	5	4	C3	Fail
Tf Talafa	209		A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m	5	4	C3	Fail
Km Kilmore	637	6	A deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth.	4	3	B	Pass
Sv Sullivan	3665	34	A firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m	2	2	A	Pass
Sv-Gp Sullivan gilgai phase	48	1	Normal or linear gilgai complexes, Mounds are brown self mulching cracking clay (similar to Sv). Depressions are grey to black, cracking deep clay.	3	2	A	Pass

8 REFERENCES

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9 GLOSSARY OF TERMS

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

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.

Apedal massive. Soil occurring as a coherent mass with no distinct arrangement of soil particles.

Base status. The sum of exchangeable basic cations (Ca, Mg, K and Na) expressed in cmol (+) kg^{-1} clay. This sum is obtained by multiplying the sum of the reported basic cations (which are determined on a soil fine earth basis) by 100 and dividing by the clay percentage of the sample.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milliequivalents per 100 grams of material or centimoles of charge per kilogram of exchanger.

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.

Colluvial. Unconsolidated soil and rock material moved down-slope by gravity.

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.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. This property is related to the ionic content of the sample, which is in turn a function of the total dissolved (ionisable) solids (TDS) concentration. An estimate of TDS in fresh water can be obtained by multiplying EC by 0.65.

Ephemeral stream. A stream that flows only during periods of precipitation and briefly thereafter, or during periods of elevated water-table levels when the stream is in direct hydraulic connection with the underlying unconfined aquifer (i.e. receives base-flow).

ESP. 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.

Fluvial. A material deposited by, or in transit, in streams or watercourses.

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.

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

Humic/Humus. Referring to organic matter within soil.

Infiltration. The passage of water, under the influence of gravity, from the land surface into the subsurface.

Leptic. Other soils which are underlain within 0.5 m of the surface by a hard or partly weathered unweathered rock or other hard materials.

Lithic. Containing large amounts of fragments derived from previously formed rocks.

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.

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.

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

Self mulching. When a Vertosol is dry, initial drying may form a thin (2-3mm) surface flake which readily disintegrates to a mulch on further drying. This process is accelerated by mechanical disturbance.

Sheet erosion. The removal of surface material from a wide area of gently sloping or graded land by broad continuous sheets of running water rather than by streams.

Sodic. 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. These terms are known as exchangeable sodium percentage (ESP) and sodium adsorption ratio (SAR) respectively.

Soil phase. A subdivision of a profile class based on attributes that have particular significance for land use and potentially influences its suitability for a particular land use.

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

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.

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.

10 ATTACHMENTS

Attachment A

Detailed site descriptions

Attachment B

Observation site descriptions

Attachment C

Laboratory Certificates

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SITE 1

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 639485mE 7356136mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP, Midslope, <2.5%	Brigalow, grass species	Overland flow minor depression/ gully observed, no disturbance no erosion	Self mulching, cracking. No coarse fragments	0.00-0.13 Sharp; A1	Light Clay	Polyhedral Weak Firm	Very fine roots, few	10YR3/1 very dark grey	Dry	Wet	0.05 – pH 7.0	0.0- 0.01	-
				0.13-0.40 Clear B21	Light medium clay	Angular Weak Firm	<5% Calcium Carbonate concretions	10YR3/1 very dark grey	Dry	Wet	0.25 – pH 7.5	0.03- 0.40	Very fine roots, few
				0.40-0.60 Clear B22	Medium clay	Polyhedral Moderate Firm	-	10YR2/1 Black, 5YR6/1 <20% 7.5YR4/4 <5%	Dry	Imperfect	0.50 – pH 8.5	0.50- 0.60	-
				0.60-0.87 Abrupt D1	Clayey sand	Polyhedral Weak	Gravels <20% <3mm	5YR4/2 7.5Y4/4 <2% 5YR6/1 <5%	Dry	Poorly drained	0.70 – pH 8.5	0.70- 0.80	-
				0.87-1.00 D2	Clayey sand	Polyhedral Weak	-	10YR6/3	Dry	Poorly drained	0.85 – pH 9.0	0.90- 1.00	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 2

GTES Map Unit: Boundary Sullivan/Kilmore	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 639657mE 7354543mN	Aust. Soil Class. : n/a	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain <1%	Brigalow regrowth	Nil microrelief Nil disturbance Nil erosion	Dry Firm, Gravels 10- 50mm <5%	0.00-0.05 Sharp A11	Sandy Loam	Single grain/ Massive Soft	2% coarse fragments <5mm	10YR4/2	Dry	Moderate / well drained	0.05 – pH 8.0	0.00- 0.10	-
				0.05-0.30 Sharp A12	Sandy Loam	Massive, soft, sub angular	-	10YR4/2	Dry	Moderate / well drained	0.20 – pH 8.0	0.20- 0.30	-
				0.30-0.70 Sharp A13	Loam	Weak, soft,	2% coarse fragments <5mm	10YR4/2	Dry	Moderate / well drained	0.50 – pH 8.0	0.60- 0.70	-
				0.70-1.00 D1	Clayey sand	Weak, soft	2% coarse fragments <5mm	10YR3/2	Dry	Moderate / well drained	0.90 – pH 8.0	0.90- 1.00	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 3

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 641362mE 7354555mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain <0.5%	Brigalow established and regrowth	Nil microrelief Nil disturbance Nil erosion	Crusting, cracking, gravels <2% <5mm, soft to firm, with minor self mulching	A1 0.00-0.09 Abrupt;	Light clay (Silty)	Firm, sub angular weak	Fine Roots, few	10YR3/1	Dry	Wet	0.05 – pH 8.0	0.00- 0.09	-
				B21 0.09-1.00+	Light clay	Firm, angular moderate	Fine roots, few	10YR3/1	Dry	Wet	0.30 – pH 7.5 0.60 – pH 7.5 0.90 – pH 7.5	0.30- 0.40 0.60- 0.70 0.90- 1.00	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 4

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 640544mE 7353541mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat Plain	Cleared, Brigalow in surrounding areas	Nil microrelief Nil disturbance Nil erosion	Self mulching, cracking, dry, no coarse fragments	A1 0.00-0.05 abrupt	Light Medium clay	Firm, angular, dry	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				B21 0.05-1.00+	Medium clay	Firm, sub angular, moist	-	10YR3/1	Moist	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 5

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 638039mE 7353306mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Pasture, Upper slope 1.5%	Mixed vegetation species	Nil microrelief Nil disturbance however cropping within 20.0m Nil erosion	Crust, soft , weak cracking. Mixed gravels, <20% at <10mm, <5% at <50mm	A1 0.00-0.22 Abrupt;	Light clay	Polyhedral Massive,	Calcium carbonate nodules <2%	10YR3/3	Dry	Well	0.10 / 8.0	-	-
				B21 0.22-1.00+	Light Medium Clay	Polyhedral Weak	Calcium carbonate nodules <5% at <5mm	10YR4/2	Dry	Imperfect	0.30 8.5 0.60 8.5 0.90 8.5	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 6

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 636405mE 7353822mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP, Lower slope, <2.0%	Brigalow regrowth nearby	Nil microrelief Nil disturbance Nil erosion	Crusting, soft Coarse fragments <2% at <5mm	Ap 0.00-0.13	Silty loam	Polyhedral Massive	-	2.5YR3/3	Dry	Well	0.05 – pH 8.0	0.00- 0.10	-
				A12 0.13-0.57 Clear;	Silty loam	Polyhedral Massive	-	2.5YR3/3	Dry	Well	0.40 – pH 8.0	0.30- 0.40	-
				D1 0.57-1.00	Clayey Sand	Polyhedral Massive	Unidentified segregations <10mm	2.5YR3/4	Dry	Imperfect	0.70 – pH 8.0 1.00 – pH 8.0	0.65- 0.75	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 7

GTES Map Unit: Sullivan Gilgai Phase	AMU of Bourne and Tuck (1993): Rolleston	Location (GDA94): 637411mE 7354576mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 29/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Native bushland near cropping Flat plain <0.5%	Wooded regrowth with mixed Acacia and Bauhinia	Normal gilgai 0.15-0.20m deep. Nil disturbance Minor overland flow	Self mulching, weak cracking, minor crust, no coarse fragments	A1 .00-0.13 abrupt	Light medium clay	Sub angular, weak	Fine roots, few	10YR3/1	Dry	Well	0.05 – pH 7.0	0.00-0.10	Depression of Gilgai
				B21 0.13-0.40 abrupt	Medium clay	Sub angular, moderate	Fine roots, few	10YR3/1	Dry	Well	0.30 – pH 7.0	0.30-0.40	-
				B22 0.40-0.54 abrupt	Medium clay	Sub angular, moderate	Calcium carbonate <10% concretions	10YR2/2	Dry	Moderate	0.50 – pH 7.5	0.40-0.50	-
				0.54-1.00 C	Clayey sand	Sub angular, weak	Unidentified gravels	10YR4/2	Dry	Imperfect	0.70 – pH 8.0 0.90 – pH 8.0	0.60-0.70 0.90-1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 8

GTES Map Unit: Sullivan Gilgai Phase	AMU of Bourne and Tuck (1993): Rolleston	Location (GDA94): 637415mE 7354570mN	Aust. Soil Class. : Black Vertosol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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Landscape



Surface
N/A

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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Native bushland near cropping Flat plain <0.5%	Wooded, mixed species	Normal gilgai observed Nil disturbance Minor overland flow	Self mulching, minor crust and cracking, no coarse fragments	0.00-0.10 A1 abrupt	Light medium clay	Sub angular, weak	Fine roots, few	10YR3/1	Dry	Well	0.05 – pH 7.0	0.00-0.10	Mound of Gilgai
				0.10-0.23 B21 abrupt	Medium clay	Sub angular, moderate	Fine roots, few	10YR3/1	Dry	Well	0.30 – pH 7.0	-	-
				0.23-0.75 B22 abrupt	Medium clay	Sub angular, moderate	Calcium carbonate <10% concretions	10YR2/2	Dry	Imperfect	0.50 – pH 7.5	0.50-0.60	-
				0.75-1.00 BC	Clayey sand	Sub angular, weak	Unidentified gravels 2 -8mm diameter	10YR4/2	Dry	Imperfect	0.70 – pH 8.0 0.90 – pH 8.0	0.90-1.00	Parent material

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 9

GTES Map Unit: Kilmore	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 638151mE 7353079mN	Aust. Soil Class. : Reddish Brown Dermosol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Gully 1.5%	Cropping nearby	Nil microrelief Nil disturbance Gully erosion	Eroded, very firm with sandy crust, mixed gravels <15% at <20mm	A11 0.00-0.15 abrupt	Sandy clay loam	Polyhedral Moderate	-	10R3/3	Dry	Well	0.05 – pH 8.0	-	-
				A12 0.15-0.40	Clay loam	Polyhedral Moderate, firm	-	10R3/3	Moist	Well	0.30 – pH 8.0	-	-
				B21 0.40-0.90	Sandy clay loam	Polyhedral Moderate, firm	Coarse fragments, 2% at <10mm	10R2.5/2 Mottle 5YR5/8 <10%	Dry	Imperfect	0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 10

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 637910mE 7348153mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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Landscape



Surface



Soil Profile



Landuse Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping, Flat plain 0%	Thick grass species and Sally Wattle vegetation	Nil microrelief Nil disturbance Nil erosion	Firm and cracking. <5% mixed gravels <30mm	A1 0.00-0.10 Abrupt,	Light medium clay	Firm angular weak/ moderate	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				B21 0.10-1.00+	Medium clay	Firm sub angular weak/ moderate	<5% soft carbonate	10YR3/1	Moist	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 11

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 637844mE 7349758mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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Landscape



Surface



Soil Profile



Landuse Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain 0%	Cleared	Nil microrelief Nil disturbance Nil erosion	Self mulching, dry, minor ironstone coarse fragments	Ap 0.00-0.10 Clear;	Light medium clay	Firm angular weak/ moderate	-	10YR3/1	Dry	Well	0.05 / 7.5	0.00-0.10	-
				B21 0.10-1.00	Medium clay	Firm sub angular weak/ moderate	-	10YR3/1	Moist	Well	0.20 / 8.0 0.8 / 8.0	0.30-0.40 0.60-0.70 0.90-1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 12

GTES Map Unit: Kilmore	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 637180mE 7352001mN	Aust. Soil Class. : Dermosol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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Landscape



Surface



Soil Profile



Landuse Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Native land nearby cropping Flat plain 0%	Native grass species Silver leaf Ironbark	Nil microrelief Nil disturbance Nil erosion	Dry Self mulching No coarse fragments	A1 0.00-0.08	Light silty clay	Polyhedral Weak 5-20mm strong	-	7.5YR2.5/2	Dry	Well	0.05 – pH 7.0	-	-
				B21 0.08-0.30	Light clay	Polyhedral Weak 5-20mm strong	-	10YR3/2	Dry	Well	0.25 – pH 7.0	-	-
				D1 0.30-0.60	Sandy clay loam	Polyhedral Weak 5-20mm	<2% coarse fragments	5YR3/3	Dry	Well	0.50 – pH 7.0	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 13

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 641313mE 7352993mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/04/2013
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Landscape



Surface



Soil Profile



Landuse Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain 0%	Cleared	Nil microrelief Nil disturbance Nil erosion	Self mulching, dry, soft, no coarse fragments	Ap 0.00-0.10 clear	Light medium clay	Firm angular weak/ moderate	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	Recent cultivation
				B21 0.10-1.00+	Medium clay	Firm sub angular weak/ moderate	Trace soft carbonate	10YR3/1	Moist	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 14

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 643533mE 7350445mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Pasture / cropping GUP, flat plain <0.5%	Brigalow, Narrow leaf Ironbark, Bloodwood	Nil microrelief Nil disturbance Nil erosion	Very soft, self mulching, cracking weak crust Mixed gravels <20% at <50mm <5% at 10- 50mm	0.00-0.20 A1 abrupt	Light Clay	Polyhedral Firm weak	Gravels <1% at <5mm	10YR3/2	Dry	Well	0.05 – pH 7.5	-	Five (5) boreholes augered. Fourth borehole to 1.00m
				0.20-1.00 B21	Light medium clay	Polyhedral Firm strong	Gravels <1% at <5mm	10YR3/2	Dry	Well	0.30 – pH 7.5 0.60 – pH 7.5 0.90 – pH 8.0	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	SCL FAIL

SITE 15

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Rolleston	Location (GDA94): 644750mE 7348833mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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Landscape



Surface
N/A

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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP, mid slope 1.5%	Native grass species	Nil microrelief Minor cattle grazing Nil erosion	Soft crust, self- mulching <2% at <60mm <1% at >60mm	0.00-0.11 A1 sharp	Light clay	Polyhedral Firm	Mixed gravels <5mm Fine roots few	10YR3/2	Dry	Well	0.05 – pH 7.5	0.00- 0.10	-
				0.11-0.56 B21 abrupt	Medium clay	Polyhedral Firm strong	<1% Calcium carbonates concretions Fine roots few	10YR3/2	Dry	Well	0.30 – pH 7.5	0.30- 0.40	-
				0.56-0.70 BC	Clay loam	Weak / massive	<30% gravels <0.10	10YR7/3 Mottle 10YR2/1 40% 10YR5/6 10%	Dry	Imperfect	0.60 – pH 8.0	0.60- 0.70	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m'	SCL Passed

SITE 16

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 642438mE 7349132mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Ridge / upper slope 7%	Brigalow regrowth (minor)	Nil microrelief Nil disturbance Nil erosion	Firm, sandy, dry <2% <5mm gravels	0.00-0.10 A1 abrupt	Sandy loam	Polyhedral Very strong	<2% coarse fragments	5YR4/3	Dry	Moderate	0.05 – pH 7.5	0.00- 0.10	-
				0.10-0.30 A11 abrupt	Clayey sand	Polyhedral Very strong	<2% coarse fragments	5YR3/3	Dry	Imperfect	0.25 – pH 7.5	0.20- 0.30	-
				R 0.30+	-	-	-	-	-	-	-	-	Refusal at 0.30m

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 17

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 642602mE 7348875mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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Landscape



Surface
N/A

Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP Midslope 2%	Ironbark	Nil microrelief Nil disturbance however contour banks are located nearby Nil erosion	Firm Dry Gravels <2% at <5mm	0.00-0.02 A1 Sharp	Clayey Sand	Polyhedral Massive	-	10YR4/3	Dry	Well	0.01 – pH 7.5	-	Cropping located 100m nearby
				0.02-0.41 A11	Clayey Sand	Polyhedral Weak	-	5YR4/4	Dry	Well	0.30 – pH 7.5	-	-
				R 0.41+	-	-	-	-	-	-	-	-	Refusal at 0.41m

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 18

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993): Jimbaroo	Location (GDA94): 640701mE 7347447mN	Aust. Soil Class. : Vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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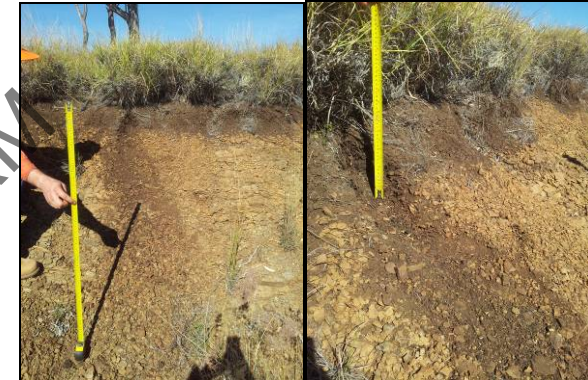
Landscape



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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP Midslope <2%	Mountain Coolibah	Nil microrelief Area appears to be historically excavate Nil erosion	Soft self mulching, non cracking, no coarse fragments	0.00-0.15 A1 abrupt	Light Clay	Polyhedral Weak	-	10YR3/1	Dry	Well	-	0.00- 0.10	Area anecdotally known as the quarry
				0.15-3.00 C	Parent Material	Weak / massive	Gravels >80% at 0-20mm	-	Dry	Poorly drained	-	0.30- 0.40	Weathered basalt

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Pass	SCL FAIL

SITE 19

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993): Jimbaroo	Location (GDA94): 640717mE 7347458mN	Aust. Soil Class. : Vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP Midslope <2%	Mountain Coolibah Bottletree.	Nil microrelief Area appears to be historically excavate Nil erosion	Soft self mulching, no coarse fragments	0.00-0.15 A1 abrupt	Light Clay	Polyhedral Weak	-	10YR3/1	Dry	Well	-	0.00- 0.10	Area anecdotally known as the quarry
				0.15-3.00 C	Parent Material	weak	Gravels >80 at 0-20mm	-	Dry	Poorly drained	-	0.30- 0.40	Weathered basalt

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Fail	SCL Fail

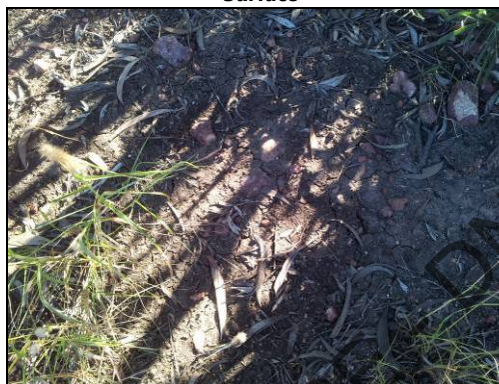
SITE 20

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 642058mE 7346729mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP Midslope <2%	Native grass species	Nil microrelief Nil disturbance Nil erosion	Self mulching, cracking, minor crusting <2% at 10- 100mm	0.00-0.22 A1 abrupt	Light clay	Polyhedral Weak	-	10YR3/1	Dry	Well	0.05 – pH 7.0	0.00- 0.10	-
				0.22-0.70 B21 diffuse	Medium clay	Sub angular, minor Polyhedral Moderate	Minor soft carbonate / small nodules	10YR3/2	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0	0.30- 0.40 0.60- 0.70	-
				0.70-1.00 D1	Sandy clay loam	Polyhedral Weak	-	10YR4/3	Dry	Imperfect	0.90 – pH 7.0	0.90- 1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 21

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 640407mE 7356849mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 01/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain 0.5%	Brigalow	Nil microrelief Cropping disturbance Nil erosion	Self mulching, soft minor crust Mixed gravels <5% at <5mm	Ap 0.00-0.18 abrupt	Light medium clay	Polyhedral Weak	-	10YR3/1	Dry	Well	-	-	-
				0.18-1.00 B21	Medium clay	Polyhedral Moderate	Calcium carbonate concretions <5%	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 22

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 640278mE 7342854mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP, lower slope <1%	Brigalow	Nil microrelief Cropping disturbance Nil erosion	Self mulching minor crusting, dry, no coarse fragments	Ap 0.00-0.10 A1 abrupt	Light clay	Polyhedral Weak	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.10-0.65 B21 abrupt	Medium clay	Angular moderate	-	10YR3/1	Humid	Well	0.40 – pH 8.0	-	-
				0.65-0.82 B22 abrupt	Light medium clay	Angular moderate	Calcium carbonate nodules <5% at <5mm	10YR3/1	Humid	Moderate	0.80 – pH 8.0	-	-
				0.65-0.82 C	gravelly	Polyhedral Weak/ massive	Weathered Basalt throughout	5Y6/3 Mottle 5Y7/4 <30%	Dry	Imperfect	1.10 – pH 8.0	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 23

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 640103mE 7343124mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Near cropping Wide depression /creek GUP 1%	Moreton bay ash, narrow leaf Ironbark	Nil microrelief Nil disturbance Gully/creek erosion	Crust, weak cracking, soft mixed gravels <5% at <60mm <2% at >60mm	0.00-0.10 A1 abrupt	Light Clay	Polyhedral Moderate	Very fine roots, few <2% <5mm gravels	10YR4/1	Humid	Well	0.05 – pH 8.0	-	-
				0.10-1.00 B21	Medium, Clay	Angular, firm moderate	Very fine roots, few	10YR3/1	Humid	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	SCL FAIL

SITE 24

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Jimbaroo	Location (GDA94): 642490mE 7345088mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Adjacent cropping GUP 1%	Mature regrowth of mixed vegetation	Nil microrelief Nil disturbance Minor surface erosion nearby	Self mulching, cracking, soft gravels <2% 20- 100mm	0.00-0.06 A1 abrupt	Light Clay	Polyhedral Weak	-	10YR3/1	Dry	Well	0.05 / 7.5	-	Shallow area within cultivation
				0.06-0.35 B2 abrupt	Medium clay	Angular moderate	<2% coarse fragments	10YR3/1	Humid	Well	0.30 / 8.0	-	-
				0.35-0.80 C	Clayey sand	Polyhedral Weak/ massive	Weathered basalt	10YR4/1	Dry	Imperfect	0.60 / 7.5	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass -based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 25

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 641265mE 7344145mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP <2%	-	Nil microrelief Cropping disturbance Nil erosion	Soft, weak crusting. no coarse fragments	Ap 0.00-0.15	Light Clay	Polyhedral Moderate	Very fine roots, few <2% <5mm gravels	10YR4/1	Humid	Well	0.05 – pH 8.0	-	-
				B21 0.15-1.00	Medium, Clay	Angular, firm moderate	Very fine roots, few 0.90-1.00 gravels <2% at <5mm	10YR3/1	Humid	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 26

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 641563mE 7343306mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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Landscape
N/A

Surface
N/A

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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP, lower slope <1%	-	Nil microrelief Cleared disturbance Nil erosion	Self mulching minor crusting dry no coarse fragments	0.00-0.10 A1 abrupt	Light clay	Polyhedral Weak	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.10-0.70 B21 abrupt	Medium clay	Angular moderate	Calcium carbonate nodules <5% at <5mm	10YR3/1	Humid	Well	0.40 – pH 8.0	-	-
				0.70-1.00 C	Weathered Basalt	Polyhedral Weak/ massive	Weathered Basalt throughout	5Y6/3 Mottle 5Y7/4 <30%	Dry	Imperfect	1.10 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 27

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 643060mE 7343240mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP upper slope <1.5%	Cropping minor narrow leaf Ironbark	Nil microrelief Cropping disturbance Nil erosion	Self mulching, minor crust, no coarse fragments	0.00-0.17 Ap abrupt	Light medium clay	Polyhedral Moderate soft	Fine roots, few	10YR3/1	Dry	Well	0.05 – pH 7.5	-	-
				0.17-1.00+ B21	Medium clay	Sub- angular firm	Fine roots, few Calcium carbonate <5% at <5mm	10YR3/1	Humid	Well	0.05 – pH 7.5	-	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 28

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 642540mE 7342125mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 02/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP flat plain <0.5%	Cropping minor narrow leaf Ironbark	Nil microrelief Cropping disturbance Nil erosion	Self mulching, minor crust, no coarse fragments	0.00-0.09 Ap abrupt	Light medium clay	Polyhedral Moderate soft	Fine roots, few	10YR3/1	Dry	Well	0.05 – pH 7.5	-	-
				0.09-1.00+ B21	Medium clay	Sub- angular firm	Fine roots, few Calcium carbonate <5% at <5mm	10YR3/1	Humid	Well	0.05 – pH 7.5	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 29

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 639483mE 7349351mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 03/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP, Flat plain <0.5%	Cleared, minor Brigalow vegetation nearby	Nil microrelief Cropping and built up berm/contour disturbance Nil erosion	Crust soft Gravels <5%at <5mm	0.00-0.14 Ap Sharp	Light medium clay	Polyhedral Weak soft	-	10YR3/1	Dry	Well	-	-	-
				0.14-1.00 B22	Medium clay	Angular/ lenticular moderate firm	<5% calcium carbonates nodules	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 30

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 638742mE 7352818mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 03/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Flat plain <1%	Cleared	Nil microrelief Cropping disturbance Nil erosion	Crust, soft <2% coarse fragments <5mm	0.00-0.18 Ap abrupt	Light clay	Polyhedral Weak soft	-	10YR3/1	Dry	Well	-	-	-
				0.18-1.00 B21	Medium clay	Angular/ lenticular moderate firm	<2% calcium carbonates nodules	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 31

GTES Map Unit: Kilmore	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 638695mE 7352857mN	Aust. Soil Class. : Reddish Brown Dermosol	Site Type: Detailed - 50mm soil core	Date: 03/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Upper slope of GUP Flat plain <1%	Cleared	Nil microrelief Cropping disturbance Nil erosion	Firm minor surface flake mixed gravels <5% at <60mm	0.00-0.15 Ap abrupt	Sandy Clay loam	Polynedral Weak soft	-	5YR3/3	Dry	Well	0.10 / 7.0	-	Fine roots common.
				B21 0.15-0.65, clear to;	Light clay	Sub angular Weak soft	Coarse fragments <5% at <5mm	5YR3/4	Dry	Moderate	0.30 / 8.0	-	Fine roots common.
				B22 0.65-1.0+	Light sandy clay	Weak sub angular blocky, firm to hard		Mottle 5YR6/6 <10% below 0.65m <40% below 0.85m	Dry	slow	0.70 / 8.0	-	Few, Very fine roots

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 32

GTES Map Unit: Sullivan Duplex Variant	AMU of Bourne and Tuck (1993): Turkey Creek	Location (GDA94): 636887mE 7350942mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 03/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Midslope 1%	Cleared Brigalow nearby	Nil microrelief Cropping disturbance Nil erosion	Crusting firm dry,	0.00-0.10 Ap abrupt	Sandy clay loam	Polyhedral Massive	-	10YR3/2	Dry	Well	0.05 / 7.5	-	-
				0.10-1.00 B21	Light medium clay	Angular moderate	Large pebble <1% <60mm	10YR2/1	Dry	Well	0.30 / 8.0 0.60 / 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 33

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 643617mE 7347091mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Gup Lower slope 2%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching . weak crust, soft	0.00-0.15 Ap abrupt	Light clay	Polyhedral Soft	Fine roots few	10YR2/1	Dry	Well	0.05 – pH 7.5	0.00-0.10	-
				0.15-0.60 B21 clear	Medium clay	Sub angular moderate	Fine roots few	10YR2/1	Dry	Well	0.40 – pH 7.0	0.30-0.40	-
				0.60-1.00 BC	Clayey sand	Massive loose	Unidentified gravels <5% at <5mm	10YR3/3	Dry	Imperfect	0.85 – pH 8.0	0.60-0.70 0.80-0.90	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 34

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 643676mE 7346946mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP contour bank 2%	-	Nil microrelief Cropping disturbance Active rill / gully erosion	Self mulching, crust soft	0.00-0.10 Ap abrupt	Light clay	Polyhedral Soft	Fine roots few	10YR2/1	Dry	Well	-	0.00- 0.10	-
				0.10-0.60 B21 abrupt	Medium clay	Sub angular moderate	Fine roots few	10YR2/1	Dry	Well	-	0.30- 0.40 0.40- 0.50	-
				0.60-1.00 C	Silty loam	-	Weathered parent material (basalt)	-	-	-	-	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass -based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Passed

SITE 35

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 643603mE 7346687mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Gully wide open depression	Flooded Coolabah Moreton bay ash	Nil microrelief Nil disturbance Gully erosion	Firm crusting / cracking dry	0.00-0.10 A1 clear	Light clay	Polyhedral Weak	-	10YR3/1	Dry	Well	-	0.00-0.10	-
				0.10-1.00+ B21	Medium clay	Angular moderate	-	10YR3/1	Humid	Well	-	0.30-0.40 0.60-0.70 0.90 1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	SCL FAIL

SITE 36

GTES Map Unit: Kammel	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 644276mE 7347252mN	Aust. Soil Class. : Red brown vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Midslope 1.5%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching , soft, mixed gravels <2% at <60mm	0.00-0.10 Ap abrupt	Light clay	Polyhedral Weak	-	5YR3/2	Dry	Well	0.05 – pH 8.0	0.00-0.10	Fine roots few
				0.10-1.00 B21	Medium clay	Angular moderate firm	-	5YR3/3	Dry	Well	0.35 – pH 8.0 0.65 – pH 8.0 0.95 – pH 8.0	0.30-0.40 0.60-0.70 0.90-1.00	Fine roots few

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 37

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 646073mE 7347672mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Pasture GUP Upper slope 2% wide ridge	Grass species	Nil microrelief Nil disturbance however cleared Nil erosion	Firm dry no coarse fragments	0.00-0.10 A1 abrupt	Sandy Loam	Single grain firm	-	5YR3/4	Dry	Moderate	0.05 – pH 8.0	0.00- 0.10	-
				0.10-0.88 A12 abrupt	Sandy Loam	Massive Firm	-	5YR3/4	Dry	Moderate	0.30 – pH 8.0 0.60 – pH 8.0	0.30- 0.40 0.60- 0.70	-
				0.88-1.00 D1	Clayey sand	Massive Firm	Very thin gravel pan at 0.80m	5YR4/4	Dry	Moderate	0.90 – pH 8.0	0.90- 1.00	-

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 38

GTES Map Unit: Kammel	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 644881mE 7346213mN	Aust. Soil Class. : Red brown vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Upper slope <1.5%	-	Nil microrelief Cropping disturbance Nil erosion	weak crust, soft mixed gravels <5% at <5mm	0.00-0.07 Ap abrupt	Light clay	Polyhedral Massive	-	5YR3/2	Dry	Well	0.05 – pH 7.5	0.00-0.10	-
				0.07-1.00 B21	Medium clay	Sub angular moderate firm	Manganese nodules <2%	5YR3/3	Humid	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	0.30-0.40 0.60-0.70 0.90-1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 39

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 644788mE 7345494mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 04/05/2013
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Landscape



Surface



Soil Profile



Landuse Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Upper slope 2%	-	Nil microrelief Cropping disturbance Nil erosion	Weak crust, soft no coarse fragments	0.00-0.08 Ap abrupt	Silty clay loam	Polyhedral Massive	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.08-1.00 B21	Medium Clay	Angular firm moderate	Occasional carbonate and manganese nodules.	10YR3/1	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 40

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 646237mE 7346680mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP mid slope	-	Nil microrelief Cropping disturbance Nil erosion	Weak crust. Soft	0.00-0.10 Ap abrupt	Light clay	Polyhedral Massive	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.10-1.00 B21	Medium Clay	Angular firm moderate	-	10YR3/1	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 41

GTES Map Unit: Sullivan Duplex Variant	AMU of Bourne and Tuck (1993): Turkey Creek	Location (GDA94): 646453mE 7345909mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Wide gully	Remnant vegetation Brigalow, Silver leaf ironbark	Nil microrelief Nil disturbance Nil erosion	Dry firm no coarse fragments minor crusting	0.00-0.28 A1 abrupt	Sandy clay loam	Polyhedral Weak	-	7.5YR3/2	Dry	Well	0.05 – pH 8.5	0.00-0.10	-
				0.28-0.63 B21 sharp	Light medium clay	Polyhedral Weak very strong	-	7.5YR3/2	Dry	Well	0.30 – pH 7.5	0.30-0.40	-
				0.63-0.80 B21 sharp	Charcoal	Weak	80% charcoal	-	Dry	-	0.70 – pH 8.0	0.70-0.80	-
				0.80-1.00 B21 sharp	Light medium clay	Sub angular moderate	-	10YR3/1	Dry	Well	0.90 – pH 8.0	0.90-1.00	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	SCL FAIL

SITE 42

GTES Map Unit: Sullivan Duplex Variant	AMU of Bourne and Tuck (1993): Turkey Creek	Location (GDA94): 646453mE 7345905mN	Aust. Soil Class. : Black Vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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Landscape



Surface



Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Wide gully <1.0%	Remnant vegetation Brigalow, Silver leaf ironbark	Nil microrelief Nil disturbance Nil erosion	Dry firm no coarse fragments minor crusting	0.00-0.23 A1 abrupt	Sandy clay loam	Polyhedral Weak	-	7.5YR3/2	Dry	Well	0.05 – pH 8.5	0.00-0.10	-
				0.23-1.00+ B21	Light medium clay	Polyhedral Weak very strong	-	7.5YR3/2	Dry	Well	0.30 – pH 7.5 0.60 – pH 8.0 0.90 – pH 8.0	0.30-0.40	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 43

GTES Map Unit: Sullivan Duplex Variant	AMU of Bourne and Tuck (1993): Turkey Creek	Location (GDA94): 7344328mE 7344328mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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Landscape



Surface



Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
GUP lower slope 1%	Remnant vegetation Brigalow, Silver leaf ironbark	Nil microrelief Nil disturbance Nil erosion	Dry no coarse fragments self mulching	0.00-0.25 A1 abrupt	Sandy clay loam	Polyhedral Weak	-	7.5YR3/2	Dry	Well	0.05 – pH 8.5	0.00-0.10	-
				0.25-1.00 B21	Light medium clay	Polyhedral Weak very strong	-	7.5YR3/2	Dry	Well	0.30 – pH 7.5 0.60 – pH 8.0 0.90 – pH 8.0	0.30-0.40	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	SCL FAIL

SITE 44

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 646256mE 7345408mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP lower slope 2.5% Wash out	-	Nil microrelief Cropping disturbance Nil erosion	Soft crusting weak cracking.	0.00-0.10	Light clay	Polyhedral	-	10YR3/2	Dry	Well	-	-	-
				Ap abrupt		Massive							
				0.10-0.60	Medium clay	Polyhedral	-	10YR3/2	Dry	Well	-	-	-
				B21		Moderate							

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 45

GTES Map Unit: Kammel	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 645161mE 7343937mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Midslope <1%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching, with weak crusting. dry	0.00-0.15 Ap abrupt	Light Clay	Polyhedral Massive	-	7.5YR3/3	Dry	Well	0.05 – pH 9.0	-	-
				0.15-1.00+ B21	Medium clay	Polyhedral Moderate	-	7.5YR3/3	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Passed

SITE 46

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 645849mE 7347437mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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Landscape



Surface



Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Midslope 1.5%	-	Nil microrelief Cropping disturbance Nil erosion	Granular, soft mixed gravels <2% at <60mm	0.00-0.08 Ap abrupt	Sandy Loam	Massive Firm	-	5YR3/2	Dry	Well	0.05 – pH 8.0	-	-
				0.08-1.00 B21	Clayey sand	Weak Firm	Mixed gravels <40% at <5mm	5YR3/3	Dry	Well	0.35 – pH 8.0 0.65 – pH 8.0 0.95 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 47

GTES Map Unit: Kammel	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 643964mE 7344557mN	Aust. Soil Class. : Brown vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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Landscape



Surface



Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Upper slope 2%	-	Nil microrelief Cropping disturbance Nil erosion	Weak crust, soft no coarse fragments	0.00-0.08 Ap abrupt	Silty clay loam	Polyhedral Massive	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.08-1.00 B21	Medium Clay	Angular firm moderate	-	10YR3/1	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 48

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 645112mE 7342720mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 05/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Pasture near cropping GUP lower slope 1.5%	Grass species	Nil microrelief Cleared/ Cropping disturbance nearby Nil erosion	Self mulching soft dry coarse fragments <2% at 10- 20mm	0.00-0.24 B2 abrupt	Light clay	Polyhedral Weak	-	10YR3/1	Dry	Well	-	-	Area has being blade ploughed, refusal and no recovery encountered
				0.24-1.00 B21	Medium clay	Polyhedral Moderate	-	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 49

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 646983mE 7342212mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Upper slope <2%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching mixed gravels <2% <60mm	0.00-0.10 Ap Abrupt	Light clay	Polyhedral Massive/ Weak	mixed gravels <2% <60mm	10YR3/2	Dry	Well	0.05 – pH 7.0	0.00-0.10	-
				0.10-0.35 B21 Abrupt	Medium clay	Polyhedral Weak	-	10YR3/1	Humid	Well	0.30 – pH 8.0	0.25-0.35	-
				0.35-1.00 B22	Medium clay	Sub angular moderate	-	10YR3/1	Humid	Well	0.60 – pH 8.0 0.90 – pH 8.0	0.60-0.70 0.90-1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 50

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 646787mE 7343339mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Flat plain	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching minor crusting no coarse fragments	0.00-0.10 Ap abrupt	Light clay	Polyhedral Massive/ single gain	-	10YR3/1	Dry	Well	0.05 – pH 7.5	-	-
				0.10-0.60 B21 abrupt	Medium clay	Sub angular moderate	-	10YR3/1	Humid	Well	0.30 – pH 8.0	-	-
				0.60-1.00 BC	Clayey sand	Sub angular weak	Parent material <20% at 2-6mm	7.5YR3/2	Dry	Imperfect	0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Pass

SITE 51

GTES Map Unit: Kammel	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 647547mE 7345379mN	Aust. Soil Class. : Reddish brown vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Upper slope <1%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching soft mixed gravels <2% at <60mm	0.00-0.10 Ap abrupt	Light clay	Polhedral Weak	-	5YR3/2	Dry	Well	0.05 – pH 8.0	0.00-0.10	-
				0.10-1.00 B21	Medium clay	Angular moderate firm	-	5YR3/3	Dry	Well	0.35 – pH 8.0 0.65 – pH 8.0 0.95 – pH 8.0	0.30-0.40 0.60-0.70 0.90-1.00	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 52

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 648523mE 7345268mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Wide ridge Upper slope <1%	Bottle Tree, Poplar box	Nil microrelief Nil disturbance Nil erosion	Firm dry no coarse fragments	0.00-0.27 A1 abrupt	Clayey sand	Single grain/ massive granular	-	5YR3/3	Dry	Well	0.05 – pH 8.0	-	
				0.27-0.70 A12	Clayey sand	Polyhedral Massive	-	5YR3/3	Dry	Well	0.35 – pH 8.0 0.70 – pH 8.0	-	-
				0.70+ R	-	-	Hard or rocky layer	-	-	-	-	-	Refusal at 0.70m

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL FAIL

SITE 53

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 648175mE 7344550mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Simple slope 1%	-	Nil microrelief Cropping disturbance Nil erosion	Self mulching crusting Coarse fragments <2% at <60mm	0.00-0.12 Ap Abrupt	Light clay	Polyhedral Weak	-	10YR3/2	Dry	Well	0.10 8.0	-	-
				0.12-1.00+ B21	Medium clay	Sub angular moderate	-	10YR3/1	Humid	Well	0.30 8.0 0.80 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 54

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 648776mE 7343353mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP Flat plain <0.5%	Nil	Nil microrelief Cleared disturbance Nil erosion	Self mulching, cracking soft minor crusting Coarse fragments <2% at 5- 20mm	0.00-0.12 A1 abrupt	Light clay	Polyhedral Weak	-	10YR3/2	Dry	Well	0.10 8.0	-	-
				0.12-1.00+ B21	Medium clay	Sub angular moderate	-	10YR3/1	Humid	Well	0.30 8.0 0.80 8.0	-	-

SCL Criteria	1- Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 55

GTES Map Unit: Sullivan Duplex Variant	AMU of Bourne and Tuck (1993): Turkey Creek	Location (GDA94): 648340mE 7343402mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH	Sample	Observations
Creek	Moreton bay ash	Nil microrelief Nil disturbance Gully erosion	Granular. no coarse fragments	0.00-0.15 A1 abrupt	Sandy Clay loam	Polyhedral Weak	-	10YR3/1	Dry	Well	-	-	-
				0.15-0.90 B21	Light medium clay	Polyhedral Angular Weak	-	10YR3/1	Dry	Well	-	-	-
				0.90-1.00 BC	Clayey sand	Polyhedral Weak	fine gravel and sand.	10YR3/1	Dry	Imperfect	-	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 56

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 647466mE 7342469mN	Aust. Soil Class. : Black Vertosol	Site Type: Detailed - 50mm soil core	Date: 06/05/2013
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Landscape



Surface



Soil Profile



Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Flat plain <0.5%	-	Nil microrelief Cropping disturbance Nil erosion	Soft dry coarse fragments <2% 10-40mm	0.00-0.10 Ap abrupt	Light clay	Polyhedral Massive	-	10YR3/1	Dry	Well	0.05 – pH 8.0	-	-
				0.10-1.00+ B21	Medium Clay	Angular firm moderate	Trace soft carbonate and Mn nodules	10YR3/1	Dry	Well	0.30 – pH 8.0 0.60 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 57

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 637689mE 7345087mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Lower slope gully	Ironbark, Coolibah	Nil microrelief Nil disturbance Gully erosion	Self mulching, cracking, moist	0.00-0.15 A1 abrupt	Light medium clay	Polyhedral Weak	<10% light brown sands	10YR3/1	Moist	Well	0.10 pH 7.5	-	Fine roots common
				0.15-0.80+ B21	Medium clay	Polyhedral Firm angular blocky	-	10YR3/1	Dry	Well	0.40 pH 8.0 0.80 pH 8.0	-	Very fine roots common

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 58

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 637772mE 7345144mN	Aust. Soil Class. : Black Vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Lower slope gully <2%	Flooded coolabah, Ironbark	Nil microrelief Nil disturbance Gully erosion	Coarse granular / self mulching, cracking moist	0.00-0.20 A1 abrupt	Medium clay	Polyhedral Weak slicken sides	-	10YR3/2	Humid	Well	0.05 – pH 7.5	-	Fine roots common
				0.20-1.00+ B21	Medium clay	Firm sub angular blocky	-	10YR3/1	Dry	Well	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 8.0	-	Very fine roots common

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL FAIL

SITE 59

GTES Map Unit: Ronnoc	AMU of Bourne and Tuck (1993): Jimbaroo	Location (GDA94): 638161mE 7344764mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP mid slope 1.5%	Cleared	Nil microrelief Cropping disturbance Nil erosion	Self mulching dry	0.00-0.11 Ap Sharp	Light medium clay	Polyhedral Weak	-	10YR3/1	Dry	Well	0.10 – pH 6.5	0.00- 0.10	Fine roots common
				0.11-0.45 B21 abrupt	Medium clay	Angular blocky Moderate	-	10YR3/1	Dry	Well	0.30 – pH 7.0	0.30- 0.40	Very fine roots common
				0.45-0.60 C	Clayey sand	Polyhedral Weak	Basalt gravels 10% at 5- 400mm	10YR4/2	Dry	Imperfect	0.50 – pH 7.0	0.50- 0.60	Refusal at 0.60m

SCL Criteria	1 - Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass –based upon the 70/30 Purity Rule for the SMU +0.80m	SCL Pass

SITE 60

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 639383mE 7348157mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain Gully	Moreton bay ash, Flooded coolibah	Nil microrelief Minor clearing disturbance Nil erosion	Cracking, no coarse fragments	0.00-0.14 B21 abrupt	Light medium clay	Polyhedral Weak soft	-	10YR3/1	Dry	Well	0.05 – pH 7.5	-	-
				0.14-1.00 B22	Medium clay	Sub angular moderate firm	Occasional carbonate nodule	10YR3/1	Dry	Well	0.35 – pH 8.0 0.65 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL FAIL

SITE 61

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 640306mE 7348931mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain <0.5%	Moreton bay ash, Flooded coolibah	Nil microrelief Minor clearing disturbance Nil erosion	Cracking, granular. no coarse fragments	0.00-0.22 A1 abrupt	Light medium clay	Polyhedral Weak soft	nil	10YR2/1	Humid	Well drained. Moderate permeability	0.05 – pH 7.5	0.00-0.10	No surface rock No segregations. Roots common
				0.22-1.00 B21	Medium clay (silty)	Polyhedral moderate	nil	10YR3/1	Dry	Well drained.	0.35 – pH 7.5 0.65 – pH 7.0 0.90 – pH 8.0	0.30-0.40 0.60-0.70 0.90-1.00	No segregations. Roots common to 1.0m.

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL FAIL

SITE 62

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993): Orion	Location (GDA94): 640765mE 7347930mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing / cleared Upper slope <2%	Bottle tree, grass species	Nil microrelief Clearing disturbance Nil erosion	Self mulching, cracking. minor crust large pebbles <5% at <20mm	0.00-0.15 A1 Sharp	Silty clay loam	Sub angular moderate	-	10YR3/1	Dry	Well	0.10 – pH 7.0	0.00- 0.10	-
				0.15-0.45 B2 abrupt	Light clay	Sub angular weak	-	10YR3/1	Dry	Well	0.30 – pH 7.5	0.30- 0.40	-
				0.45 C	Basalt	-	-	-	-	-	-	-	Refusal at 0.45m

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Fail	Fail	SCL FAIL

SITE 63

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 640899mE 7346036mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain Gully	Flooded coolabah, Moreton bay ash	Nil microrelief Minor clearing disturbance Nil erosion	Cracking, granular , no coarse fragments	0.00-0.13 A1 abrupt	Light medium clay	Polyhedral Weak soft	-	10YR3/1	Dry	Well	0.05 – pH 7.5	-	-
				0.13-1.00 B21	Medium clay	Sub angular moderate firm	-	10YR3/1	Dry	Well	0.35 – pH 8.0 0.65 – pH 8.0 0.90 – pH 8.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 64

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 640212mE 7345491mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping GUP Flat Plain <1.0%	-	Nil microrelief Clearing disturbance Nil erosion	Self mulching cry, no coarse fragments	0.00-0.12 A1	Light medium clay	Polyhedral Moderate	-	10YR3/1	Humid	Well	0.05 – pH 8.0	-	-
				0.12-1.00+ B21	Medium clay	Angular blocky moderate	-	10YR3/1	Dry	Well	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 7.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 65

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 638236mE 7346705mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 30/05/2013
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Landscape



Surface



Soil Profile

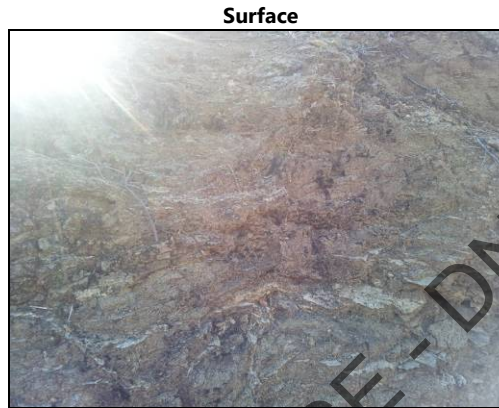


Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain <1%	N/A	Nil microrelief Minor clearing disturbance Nil erosion	Self mulching, dry	0.00-0.16 A1 abrupt	Light medium clay	Polyhedral Moderate	-	10YR3/1	Humid	Well	0.05 – pH 8.0	-	-
				0.16-0.90+ B21	Medium clay	Angular blocky moderate	-	10YR3/1	Dry	Well	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 7.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 66

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 640603mE 7350686mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief, Disturbance, Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing creek cutting	Moreton bay ash	Nil microrelief Minor clearing disturbance Gully erosion	Self mulching firm gravels <5% at <5mm	0.00-0.30 A1 diffuse	Light medium clay	Polyhedral Moderate	-	10YR3/1	Humid	Well	-	-	Profile cutting Fine roots few
				0.10-0.80 C	Loamy sand / weathere d parent material	Granular firm	-	7.5YR7/1	Dry	Poorly drained	-	-	-
				0.10-0.80 C	Loamy sand / weathere d parent material	Very stong	-	7.5YR7/1	Dry	None	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Fail	SCL FAIL

SITE 67

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993):	Location (GDA94): 640655mE 7350737mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain <0.5%	Moreton bay ash	Nil microrelief Minor clearing disturbance Nil erosion	Self mulching firm gravels <5% at <5mm	0.00-0.30 B2 diffuse	Light medium clay	Polyhedral Moderate	-	10YR3/1	Humid	Well	-	0.00- 0.10	Profile cutting Fine roots few
				0.30-0.60 C	Sandy Loam / weathere d parent material	Granular	-	7.5YR7/1	Dry	Poorly drained	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 7.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Fail	SCL FAIL

SITE 68

GTES Map Unit: Boundary Lexington/Minerva	AMU of Bourne and Tuck (1993):	Location (GDA94): 640811mE 7348799mN	Aust. Soil Class. : n/a	Site Type: Exposed soil profile	Date: 31/05/2013
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Landscape
N/A

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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing	Ironbark	Nil microrelief Minor clearing disturbance Nil erosion	Self mulching firm gravels <5% at <60mm	0.00-0.30	Silty clay loam	Polynhedral Massive firm	<5% at <60mm	-	Dry	Imperfect	-	-	Exposed tree root may not have being representative of the area it was found.

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	-	-	-	-	-	-	-	-	-

SITE 69

GTES Map Unit: Lexington	AMU of Bourne and Tuck (1993): Jimbaroo	Location (GDA94): 641285mE 7348437mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Upper slope 1%	Sparse Bloodwood	Nil microrelief Clearing disturbance Nil erosion	Self mulching, cracking, trampled dry	0.00-0.45 B21 abrupt	Light medium clay	Polyhedral Moderate	-	10YR3/1	Humid	Well	0.10 – pH 7.0 0.30 – pH 7.5	-	Cropping 100m nearby. No recovery after 0.45m
				0.45 C	Weathered basalt	-	-	-	-	-	-	-	Refusal at 0.45m

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Fail	SCL FAIL

SITE 70

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 641489mE 7350423mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain <0.5%	Silver leaf Ironbark, brigalow	Nil microrelief Clearing disturbance Nil erosion	Self mulching soft	0.00-0.30 A1 abrupt	Medium clay	Sub angular firm	-	10YR3/1	Humid	Well	-	-	Voids encountered during hand augering, area suspected of being blade ploughed
				0.30-0.50+ B21	Medium clay	Sub angular firm	-	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 71

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 642340mE 7352079mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Flat plain <0.5%	Moreton bay ash, flooded coolabah. Occasional black tea tree.	Nil microrelief Nil disturbance Nil erosion	Self mulching, thin cracking, granular, soft	0.00-0.10 A1 abrupt	Light medium clay	Polyhedral Weak	nil	10YR3/1	Humid	Well	0.05 – pH 8.0	-	Roots common
				0.10-1.00+ B21	Medium clay	Polyhedral Moderate, firm.	nil	10YR3/1	Dry	Well	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 7.0	-	Roots to 1.0m

SCL Criteria	1 - Slope	2 - Rockiness	3 - Gilgai Microrelief	4 - Soil Depth	5 - Soil wetness	6 - Soil pH	7 - Salinity	8 - Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 72

GTES Map Unit: Sullivan	AMU of Bourne and Tuck (1993): Picardy	Location (GDA94): 636889mE 7346986mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing GUP upper slope <1%	-	Nil microrelief Nil disturbance however historical clearing Nil erosion	Self mulching, cracking, firm	0.00-0.10 A1 abrupt	Medium clay	Sub angular Weak	nil	10YR3/1	Dry	Well	-	-	-
				0.10-1.00+ B21	Medium clay	Sub angular Weak	nil	10YR3/1	Dry	Well	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	SCL Pass

SITE 73

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 637108mE 7346655mN	Aust. Soil Class. : Black vertosol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Creek		Nil microrelief Nil disturbance Gully erosion	Self mulching, granular.	0.0 – 0.05 A1 abrupt	Light sandy clay	Weak granular	nil	10YR3/2	Dry	Well	0.02 pH 7.5	-	-
				0.05-1.00+ B21	Light Medium clay	Sub angular Weak	nil	10YR3/1	Dry	Well	0.07 pH 8.0	-	-Exposed gully cutting

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 74

GTES Map Unit: Minerva	AMU of Bourne and Tuck (1993): Adelong	Location (GDA94): 637143mE 7346609mN	Aust. Soil Class. : Black vertisol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Grazing Flat plain, shallow creek nearby	Odd ironbark	Nil microrelief Nil disturbance however historical minor clearing Nil erosion	Fine, self mulching, cracking	0.00-0.22 A1 abrupt	Light medium clay	Polyhedral Weak	nil	10YR3/1	Humid	Well	0.05 – pH 8.0	-	-
				0.22-1.00+ B21	Medium clay	Polyhedral Weak	nil	10YR3/1	Dry	Well	0.35 – pH 7.5 0.65 – pH 7.5 0.90 – pH 7.0	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Fail	Pass	Fail	Pass	SCL Fail

SITE 75

GTES Map Unit: Talafa	AMU of Bourne and Tuck (1993): Glen Idol	Location (GDA94): 636377mE 7353756mN	Aust. Soil Class. : Kandosol	Site Type: Detailed - 50mm soil core	Date: 31/05/2013
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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	Inclusions / Segregations	Colour / Mottle	Moisture	Drainage	Depth (m) / Field pH / Field EC (dS/m)	Sample	Observations
Cropping Flat plain <0.5%	-	Nil microrelief Cropping disturbance Nil erosion	Soft granular. gravels <5% at <20mm	Ap 0.00-0.20	Silty loam	Polyhedral Massive	-	2.5YR3/3	Dry	Well	-	-	-
				A12 0.20-0.70	Clayey Sand	Angular weak	<5% coarse fragments	2.5YR3/3	Dry	Well	-	-	-
				A13 0.70-1.00	Clayey Sand	Angular weak	<5% coarse fragments	2.5YR3/4	Dry	Imperfect	-	-	-

SCL Criteria	1- Slope	2 – Rockiness	3 – Gilgai Microrelief	4 – Soil Depth	5 – Soil wetness	6 – Soil pH	7 – Salinity	8 – Soil water storage	SCL ?
Pass or Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	SCL Fail

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob1	639403mE 7356066mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <2.5%	Nil Microrelief	Brigalow Nearby
Ob2	639531mE 7356092mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <2.5%	Nil Microrelief	-
Ob3	639805mE 7355979mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob4	639974mE 7355765mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob5	640148mE 7355427mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob6	64020 mE 7355100mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob7	640282mE 7354727mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob8	640302mE 7354453mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob9	640223mE 7353609mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob10	640000mE 7353369mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob11	639186mE 735283 mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob12	639598mE 7353535mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob13	639770mE 7354184mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob14	641278mE 735423mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob15	641274mE 7354506mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob16	638372mE 7353033mN	Kilmore	Firm minor surface flake mixed gravels <5% at <60mm	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob17	638063mE 7353219mN	Boundary Sullivan / Kilmore	Firm, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	Boundary
Ob18	637921mE 7353456mN	Kilmore	Firm minor surface flake mixed gravels <5% at <60mm	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob19	637926mE 7353615mN	Kilmore	Firm minor surface flake mixed gravels <5% at <60mm	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob20	636333mE 7353771mN	Talafa	Crusting, soft, cropping	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob21	636408mE 7353301mN	Boundary Talafa / Sullivan	Crusting, soft, cropping	Cropping, gently undulating plain, <2%	Nil Microrelief	Boundary
Ob22	636490mE 7353886mN	Talafa	Crusting, soft, cropping	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob23	636639mE 7353990mN	Talafa	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob24	636774mE 7354098mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob25	637175mE 7354407mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	100m from tree line / creek

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob26	637392mE 7354566mN	Sullivan Gilgai Phase	Self mulching, weak cracking, minor crust, no coarse fragments	Nil disturbance Minor overland flow	Normal gilgai 0.15- 0.20m deep.	Wooded regrowth with mixed Acacia and Bauhinia
Ob27	637424mE 7354530mN	Sullivan Gilgai Phase	Self mulching, weak cracking, minor crust, no coarse fragments	Nil disturbance Minor overland flow	Normal gilgai 0.15- 0.20m deep.	Wooded regrowth with mixed Acacia and Bauhinia
Ob28	637436mE 7354582mN	Sullivan Gilgai Phase	Self mulching, weak cracking, minor crust, no coarse fragments	Nil disturbance Minor overland flow	Normal gilgai 0.15- 0.20m deep.	Wooded regrowth with mixed Acacia and Bauhinia
Ob29	638130mE 7353103mN	Kilmore	Eroded, very firm with sandy crust, mixed gravels <15% at <20mm	Cropping Gully 1.5%	Nil Microrelief	Nil disturbance, Gully erosion
Ob30	638158mE 7353062mN	Kilmore	Eroded, very firm with sandy crust, mixed gravels <15% at <20mm	Cropping Gully 1.5%	Nil Microrelief	Nil disturbance, Gully erosion
Ob31	638199mE 7353013mN	Kilmore	Eroded, very firm with sandy crust, mixed gravels <15% at <20mm	Cropping Gully 1.5%	Nil Microrelief	Nil disturbance, Gully erosion
Ob32	638228mE 7352981mN	Kilmore	Eroded, very firm with sandy crust, mixed gravels <15% at <20mm	Cropping Gully 1.5%	Nil Microrelief	Nil disturbance, Gully erosion
Ob33	638683mE 7351837mN	Sullivan	-	-	Nil Microrelief	Dam to the west and cropping to the east
Ob34	639425mE 7350736mN	Sullivan	-	-	Nil Microrelief	Dam to the south
Ob35	638524mE 7349894mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0.5% slope	Nil Microrelief	-
Ob36	637807mE 7348429mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0.5% slope	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob37	637532mE 7347865mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-
Ob38	637692mE 7347981mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-
Ob39	637838mE 7348091mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-
Ob40	637068mE 7350116mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 1.5% slope	Nil Microrelief	-
Ob41	637619mE 7349853mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-
Ob42	637142mE 7351982mN	Kilmore	Firm, no coarse fragments	Recent cropping, 1% slope	Nil Microrelief	-
Ob43	642117mE 7353736mN	Sullivan	Self mulching, crust, soft, no coarse fragments	Flat Plain <1% 	Nil microrelief	Nil disturbance with exception of surrounding cropping No erosion, Cropping, Brigalow Narrow Leaf ironbark
Ob44	641160mE 7352938mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-
Ob45	640976mE 7352655mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0.5% slope	Nil Microrelief	-
Ob46	640663mE 7352638mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0.5% slope	Nil Microrelief	-
Ob47	640268mE 7352603mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, 0% slope	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob48	643401mE 7350358mN	Minerva	Moist, firm, no coarse fragments	No cropping	Nil Microrelief	-
Ob49	643068mE 7350160mN	Minerva	Moist, firm, no coarse fragments	No cropping	Nil Microrelief	-
Ob50	642864mE 7349822mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob51	644605mE 7348988mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	--
Ob52	644945mE 7348693mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob53	643598mE 7349332mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1.5%	Nil Microrelief	-
Ob54	642398mE 7349160mN	Talafa	-	Ridge 2%	Nil Microrelief	Boundary nearby, redder surface
Ob55	642432mE 7349103mN	Talafa	-	Ridge 2%	Nil Microrelief	-
Ob56	642357mE 7348938mN	Talafa	-	-	Nil Microrelief	-
Ob57	642466mE 7348757mN	Boundary Talafa / Sullivan	Crust soft, no coarse fragments	GUP	Nil microrelief	Cropping/grazing grasses species Cleared land, tracks
Ob58	642713mE 7349152mN	Boundary Talafa / Sullivan	-	-	Nil Microrelief	Boundary
Ob59	641574mE 7348544mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob60	641172mE 7348084mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1.5%	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob61	641123mE 7346548mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob62	641806mE 7346229mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob63	642311mE 7346256mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	-
Ob64	640182mE 7342406mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob65	640185mE 7343012mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil microrelief	-
Ob66	642165mE 7345242mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	-
Ob67	642473mE 7344201mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	-
Ob68	642427mE 7343880mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	-
Ob69	641788mE 7344014mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob70	641096mE 7343678mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob71	641399mE 7343438mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob72	643012mE 7343877mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob73	642917mE 7342438mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil microrelief	
Ob74	642653mE 7342080mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob75	642467mE 7341845mN	Ronnoc	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob76	639068mE 7350097mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob77	639399mE 7349490mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1.5%	Nil Microrelief	-
Ob78	638727mE 7352842mN	Boundary Sullivan / Kilmore	No coarse fragments	-	Nil Microrelief	Boundary
Ob79	638873mE 7352973mN	Boundary Sullivan / Kilmore	No coarse fragments	-	Nil Microrelief	Boundary
Ob80	639059mE 7353113mN	Boundary Sullivan / Kilmore	No coarse fragments	-	Nil Microrelief	Boundary
Ob81	639097mE 7353428mN	Kilmore	Minor surface flake, dry, firm	-	Nil microrelief	-
Ob82	638312mE 7353471mN	Boundary Sullivan / Kilmore	-	-	Nil Microrelief	Boundary
Ob83	638472mE 7353675mN	Kilmore	Minor surface flake, dry, firm	-	Nil Microrelief	-
Ob84	639005mE 7354330mN	Kilmore	Minor surface flake, dry, firm	-	Nil Microrelief	-
Ob85	637809mE 7354394mN	Kilmore	Minor surface flake, dry, firm	-	Nil Microrelief	-
Ob86	636853mE 7351107mN	Boundary Sullivan / Kilmore	No coarse fragments	-	Nil Microrelief	Boundary

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob87	638178mE 7354574mN	Kilmore	Minor surface flake, dry, firm	-	Nil Microrelief	-
Ob88	638578mE 7354908mN	Kilmore	Minor surface flake, dry, firm	-	Nil Microrelief	-
Ob89	636472mE 7352977mN	Sullivan Gilgai Phase	Moist, firm, no coarse fragments	No cropping, 0% slope	Nil microrelief	-
Ob90	636691mE 7352992mN	Sullivan Gilgai Phase	Moist, firm, no coarse fragments	No cropping, 0% slope	Nil Microrelief	-
Ob91	638009mE 7356066 mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob92	638700mE 7355553mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1.5%	Nil Microrelief	-
Ob93	639754mE 7356383mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1.5%	Nil Microrelief	-
Ob94	640234mE 7356552mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <2%	Nil Microrelief	-
Ob95	640577mE 7356774mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob96	640912mE 7357247mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob97	643590mE 7346976mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil microrelief	-
Ob98	643507mE 7346775mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob99	643593mE 7346656mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob100	643495mE 7347047mN	Boundary Minerva / Ronnoc	No coarse fragments	-	Nil Microrelief	-
Ob101	643651mE 7347288mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob102	643817mE 7347359mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob103	644302mE 7347423mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob104	644430mE 7347285mN	Kammel	Self mulching , soft, mixed gravels <2% at <60mm	-	Nil Microrelief	-
Ob105	644370mE 7347139mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil microrelief	Boundary
Ob106	645472mE 7347083mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob107	645712mE 7347044mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob108	645667mE 7347280mN	Boundary Ronnoc / Talafa	No coarse fragments	-	Nil Microrelief	Boundary
Ob109	645997mE 7347485mN	Boundary Ronnoc / Talafa	No coarse fragments	-	Nil Microrelief	Boundary
Ob110	646247mE 7347858mN	Talafa	Firm, no coarse fragments	-	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob111	646292mE 7347731mN	Boundary Ronnoc / Talafa	No coarse fragments		Nil Microrelief	Boundary
Ob112	645402mE 7346904mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob113	644955mE 7346393mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil microrelief	Boundary
Ob114	644754mE 7346141mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob115	644961mE 7345480mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob116	644682mE 7345192mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob117	645870mE 7346865mN	Kammel	Self mulching , soft		Nil Microrelief	-
Ob118	646630mE 7346478mN	Boundary Ronnoc / Minerva	No coarse fragments	-	Nil Microrelief	Boundary
Ob119	646343mE 7345400mN	Boundary Ronnoc / Minerva	No coarse fragments	-	Nil Microrelief	Boundary
Ob120	646146mE 7345407mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob121	646223mE 7344947mN	Ronnoc	No coarse fragments	-	Nil microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob122	646332mE 7344782mN	Minerva	Moist, firm, no coarse fragments	Near to creek	Nil Microrelief	-
Ob123	646194mE 7344291mN	Minerva	Moist, firm, no coarse fragments	Near to creek	Nil Microrelief	-
Ob124	645923mE 7344096mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob125	645813mE 7343765mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob126	645492mE 7343809mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob127	645217mE 7343906mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob128	645251mE 7343815mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	-
Ob129	645015mE 7343963mN	Kammel	Self mulching , soft	-	Nil microrelief	-
Ob130	644881mE 7344004mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob131	644519mE 7344088mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob132	643581mE 7344169mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob133	644908mE 7342563mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob134	645162mE 7342424mN	Minerva	Moist, firm, no coarse fragments	Near to creek	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob135	647002mE 7342117mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob136	646945mE 7342376mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob137	646580mE 7343124mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil microrelief	Boundary
Ob138	646736mE 7343444mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob139	646891mE 7343593mN	Boundary Ronnoc / Kammel	No coarse fragments	-	Nil Microrelief	Boundary
Ob140	647363mE 7344869mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob141	649259mE 7345242mN	Minerva	Moist, firm, no coarse fragments	-	Nil Microrelief	Mixed veg (no Poplar Box)
Ob142	648885mE 7345494mN	Talafa	Firm, no coarse fragments	-	Nil Microrelief	-
Ob143	648415mE 7345131mN	Talafa	Firm, no coarse fragments	-	Nil Microrelief	-
Ob144	648264mE 7344712mN	Boundary Ronnoc / Talafa	No coarse fragments	-	Nil Microrelief	Boundary
Ob145	648500mE 7343420mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil microrelief	-
Ob146	648332mE 7343385mN	Talafa	Moist, firm, no coarse fragments	Near to creek	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob147	646196mE 7341896mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob148	637994mE 7345301mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob149	637816mE 7345086mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob150	638096mE 7344791mN	Ronnoc	Self mulching, cracking, no coarse fragments	-	Nil Microrelief	-
Ob151	639527mE 7348071mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob152	640167mE 7349121mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob153	640408mE 7348825mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil microrelief	-
Ob154	640619mE 7348305mN	Boundary Minerva / Lexington	No coarse fragments	-	Nil Microrelief	Boundary
Ob155	640745mE 7347814mN	Lexington	Self mulching, cracking, no coarse fragments	Mid slope 2%	Nil Microrelief	-
Ob156	640921mE 7345919mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob157	640349mE 7345838mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob158	640311mE 7345396mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob159	639672mE 7346487mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob160	638951mE 7346280mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob161	638224mE 7346835mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil microrelief	-
Ob162	638089mE 7347143mN	Boundary Minerva / Sullivan	No coarse fragments	-	Nil Microrelief	Boundary
Ob163	640632mE 7350609mN	Lexington	Firm, dry, no coarse fragments	Crest	Nil Microrelief	--
Ob164	640573mE 7349969mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob165	640908mE 7349476mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob166	640810mE 7348533mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob167	641128mE 7348301mN	Lexington	Firm, dry, no coarse fragments	-	Nil Microrelief	-
Ob168	641677mE 7350366mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob169	642120mE 7350837mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob170	641375mE 7351596mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob171	642431mE 7351961mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob172	642270mE 7352076mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-

Site No.	Location (GDA94)	Soil Type	Surface	Landform / Land use	Microrelief	Comments
Ob173	637144mE 7347484mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob174	636376mE 7346887mN	Sullivan	Self mulching, cracking, no coarse fragments	Cropping, gently undulating plain, <1%	Nil Microrelief	-
Ob175	637204mE 7346672mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-
Ob176	637394mE 7346735mN	Minerva	Moist, firm, no coarse fragments	Creek line nearby	Nil Microrelief	-

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Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : EB1311611 Client : GT ENVIRONMENTAL Contact : MR REECE MCCANN Address : 10 CRESSBROOK STREET EIGHT MILE PLAINS QLD, AUSTRALIA 4113 E-mail : cash.sale@alsenviro.com.au Telephone : ---- Facsimile : ---- Project : SC-13 Order number : SC-13 C-O-C number : ---- Sampler : Reece McCann Site : ---- Quote number : ----	Page : 1 of 13 Laboratory : Environmental Division Brisbane Contact : Customer Services Address : 2 Byth Street Stafford QLD Australia 4053 E-mail : Brisbane.Enviro.Services@alsglobal.com Telephone : +61 7 3243 7222 Facsimile : +61 7 3243 7218 QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 15-MAY-2013 Issue Date : 05-JUN-2013 No. of samples received : 27 No. of samples analysed : 27	
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting

- ED091 (Calcium Chloride Extractable Boron) : Insufficient sample volume to perform metal analysis on sample EB1311611-006 (8 - 0-10).
- ED092 (DTPA Extractable Metals) : Insufficient sample volume to perform metal analysis on sample EB1311611-006 (8 - 0-10).

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NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Hamish Murray	Laboratory Supervisor	Newcastle - Inorganics
SATISH.TRIVEDI	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				7 - 0-10	7 - 30-40	7 - 40-50	7 - 60-70	7 - 90-100
				30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-001	EB1311611-002	EB1311611-003	EB1311611-004	EB1311611-005
EA150: Particle Sizing								
+75µm	----	1	%	11	----	----	----	----
+150µm	----	1	%	8	----	----	----	----
+300µm	----	1	%	4	----	----	----	----
+425µm	----	1	%	2	----	----	----	----
+600µm	----	1	%	1	----	----	----	----
+1180µm	----	1	%	<1	----	----	----	----
+2.36mm	----	1	%	<1	----	----	----	----
+4.75mm	----	1	%	<1	----	----	----	----
+9.5mm	----	1	%	<1	----	----	----	----
+19.0mm	----	1	%	<1	----	----	----	----
+37.5mm	----	1	%	<1	----	----	----	----
+75.0mm	----	1	%	<1	----	----	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.2	7.1	7.9	8.3	8.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	34	38	114	91	103
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	16.9	15.9	13.8	6.2	6.5
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	61	----	----	----	----
Silt (2-60 µm)	----	1	%	26	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	13	----	----	----	----
Gravel (>2mm)	----	1	%	<1	----	----	----	----
Cobbles (>6cm)	----	1	%	<1	----	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	24.0	24.4	29.3	19.2	25.0
Exchangeable Magnesium	----	0.1	meq/100g	12.2	11.2	9.3	4.1	5.0
Exchangeable Potassium	----	0.1	meq/100g	0.7	0.2	0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	36.9	36.0	38.8	23.4	30.2
Exchangeable Sodium Percent	----	0.1	%	0.1	0.2	<0.1	<0.1	<0.1
Calcium/Magnesium Ratio	----	0.1	-	2.0	2.2	3.1	4.7	5.0

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				7 - 0-10	7 - 30-40	7 - 40-50	7 - 60-70	7 - 90-100
				30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-001	EB1311611-002	EB1311611-003	EB1311611-004	EB1311611-005
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	<10
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	<0.2	----	----	----	----
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	1.75	----	----	----	----
Iron	7439-89-6	1.00	mg/kg	84.3	----	----	----	----
Manganese	7439-96-5	1.00	mg/kg	65.0	----	----	----	----
Zinc	7440-66-6	1.00	mg/kg	<1.00	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.1	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	3.8	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	3.9	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1490	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	1490	----	----	----	----
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	0.60	----	----	----	----
EP004: Organic Matter								
Organic Matter	----	0.5	%	0.8	----	----	----	----

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				8 - 0-10	8 - 30-40	8 - 50-60	8 - 90-100	16 - 0-10
				30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-006	EB1311611-007	EB1311611-008	EB1311611-009	EB1311611-010
EA150: Particle Sizing								
+75µm	----	1	%	24	----	----	----	39
+150µm	----	1	%	19	----	----	----	33
+300µm	----	1	%	8	----	----	----	28
+425µm	----	1	%	3	----	----	----	25
+600µm	----	1	%	2	----	----	----	22
+1180µm	----	1	%	<1	----	----	----	15
+2.36mm	----	1	%	<1	----	----	----	9
+4.75mm	----	1	%	<1	----	----	----	6
+9.5mm	----	1	%	<1	----	----	----	6
+19.0mm	----	1	%	<1	----	----	----	<1
+37.5mm	----	1	%	<1	----	----	----	<1
+75.0mm	----	1	%	<1	----	----	----	<1
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.3	7.6	7.5	8.4	6.7
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	25	21	20	74	96
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	11.8	7.5	8.6	5.2	13.2
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	53	----	----	----	42
Silt (2-60 µm)	----	1	%	22	----	----	----	18
Sand (0.06-2.00 mm)	----	1	%	25	----	----	----	31
Gravel (>2mm)	----	1	%	<1	----	----	----	9
Cobbles (>6cm)	----	1	%	<1	----	----	----	<1
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	25.4	12.7	13.4	12.4	14.2
Exchangeable Magnesium	----	0.1	meq/100g	12.6	6.0	6.4	3.8	3.3
Exchangeable Potassium	----	0.1	meq/100g	0.8	<0.1	0.1	<0.1	1.9
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	38.9	18.7	20.0	16.2	19.5
Exchangeable Sodium Percent	----	0.1	%	0.1	<0.1	<0.1	<0.1	<0.1
Calcium/Magnesium Ratio	----	0.1	-	2.0	2.1	2.1	3.3	4.3

PTI DL RELEASE - DNRM



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				8 - 0-10	8 - 30-40	8 - 50-60	8 - 90-100	16 - 0-10
				30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00	30-APR-2013 15:00
				EB1311611-006	EB1311611-007	EB1311611-008	EB1311611-009	EB1311611-010
Compound	CAS Number	LOR	Unit					
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	----	----	----	0.04
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	20
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	----	----	----	----	<0.2
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	----	----	----	----	1.28
Iron	7439-89-6	1.00	mg/kg	----	----	----	----	55.6
Manganese	7439-96-5	1.00	mg/kg	----	----	----	----	20.6
Zinc	7440-66-6	1.00	mg/kg	----	----	----	----	4.95
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.2	----	----	----	0.3
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	3.7	----	----	----	37.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	3.9	----	----	----	37.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	930	----	----	----	3890
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	930	----	----	----	3930
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	----	----	----	----	4.45
EP004: Organic Matter								
Organic Matter	----	0.5	%	0.9	----	----	----	2.7

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				16 - 20-30	31 - 0-10	31 - 30-40	61 - 60-70	31 - 90-100
				30-APR-2013 15:00	30-APR-2013 15:00	03-MAY-2013 15:00	03-MAY-2013 15:00	03-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-011	EB1311611-012	EB1311611-013	EB1311611-014	EB1311611-015
EA150: Particle Sizing								
+75µm	----	1	%	----	59	----	----	----
+150µm	----	1	%	----	48	----	----	----
+300µm	----	1	%	----	26	----	----	----
+425µm	----	1	%	----	19	----	----	----
+600µm	----	1	%	----	15	----	----	----
+1180µm	----	1	%	----	12	----	----	----
+2.36mm	----	1	%	----	9	----	----	----
+4.75mm	----	1	%	----	7	----	----	----
+9.5mm	----	1	%	----	7	----	----	----
+19.0mm	----	1	%	----	<1	----	----	----
+37.5mm	----	1	%	----	<1	----	----	----
+75.0mm	----	1	%	----	<1	----	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.6	6.5	6.5	6.5	6.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	65	53	24	25	22
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	23.1	4.4	12.0	11.2	11.3
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	28	----	----	----
Silt (2-60 µm)	----	1	%	----	11	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	52	----	----	----
Gravel (>2mm)	----	1	%	----	9	----	----	----
Cobbles (>6cm)	----	1	%	----	<1	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	9.9	7.1	8.5	7.8	7.3
Exchangeable Magnesium	----	0.1	meq/100g	2.1	2.8	3.2	3.2	3.2
Exchangeable Potassium	----	0.1	meq/100g	1.7	0.4	0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	13.6	10.3	11.8	11.1	10.6
Exchangeable Sodium Percent	----	0.1	%	<0.1	0.1	0.1	<0.1	<0.1
Calcium/Magnesium Ratio	----	0.1	-	4.7	2.5	2.7	2.4	2.3



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				16 - 20-30	31 - 0-10	31 - 30-40	61 - 60-70	31 - 90-100
				30-APR-2013 15:00	30-APR-2013 15:00	03-MAY-2013 15:00	03-MAY-2013 15:00	03-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-011	EB1311611-012	EB1311611-013	EB1311611-014	EB1311611-015
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	----	<0.01	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	10	10	<10	<10	<10
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	----	<0.2	----	----	----
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	----	<1.00	----	----	----
Iron	7439-89-6	1.00	mg/kg	----	21.3	----	----	----
Manganese	7439-96-5	1.00	mg/kg	----	63.2	----	----	----
Zinc	7440-66-6	1.00	mg/kg	----	<1.00	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	----	0.2	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	----	21.4	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	21.6	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	660	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	----	680	----	----	----
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	----	0.38	----	----	----
EP004: Organic Matter								
Organic Matter	----	0.5	%	----	1.2	----	----	----

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				36 - 0-10	36 - 30-40	36 - 60-70	36 - 90-100	37 - 0-10
				04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-016	EB1311611-017	EB1311611-018	EB1311611-019	EB1311611-020
EA150: Particle Sizing								
+75µm	----	1	%	14	----	----	----	29
+150µm	----	1	%	9	----	----	----	22
+300µm	----	1	%	5	----	----	----	16
+425µm	----	1	%	4	----	----	----	14
+600µm	----	1	%	3	----	----	----	12
+1180µm	----	1	%	2	----	----	----	10
+2.36mm	----	1	%	1	----	----	----	7
+4.75mm	----	1	%	<1	----	----	----	3
+9.5mm	----	1	%	<1	----	----	----	<1
+19.0mm	----	1	%	<1	----	----	----	<1
+37.5mm	----	1	%	<1	----	----	----	<1
+75.0mm	----	1	%	<1	----	----	----	<1
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.1	8.3	8.4	8.5	8.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	137	132	150	194	134
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	17.5	18.8	20.0	19.9	7.8
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	59	----	----	----	46
Silt (2-60 µm)	----	1	%	25	----	----	----	25
Sand (0.06-2.00 mm)	----	1	%	15	----	----	----	22
Gravel (>2mm)	----	1	%	1	----	----	----	7
Cobbles (>6cm)	----	1	%	<1	----	----	----	<1
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	36.9	40.2	33.6	31.9	33.6
Exchangeable Magnesium	----	0.1	meq/100g	6.4	9.6	12.3	15.1	3.2
Exchangeable Potassium	----	0.1	meq/100g	1.0	0.2	0.2	0.2	2.0
Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.1	0.4	1.0	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	44.3	50.2	46.5	48.2	38.8
Exchangeable Sodium Percent	----	0.1	%	<0.1	0.2	1.0	2.1	<0.1
Calcium/Magnesium Ratio	----	0.1	-	5.8	4.2	2.7	2.1	10.5

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				36 - 0-10	36 - 30-40	36 - 60-70	36 - 90-100	37 - 0-10
				04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-016	EB1311611-017	EB1311611-018	EB1311611-019	EB1311611-020
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	0.01	----	----	----	0.03
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	20
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	<0.2	----	----	----	<0.2
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	1.78	----	----	----	2.72
Iron	7439-89-6	1.00	mg/kg	12.4	----	----	----	21.4
Manganese	7439-96-5	1.00	mg/kg	10.1	----	----	----	24.8
Zinc	7440-66-6	1.00	mg/kg	<1.00	----	----	----	1.87
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	----	----	----	0.8
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	32.6	----	----	----	1.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	32.6	----	----	----	2.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1300	----	----	----	2760
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	1330	----	----	----	2760
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	0.56	----	----	----	1.79
EP004: Organic Matter								
Organic Matter	----	0.5	%	1.0	----	----	----	2.7

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				37 - 30-40	37 - 60-70	37 - 90-100	42 - 0 - 10	42 - 30 - 40
				04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	05-MAY-2013 15:00	05-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1311611-021	EB1311611-022	EB1311611-023	EB1311611-024	EB1311611-025
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	11	----
+150µm	----	1	%	----	----	----	10	----
+300µm	----	1	%	----	----	----	9	----
+425µm	----	1	%	----	----	----	9	----
+600µm	----	1	%	----	----	----	8	----
+1180µm	----	1	%	----	----	----	7	----
+2.36mm	----	1	%	----	----	----	6	----
+4.75mm	----	1	%	----	----	----	4	----
+9.5mm	----	1	%	----	----	----	<1	----
+19.0mm	----	1	%	----	----	----	<1	----
+37.5mm	----	1	%	----	----	----	<1	----
+75.0mm	----	1	%	----	----	----	<1	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.3	8.4	8.5	7.6	8.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	108	114	128	119	183
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	9.7	9.7	8.9	16.1	20.9
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	56	----
Silt (2-60 µm)	----	1	%	----	----	----	30	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	8	----
Gravel (>2mm)	----	1	%	----	----	----	6	----
Cobbles (>6cm)	----	1	%	----	----	----	<1	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	31.4	32.4	30.2	43.9	48.0
Exchangeable Magnesium	----	0.1	meq/100g	2.2	3.4	6.1	10.4	20.4
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.1	0.1	1.6	0.5
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	0.3
Cation Exchange Capacity	----	0.1	meq/100g	33.8	35.9	36.4	56.0	69.2
Exchangeable Sodium Percent	----	0.1	%	<0.1	<0.1	0.2	<0.1	0.5
Calcium/Magnesium Ratio	----	0.1	-	14.3	9.6	5.0	4.2	2.4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				37 - 30-40	37 - 60-70	37 - 90-100	42 - 0 - 10	42 - 30 - 40
				04-MAY-2013 15:00	04-MAY-2013 15:00	04-MAY-2013 15:00	05-MAY-2013 15:00	05-MAY-2013 15:00
				EB1311611-021	EB1311611-022	EB1311611-023	EB1311611-024	EB1311611-025
Compound	CAS Number	LOR	Unit					
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	----	----	----	0.04	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	30	40	70
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	----	----	----	<0.2	----
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	----	----	----	1.94	----
Iron	7439-89-6	1.00	mg/kg	----	----	----	26.2	----
Manganese	7439-96-5	1.00	mg/kg	----	----	----	15.9	----
Zinc	7440-66-6	1.00	mg/kg	----	----	----	3.25	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	----	----	----	0.6	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	18.9	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	19.5	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	5610	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	5630	----
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	----	----	----	1.93	----
EP004: Organic Matter								
Organic Matter	----	0.5	%	----	----	----	2.0	----

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Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : EB1313497 Client : GT ENVIRONMENTAL Contact : MR REECE MCCANN (COC/SRN) Address : 10 CRESSBROOK STREET EIGHT MILE PLAINS QLD, AUSTRALIA 4113 E-mail : reece.mccann@gtenvironmental.com.au Telephone : ---- Facsimile : ---- Project : SC-13 Order number : SC-13 C-O-C number : ---- Sampler : Reece McCann Site : ---- Quote number : ----	Page : 1 of 5 Laboratory : Environmental Division Brisbane Contact : Customer Services Address : 2 Byth Street Stafford QLD Australia 4053 E-mail : Brisbane.Enviro.Services@alsglobal.com Telephone : +61 7 3243 7222 Facsimile : +61 7 3243 7218 QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 04-JUN-2013 Issue Date : 14-JUN-2013 No. of samples received : 6 No. of samples analysed : 6	
--	--	--

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

RTI DL RELEASE - DNR/M



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK067 (Total Phosphorus); Sample EB1313520 004 shows poor duplicate recovery due to sample heterogeneity. This was confirmed by visual inspection.**

RTI DL RELEASE - DNR/PA



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Hamish Murray	Supervisor - Soils	Newcastle - Inorganics
Jonathon Angell	Inorganic Coordinator	Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Acid Sulphate Soils



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				61 - 0-0.1	61 - 0.3-0.4	61 - 0.6-0.7	61 - 0.9-1.0	62 - 0-0.1
				30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1313497-001	EB1313497-002	EB1313497-003	EB1313497-004	EB1313497-005
EA150: Particle Sizing								
+75µm	----	1	%	4	----	----	----	6
+150µm	----	1	%	3	----	----	----	4
+300µm	----	1	%	2	----	----	----	2
+425µm	----	1	%	2	----	----	----	<1
+600µm	----	1	%	2	----	----	----	<1
+1180µm	----	1	%	1	----	----	----	<1
+2.36mm	----	1	%	<1	----	----	----	<1
+4.75mm	----	1	%	<1	----	----	----	<1
+9.5mm	----	1	%	<1	----	----	----	<1
+19.0mm	----	1	%	<1	----	----	----	<1
+37.5mm	----	1	%	<1	----	----	----	<1
+75.0mm	----	1	%	<1	----	----	----	<1
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.2	8.7	8.8	8.1	7.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	57	506	1060	2410	88
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	18.6	17.4	16.6	17.0	37.1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	42	----	----	----	64
Silt (2-60 µm)	----	1	%	51	----	----	----	30
Sand (0.06-2.00 mm)	----	1	%	7	----	----	----	6
Gravel (>2mm)	----	1	%	<1	----	----	----	<1
Cobbles (>6cm)	----	1	%	<1	----	----	----	<1
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	26.1	10.0	20.8	25.1	31.0
Exchangeable Magnesium	----	0.1	meq/100g	15.0	7.1	16.7	16.4	15.1
Exchangeable Potassium	----	0.1	meq/100g	1.2	0.3	0.4	0.3	1.0
Exchangeable Sodium	----	0.1	meq/100g	0.3	2.3	6.0	4.2	<0.1
Cation Exchange Capacity	----	0.1	meq/100g	42.7	19.7	43.9	46.0	47.2
Exchangeable Sodium Percent	----	0.1	%	0.6	11.7	13.6	9.2	0.2
Calcium/Magnesium Ratio	----	0.1	-	1.7	1.4	1.2	1.5	2.0

PTI DL RELEASE - DNRM



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				61 - 0-0.1	61 - 0.3-0.4	61 - 0.6-0.7	61 - 0.9-1.0	62 - 0-0.1
				30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00	30-MAY-2013 15:00
Compound	CAS Number	LOR	Unit	EB1313497-001	EB1313497-002	EB1313497-003	EB1313497-004	EB1313497-005
ED042T: Total Sulfur by LECO - Continued								
Sulfur - Total as S (LECO)	----	0.01	%	0.04	----	----	----	0.02
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	20	560	1400	1870	90
ED091 : Calcium Chloride Extractable Boron								
Boron	7440-42-8	0.2	mg/kg	<0.2	----	----	----	<0.2
ED092: DTPA Extractable Metals								
Copper	7440-50-8	1.00	mg/kg	1.21	----	----	----	1.35
Iron	7439-89-6	1.00	mg/kg	34.8	----	----	----	28.7
Manganese	7439-96-5	1.00	mg/kg	39.8	----	----	----	64.0
Zinc	7440-66-6	1.00	mg/kg	1.25	----	----	----	<1.00
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.1	----	----	----	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	5.8	----	----	----	16.5
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	5.9	----	----	----	16.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	3070	----	----	----	1360
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	3080	----	----	----	1380
EK081: Bicarbonate Extractable Phosphorus (Olsen)								
Bicarbonate Extractable P (Olsen)	----	0.01	mg/kg	3.52	----	----	----	1.67
EP004: Organic Matter								
Organic Matter	----	0.5	%	2.6	----	----	----	2.2

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Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

62 - 0.3-0.4

Client sampling date / time

30-MAY-2013 15:00

Compound	CAS Number	LOR	Unit	EB1313497-006	---	---	---	---
EA002 : pH (Soils)								
pH Value	---	0.1	pH Unit	7.6	---	---	---	---
EA010: Conductivity								
Electrical Conductivity @ 25°C	---	1	µS/cm	33	---	---	---	---
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	---	1.0	%	18.5	---	---	---	---
ED008: Exchangeable Cations								
Exchangeable Calcium	---	0.1	meq/100g	32.8	---	---	---	---
Exchangeable Magnesium	---	0.1	meq/100g	15.3	---	---	---	---
Exchangeable Potassium	---	0.1	meq/100g	0.6	---	---	---	---
Exchangeable Sodium	---	0.1	meq/100g	0.3	---	---	---	---
Cation Exchange Capacity	---	0.1	meq/100g	48.9	---	---	---	---
Exchangeable Sodium Percent	---	0.1	%	0.6	---	---	---	---
Calcium/Magnesium Ratio	---	0.1	-	2.2	---	---	---	---
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	<10	---	---	---	---

RTI DL RELEASE - DNRM



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				42 - 60-70	42 - 90-100	----	----	----
				05-MAY-2013 15:00	05-MAY-2013 15:00	----	----	----
Client sampling date / time				EB1311611-026	EB1311611-027	----	----	----
Compound	CAS Number	LOR	Unit					
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.5	8.4	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	280	446	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	21.2	20.6	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	42.0	37.7	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	26.6	26.9	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.3	0.4	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	1.9	3.0	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	70.8	67.9	----	----	----
Exchangeable Sodium Percent	----	0.1	%	2.7	4.4	----	----	----
Calcium/Magnesium Ratio	----	0.1	-	1.6	1.4	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	240	600	----	----	----

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11 FIGURES

- Figure 1** **Location Plan**
- Figure 2** **Soil Mapping Units**
- Figure 3** **Topsoil Stripping Depths**
- Figure 4** **Existing Land Suitability – Rainfed Cropping**
- Figure 5** **Existing Land Suitability – Beef Cattle Grazing**
- Figure 6** **Existing Land Suitability – GQAL**
- Figure 7** **Land Systems (Story et al 1967)**
- Figure 8** **Revised SCL**

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Springsure Creek Coal Mine Project
Figure 1: Location Plan



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Legend

- MLA 70486
- Proposed Mine Disturbance
- SCL Trigger Map
- Detailed Site
- Observation Site
- CDM Smith Detailed Site
- Recent alluvial channels and floodplains
- Mv - Minerva - Grey to black cracking clay with coarsely self mulching surface
- Gently undulating plains with soils overlying Tertiary volcanics
- Rn - Ronnoc - Self mulching, black to grey, alkaline cracking clay overlying basalt below 0.45m
- Undulating plains and rises with soils overlying Tertiary sedimentary rocks
- Ka - Kammel - Deep self mulching, red to brown cracking clay overlying a mottled zone below 0.5m depth
- Lx - Lexington - Shallow, firm, red to brown clay / clay loam overlying ferruginised basalt or other gravel by 0.5m depth
- Level to undulating plains with soils overlying Cainozoic sediments
- Km - Kilmore - Firm red to brown duplex soil with sandy clay loam over clay subsoil which may be mottled over gravel and carbonate dominated material below 0.7m
- Sv - Sullivan - Deep sandy self mulching grey to black (occasionally brown) cracking clay over buried layers with gravel below 0.7m depth
- Sv-Gp - Sullivan Gilgai Phase - Normal or linear gilgai complex, Mounds are brown self mulching cracking clay (similar to Sv), depressions are grey to black, cracking deep clay
- Tf - Talafa - Firm to hard setting red to brown massive gradational or duplex soil overlying buried layers of possibly mottled grey clay or gravelly material below 0.9m depth



**Springsure Creek Coal Mine Project
Figure 2: Soil Mapping Units**

Drawn: GREG TUCK 17-06-2013
 Checked: GRAHAM TUCK 17-06-2013
 Size A4
 Page 1 of 1
 Revision 2
 Scale 1:100,000







Projection: GDA94 Zone 55



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Legend

-  MLA 70486
-  Proposed Mine Disturbance
-  0.3 metres
-  0.4 metres


GT ENVIRONMENTAL SERVICES

Springsure Creek Coal Mine Project
Figure 3: Topsoil Stripping Depths

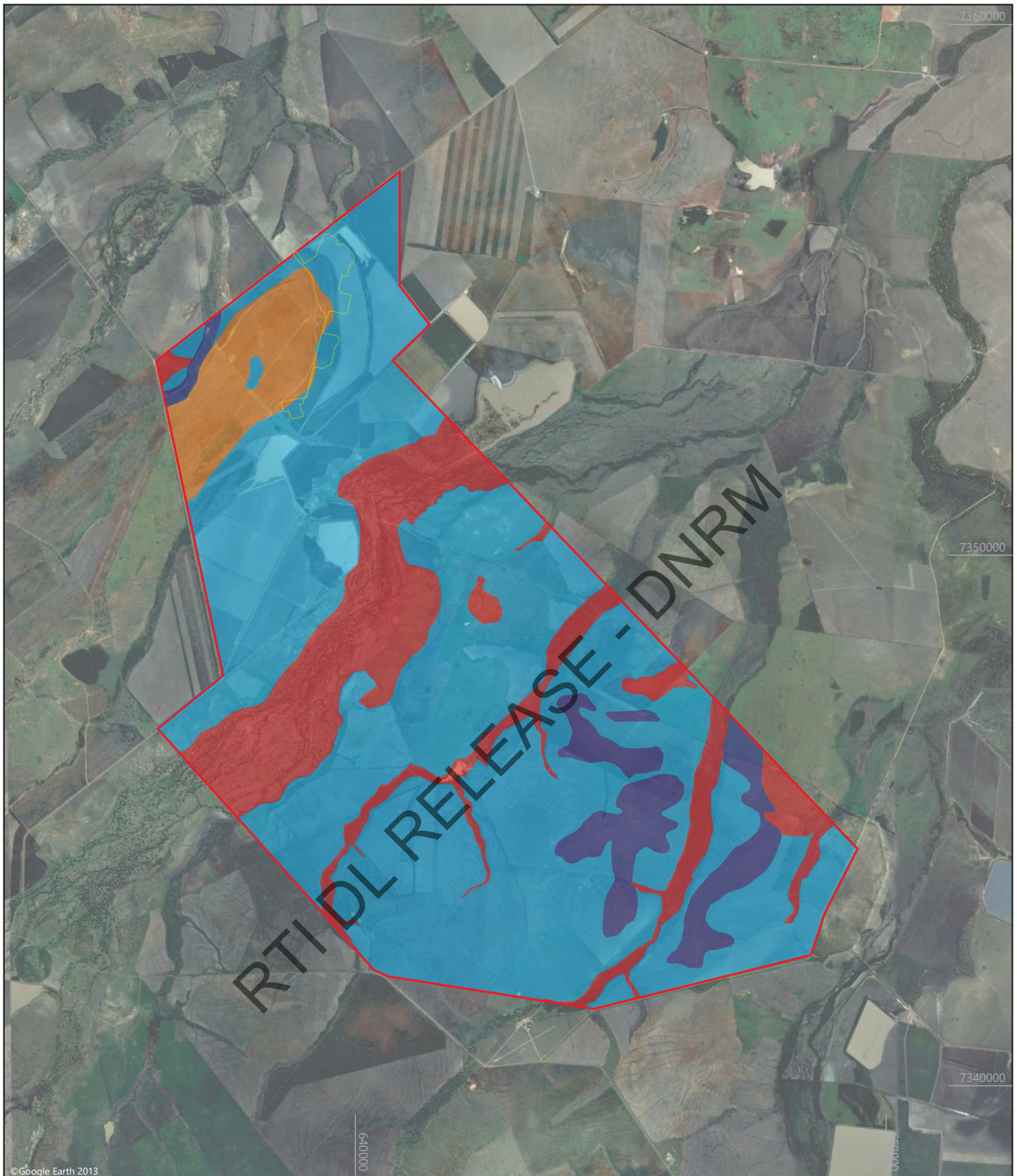
Drawn: GREG TUCK	12-06-2013
Checked: GRAHAM TUCK	12-06-2013
Size A4	Revision 1
Page 1 of 1	Scale 1:100,000

0 1000
Metres

Projection: GDA94 Zone 55



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Legend

- MLA 70486
- Proposed Mine Disturbance
- Class 2
- Class 3
- Class 4
- Class 5



Springsure Creek Coal Mine Project
Figure 4: Existing Land Suitability -
Rainfed Cropping

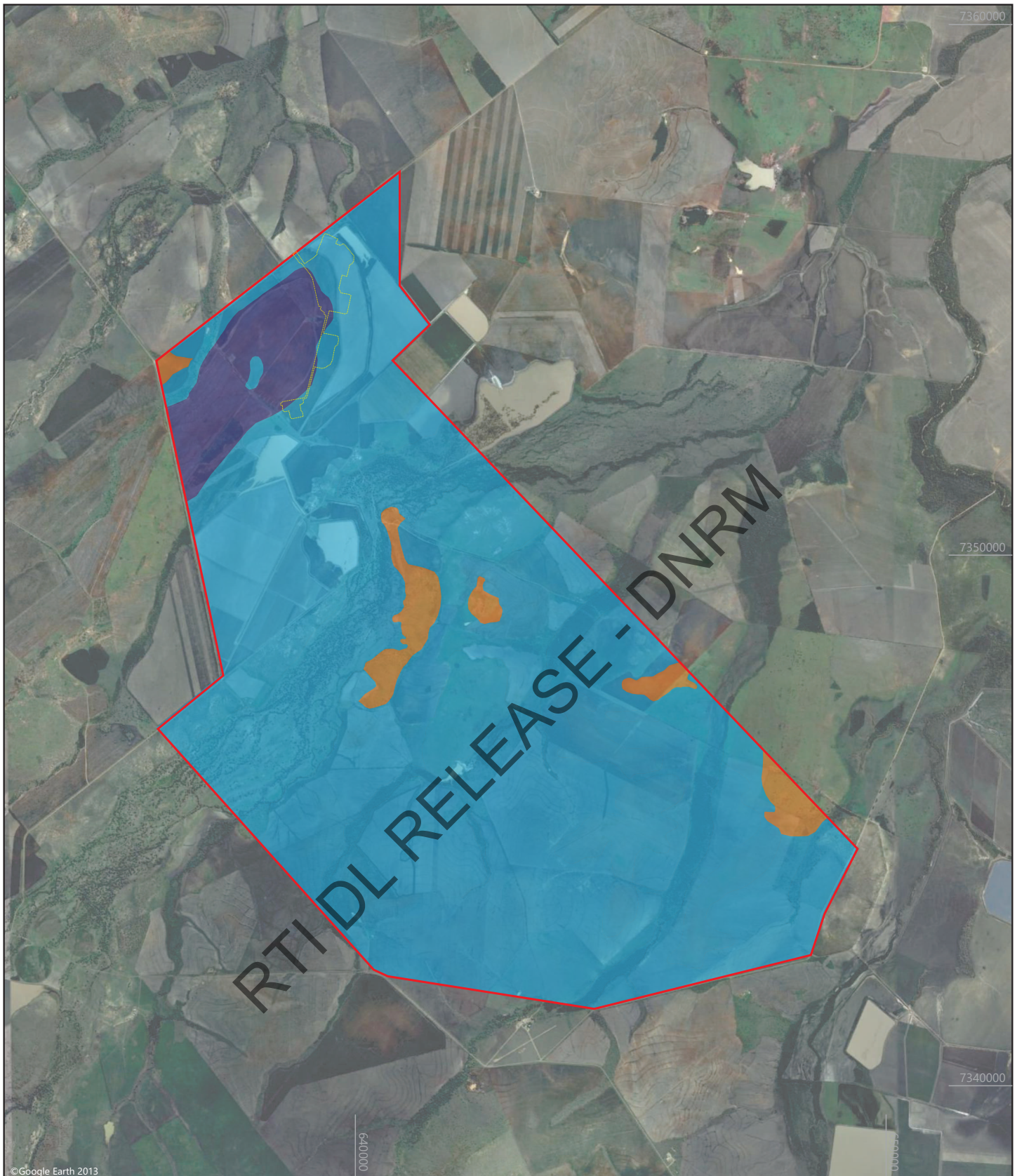
Drawn:	GREG TUCK	12-06-2013
Checked:	GRAHAM TUCK	12-06-2013
Size A4		Revision 1
Page 1 of 1		Scale 1:100,000



Projection: GDA94 Zone 55








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Legend

-  MLA 70486
-  Proposed Mine Disturbance
-  Class 2
-  Class 3
-  Class 4



Springsure Creek Coal Mine Project
Figure 5: Existing Land Suitability -
Beef Cattle Grazing

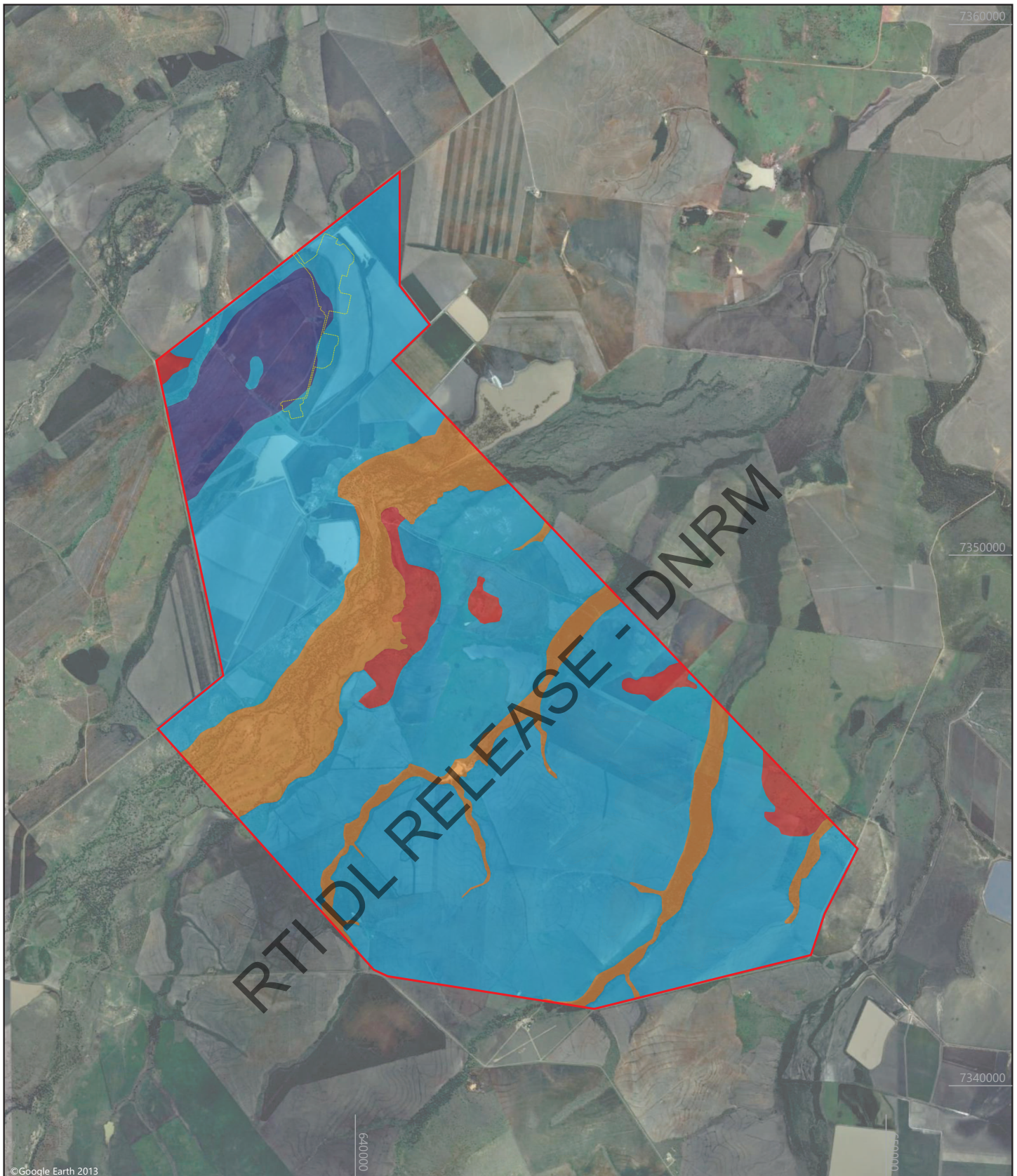
Drawn:	GREG TUCK	12-06-2013
Checked:	GRAHAM TUCK	12-06-2013
Size A4		Revision 1
Page 1 of 1		Scale 1:100,000



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Legend


- MLA 70486
- Proposed Mine Disturbance
- Class A
- Class B
- Class C1
- Class C3




GT ENVIRONMENTAL SERVICES

Springsure Creek Coal Mine Project
Figure 6: Existing Land Suitability - GQAL

Drawn: GREG TUCK	12-06-2013
Checked: GRAHAM TUCK	12-06-2013
Size A4	Revision 1
Page 1 of 1	Scale 1:100,000

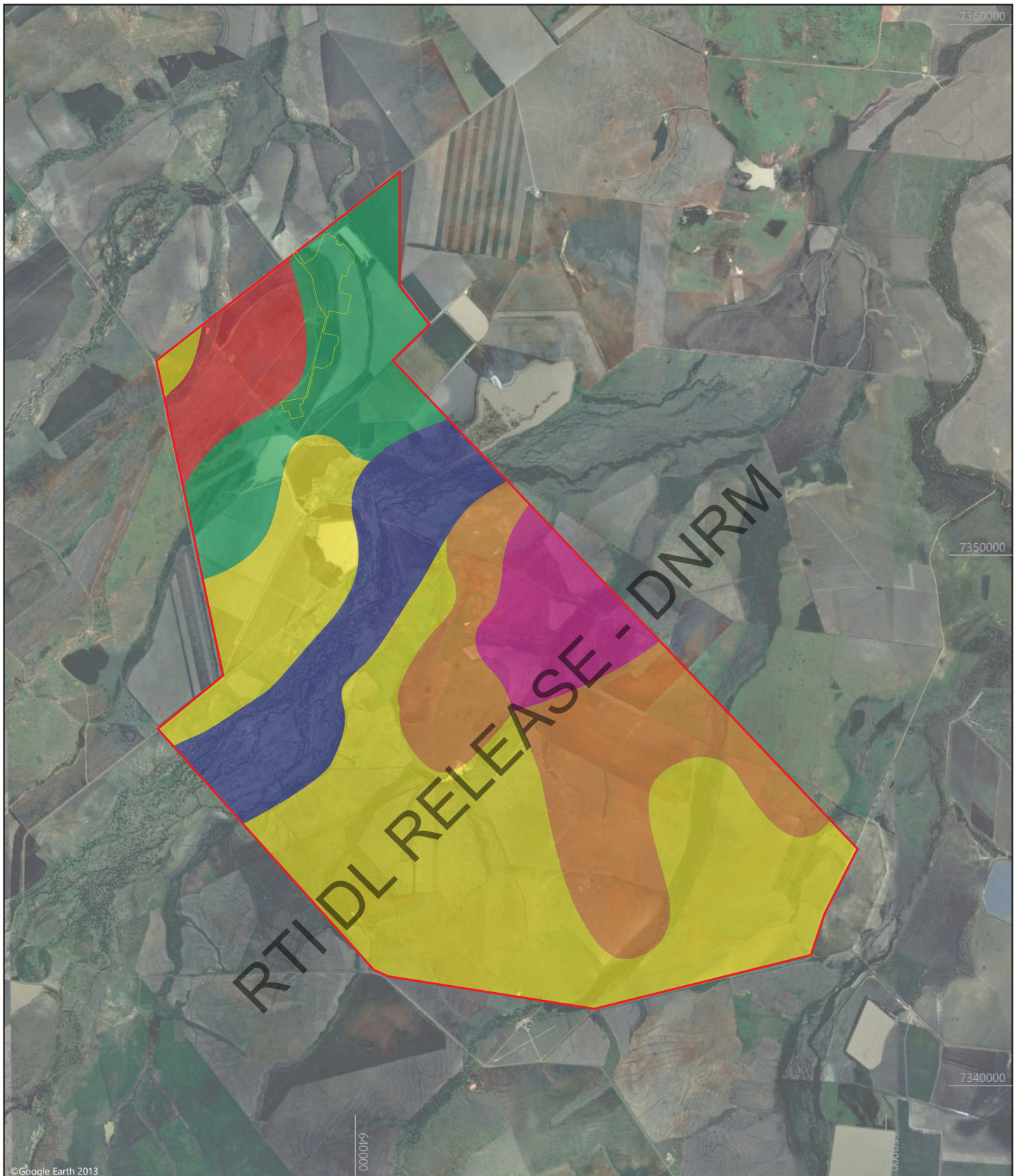


0 1000
Metres



Projection: GDA94 Zone 55

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Legend

-  MLA 70486
-  Proposed Mine Disturbance
-  Arcadia
-  Oxford
-  Blackwater
-  Racecourse
-  Monteagle
-  Funnel



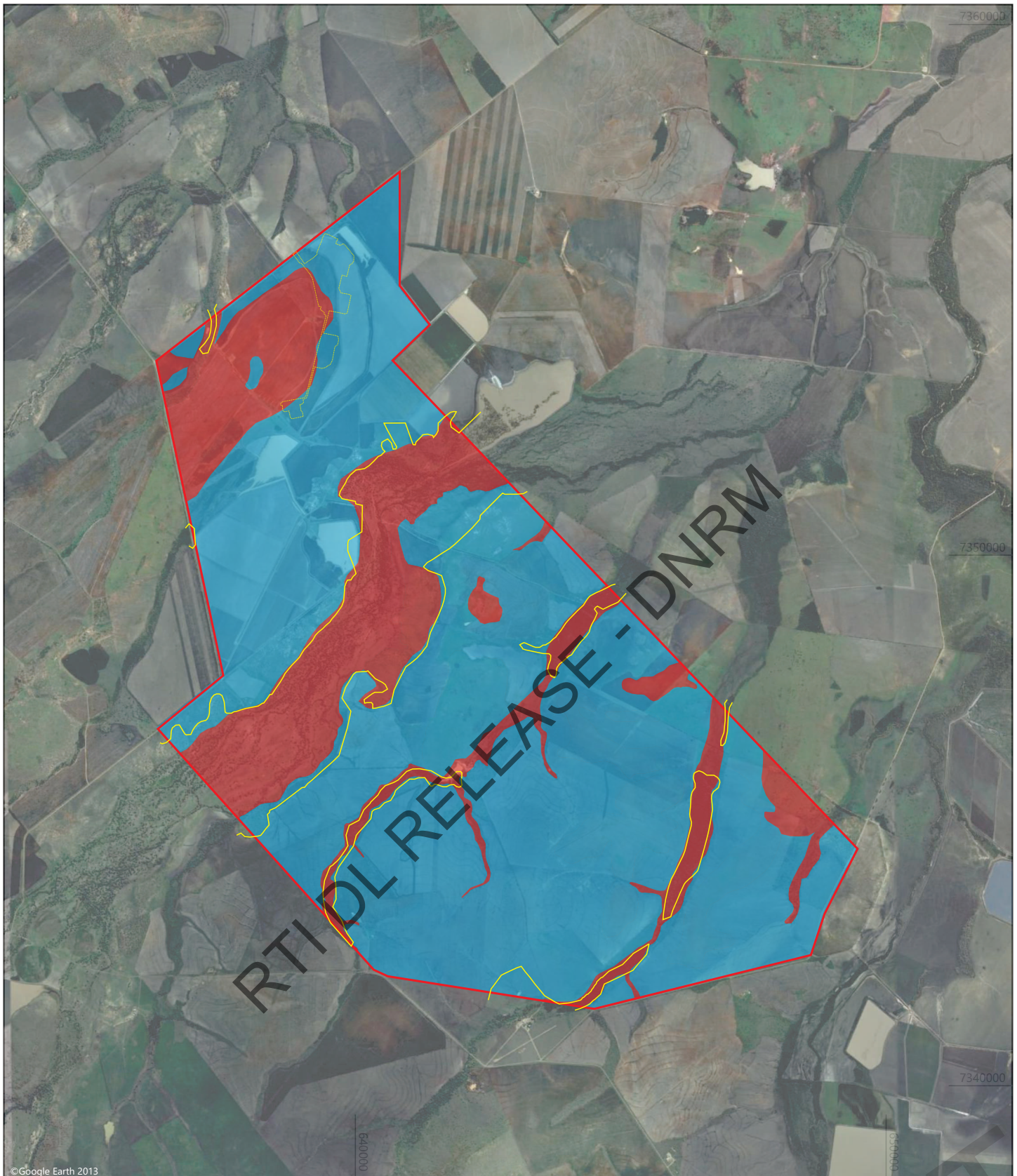
Springsure Creek Coal Mine Project
Figure 7: Land Systems
(Story et al 1967)

Drawn:	GREG TUCK	12-06-2013
Checked:	GRAHAM TUCK	12-06-2013
Size A4		Revision 1
Page 1 of 1		Scale 1:100,000




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Legend

- MLA 70486
- Proposed Mine Disturbance
- SCL Trigger Map
- SCL Pass
- SCL Fail




Springsure Creek Coal Mine Project
Figure 8: Revised SCL

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Checked: GRAHAM TUCK	17-06-2013	
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Page 1 of 1		Scale 1:100,000



Projection: GDA94 Zone 55



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